11th annual Congress of the

EUROPEAN COLLEGE OF SPORT SCIENCE

05-08 July LAUSANNE 2006 - Switzerland

BOOK OF ABSTRACTS

Edited by:
Hoppeler H., Reilly T., Tsolakidis E., Gfeller L., Klossner S.

Hosted by:
University of Bern, University of Lausanne,
École Polytechnique Fédérale de Lausanne and the
Swiss Society of Sports Medicine

ISBN 3-939390-35-6

Bibliografische Information Der Deutschen Bibliothek
Die Deutsche Bibliothek verzeichnet diese Publikation in der
Deutschen Nationalbibliografie; detaillierte bibliografische Daten
sind im Internet über <http://dnb.ddb.de> abrufbar.

European College of Sport Science:
Book of Abstracts of the 11th annual congress of the
European College of Sport Science – 5-8 July 2006 Lausanne-Switzerland.
Edited by Hoppeler H., Reilly T., Tsolakidis E., Gfeller L., Klossner S.
– Cologne: Sportverlag Strauss 2006
ISBN 3-939390-35-6

Conception & DTP: Elias Tsolakidis & Dr. Gerard King
Cover: Liliane Gfeller-Tüscher
Corrections: Claudine Fleury, Dana Jung, Katja Kuhn, Ioanna-Barbara Patera, Bente Weidmann

Supported by:

SPORTOOLS Ltd
Data management in sports
Cologne/Germany

Organisation

Congress President

– Hans Hoppeler, CH

Congress Director

– Gérald Gremion, CH

Congress Manager

– Rosemarie Repond, CH

ECSS Executive Board

– *President:* Erich Müller, AUT
– *President-Elect:* Albert Gollhofer, GER
– *Past President:* Michael Kjaer, DEN
– *General Secretary:* Hans Hoppeler, CH
– *Treasurer:* Sigmund Loland, NOR

ECSS Scientific Board

– *Chair:* Tom Reilly, UK
– Peter Bärtsch, GER
– Werner Helsen, BEL
– Paavo Komi, FIN
– Gertrud Pfister, DEN
– Anton Wagenmakers, UK

ECSS Scientific Committee

– Jan Cabri, POR
– Daniela Caporossi, ITA
– Flemming Dela, DEN
– Hans-Hermann Dickhuth, GER
– Joan Duda, UK
– Steve Harridge, UK
– Bente Klarlund-Pedersen, DEN
– Mike McNamee, UK
– Romain Meeusen, BEL
– Caroline Nicol, FRA
– Pekka Oja, FIN
– Hermann Schwameder, AUT
– Mark Williams, UK

Organizing Committee

– Theres Fleury, CH
– Martin Flück, CH
– Liliane Gfeller-Tüscher, CH
– Barbara Grünig, CH
– Jonas Jaeggi, CH
– Gerard King, GER
– Stephan Klossner, CH
– Elias Tsolakidis, GR
– Michael Vogt, CH

Welcome

The European College of Sport Science (ECSS) welcomes you to Lausanne for its 11th annual Congress. Hosted by the University of Lausanne and Bern, École Polytechnique Fédérale de Lausanne and the Swiss Society of Sports Medicine the ECSS is delighted to stage this major event in the city of the Olympic Movement from 5-8 July 2006.

The scientific programme is composed of more than 1.500 abstracts, which were accepted after being carefully reviewed . This year´s Congress is the largest in the history of the ECSS, underlining both the interest of the sport scientific community and the importance of the ECSS as an interdisciplinary forum for ongoing debate. In view of the multifaceted character of sport science, state-of-the-art presentations cover basic and applied sciences as they relate to sport, exercise and health. The presented abstracts comprise not only all relevant sub-disciplines of sport science but also all continents and 68 different nations. The abstracts are distributed among 4 Plenary Sessions, 50 Invited Symposia, 50 Thematic Sessions and 3 Poster Sessions each presenting close to 400 Posters.

Apart from presentations discussed from the perspective of natural sciences, social/behavioural sciences, humanities, sports medicine and from practice itself, participants will also experience an extensive social programme including complimentary access to the Olympic Museum.

On behalf of the ECSS we wish you all a very pleasant and productive stay in Lausanne and hope that it will be both scientifically and socially successful.

Hans Hoppeler
Congress President

Table of Contents

11:40 - 13:10

14:15 - 15:15

15:15 - 16:45

17:00 - 18:30

Wednesday, 5th July 2006

16:00 - 17:30

Plenary session (PLS)

PLS0 Health well-being and exercise - "Athene"

WHY HUMANS NEED TO BE ACTIVE TO STAY HEALTHY

Booth, F., Lees, S., Laye, M.

University of Missouri, United States

The genome evolved in an environment in which the oxygen demands of physical activity helped to establish aerobic metabolic networks. For most of human existence on Earth, gathering food, making shelter, and defending one's self was required for survival. Thus, the oxygen demands of physical activity as well as the rise in atmospheric oxygen played complimentary roles in setting the framework of today's aerobic metabolic pathways. While demands for physical activity have diminished in the recent few decades, DNA sequences of genes remain those established over hundreds of millions of years that have been fixed for the past 1000 to 10000 yrs. The lack of physical activity establishes a new milieu as genes do not express properly in the absence of a threshold of daily physical activity. The natural cycling of the zenith and nadir for many metabolic pathways with physical activity is lost with physical inactivity. The altered metabolic state of physical inactivity (lack of appropriate gene expression and the attenuation of metabolic cycling) leads to pathophysiological changes in the presence of genes predisposing to chronic diseases. Physical inactivity is associated with an increased prevalence of many chronic diseases such as atherosclerosis, breast and colon cancers, obesity, and type 2 diabetes. The interactions of individual variations in predisposing genes among humans and in the ability of the given individual's genes to produce a higher metabolic capacity determine the risk of chronic disease; the identification of genes and their interactions will be new areas for research. A current example of impaired gene expression due to a reduced turnover of lipid stores in the sedentary state will be compared to the physically active state. In summary, humans have to remain physically active to retain metabolic cycling similar to those of our ancestors hundreds and thousands years ago.

QUALITY OF LIFE, WELL-BEING AND EXERCISE

Skevington, S., Gillison, F., Evangelidou, S., Sato, A., Standage, M. and the WHOQOL Group

University of Bath, United Kingdom

While there is growing evidence to support the view that being physically active can maintain and improve physical and mental health, questions remain about whether it improves quality of life and well-being. What does it mean to have a good quality of life and how can we best assess it? First we examine some of the issues and challenges in defining and measuring health-related quality of life, and consider which dimensions might be universal. In doing this, the paper traces the steps taken by an international collaboration of 15 countries convened by the World Health Organisation to develop a new assessment; the WHOQOL. Novel developments in methodology have enabled over 50 different language versions to be created which are highly equivalent in semantic and conceptual terms. The WHOQOL provides a reliable, valid, and responsive instrument that is facilitating multinational trials of interventions, and cross-cultural research. Data from this generic profile will be presented for illustration. Secondly, through a systematic review of randomised controlled trials we summarise the relationship between physical activity and quality of life for sick and well populations. In appraising this evidence we ask under what circumstances being physically active and having a good quality of life go hand in hand? Implications for sports science are discussed.

Thursday, 6th July 2006

08:15 - 09:30

Plenary session (PLS)

PLS1 Olympism and the Olympic Movement - "Lausanne"

SCOPE OF OLYMPIC MOVEMENT

Oswald D., CH

Without abstract submission.

OLYMPISM FOR THE 21ST CENTURY

Parry, J.

University of Leeds, United Kingdom

The philosophy of Olympism has as its focus of interest not just the elite athlete, but everyone; not just a short truce period, but the whole of life; not just competition and winning, but also the values of participation and co-operation; not just sport as an activity, but also as a formative and developmental influence contributing to desirable characteristics of individual personality and social life. For Olympism is a social philosophy which emphasises the role of sport in world development, international understanding, peaceful co-existence, and social and moral education.

A universal philosophy by definition sees itself as relevant to everyone, regardless of nation, race, gender, social class, religion or ideology, and so the Olympic movement has worked for a coherent universal representation of itself - a concept of Olympism which identifies a range of values to which each nation can sincerely commit itself whilst at the same time finding for the general idea a form of expression which is unique to itself, generated by its own culture, location, history, tradition and projected future.

The contemporary task for the Olympic Movement is to further this project: to try to see more clearly what its Games (and sport in wider society) might come to mean. This task will be both at the level of ideas and of action. If the practice of sport is to be pursued and developed according to Olympic values, the theory must strive for a conception of Olympism which will support that practice. The ideal should seek both to sustain sports practice and to lead sport towards a vision of Olympism which will help to deal with the challenges which are bound to emerge.

The search for a universal representation at the interpersonal and political level of our common humanity seems to me to be the essence of the optimism and hope of Olympism and other forms of humanism and internationalism. I have elsewhere tried to present a philosophical anthropology of Olympism as part of an explication of its ideology, and as a contribution to a theory of sport and physical education. This paper argues that Olympism is well placed to provide the basis for the world-wide development of physical education as a valued element in everyone's general education.

This is the challenge for the 21st century: to make universalism and humanism in sport an everyday reality.

09:40 - 11:10

Invited symposium (IS)

IS1-01 Gender, mass media and Olympic Sports - "Lausanne"

THE GLOBAL WOMEN IN SPORTS MEDIA PROJECT - INTRODUCTION

Pfister, G.

University of Copenhagen, Denmark

The global women in sports media project - Introduction

Sport is still a men's world – at least in the mass media. Worldwide women's sport is marginalized in the media; it gets around 5 to 15 % of the coverage. The interest of the media in female athletes increases during the "big sport events" like the Olympic Games. However, there are huge differences between the different news papers in different countries, and the coverage of female athletes depends on various factors like the attractiveness of a sport, success, the popularity of the athlete etc.

In this session we will present the results of an international research collaboration which assesses media coverage of sportswomen during the 2004 Olympic Games. Scholars from more than 20 countries participate in this project. We understand gender as a social construct which is supported and enacted by media and media sport.

The project focuses on a quantitative content analysis. The main aim is to find out how much coverage women athletes and teams receive during the 2004 Olympic Games. In addition, a textual (or qualitative) analysis shall look at the way, how men and women are presented.

Here the results of three countries, France, Germany and Denmark, are presented, compared and discussed.

THE COVERAGE OF MALE AND FEMALE ATHLETES AT THE 2004 OLYMPIC GAMES - GERMAN RESLUTS

Hartmann-Tews, I.A., Rulofs, B.

German Sport University Cologne, Germany

As part of an international research cooperation on the representation of women athletes in mass media during the Olympic Games in Athens 2004 the results of a content analysis of the coverage of the Olympic Games by the Frankfurter Allgemeine Zeitung (FAZ) and Bild Zeitung (BILD) are presented. The BILD represents the biggest tabloid national newspaper in Germany and has the highest circulation of daily national newspapers in Germany selling 3.6 mio papers a day. The newspaper has approx. 11.8 million readers across the age categories and across social strata. The circulation of the Frankfurter Allgemeine Zeitung is 0.4 million papers a day and the highest among the broadsheet newspapers in Germany. It has a high reputation as regard to the economy section and the sport section. The editorial board of the sport section received numerous awards for the best German editorial staff in sport (including the years 2004 and 2005).

The theoretical background of the analysis refers to theories of social construction of gender. In contrast to a long tradiiton of media analysis in angloamerican countries there are only very few content analysis focusing the social construction of gender in the sports media in Germany.

Results: In the coverage of the Olympics Games female athletes are less often focused in textunits (44.0% vs. 56.0%) and less often depicted in photographs (45.0% vs. 55.0%). This quantitative discrepancy is far less in comparison to daily newspaper coverage where male athletes tend to receive about 90% of the total space. However, the quantitative data on coverage has to be compared with the proportion of paticipation of athletes in the Olympic Games. Taking this into consideration the proportion of textunits and photographs shows a small overreporting of female athletes of 3% and 4% in comparison to their participation rate.

There are differences between the papers concerning the quantitative and qualitative coverage of the athletes: In the broadsheet paper there is a clear dominance of verbal communication and no quantitative gender bias (neither in texts nor in photographs) and no gender bias in content (neither in texts nor in photographs). The tabloid paper has a balanced verbal/visual communication profile, and in the visual communication male athletes outnumbered female athletes in photographs portraying action or competition.

These and aditional data will be presented and analysed on the backgound of more recent German data of gender representation in sportmedia.

THE COVERAGE OF MALE AND FEMALE ATHLETES AT THE 2004 OLYMPIC GAMES - FRENCH RESULTS

Ohl, F., Quin, G., Wipf, E.

Université de Lausanne, Switzerland

This paper presents the French results of an international research collaboration that assesses media coverage of sportswomen during the 2004 Olympic Games. In France, we analysed two newspapers L'Équipe and Le Monde. The first one, L'Équipe, is a specialized newspaper that plays an important role in sport. The second one, Le Monde, is the most important national paper considering his role in the media field. In both papers, we can observe that during the Olympic Games the media coverage of women is higher than outside this period. Nevertheless, coverage of men (around 55% of the paper) is still higher than sportswomen coverage (from 10% before the games to 20%). Differences are also qualitative. For example, women media coverage is more on emotional aspects of sport; women are less often presented during action and more outside sport. Even when French women are very successful, like in swimming, the media coverage is lower than for men. Thus, considering data we can observe some changes in the media coverage but the Olympic coverage still underrepresented women and present gender in very traditional way.

THE COVERAGE OF MALE AND FEMALE ATHLETES AT THE 2004 OLYMPIC GAMES – DANISH RESULTS

Pfister, G.

University of Copenhagen, Denmark

In Denmark, two news papers, Politikken, the most important paper, and BT, a boulevard paper, have been analyzed. Both papers focused on Danish athletes and those sports got the highest coverage where Danish participants were successful. Female athletes were highly underrepresented in both news papers. In Politikken, 57 % of the coverage of the Olympic Games was given to male athletes, 25 % to female athletes, 8 % to both sexes. 10% of the coverage did not refer to gender. In the search for the reasons for the gender imbalance we analyzed among other things the correlations between the percentages of women in the Danish team and among the medal winners on the one and the media coverage on the other hand. But this did not provide explanations. It seems to be the "taste" of the male journalists which prioritize men´s events and performances and thus produce a gender imbalance in the Olympic coverage.

INTERNATIONAL COMPARISON OF GENDER REPRESENTATION IN SPORTSMEDIA AT THE OLYMPIC GAMES 2004

Hartmann-Tews, I.A.

German Sport University Cologne, Germany

Gender representation in (sports-) media has long been characterized as anihilation and stereotyping of female athlets. The data of the international cooperation, encompassing the analysis of the coverage of the 2004 Olympic Games in more than 15 countries, confirm some of the long standing results but at the same time show deviating international variations. On the basis of the examples of three countries – France, Denmark and Germany – the presentation will outline some general features of stereotyped and stereotyping coverage and some national variations. Latter shall be integrated into a model that identifies structural and culutral elements that are supportive for a more gender-equitable quantitative and qualitaive coverage.

Invited symposium (IS)

IS1-02 Transport related physical activity and health - "Innsbruck"

RELATION OF CYCLING AND PREMATURE DEATH

Andersen, L.

Norwegian School of Sport Sciences, Norway

Physical activity in general prevents a number of diseases and premature mortality. However, little is known about the effect of specific types of habitual activity such as cycling commuting. Cycling as transportation is usually a type of activity of quite low intensity because most people want to get to work without sweating too much. Cycling as transportation is on the other hand a type of physical activity which could be easy for the individual to integrate into everyday living, and knowledge of health gain in relation to this type of physical activity is therefore important. We have earlier published cycling commuting in relation to all cause mortality, but it is not known whether improving cycling habits will decrease mortality.

Data from the prospective studies in Copenhagen was analysed.

The Copenhagen City Heart Study:

– Cycling in hours per week was assessed among 6,510 women and 8,466 men, 20-93 years of age, and changes in cycling habits was assessed after five years. During 162,016 person-years of observation 3,787 subjects died. Changes in cycling habits was assessed in 3,291 men and women who experienced 618 deaths.

Center for Preventive Medicine, Glostrupundersøgelserne and the Copenhagen Male Study:

– Cycling as transportation to work was assessed in 6,171 mænd og 783 kvinder. During 145.555 person-years of follow-up 2,291 died.

About 50% of the men and 40% of the women cycled at least ones a week, but cycling decreased with increasing age, and more in women than in men. Between the age of 20 and 45 years two third of all subjects cycled every week. Among women this percentage fell to 20% in the 65+ years old, but among men 45% in the age group 65-90 years still cycled. The amount of physical activity resulting from cycling is substantial in Denmark, and 30% of the whole adult population cycled more than three hours per week, which is sufficient to fulfil the international guidelines of 30 minutes of physical activity of moderate intensity per day.

After adjustment for other types of physical activity, socioeconomic back ground, smoking, blood pressure and cholesterol levels a mortality rate of 0,7 was found in cyclists compared to those who did not report weekly cycling. A similar difference was found when only cycling to work was analysed. These two analyses were conducted on different cohorts which show a consistent pattern. Further, changes in cycling habits over five years was analysed in relation to subsequent mortality, and a mortality rate of 0.66 was found among subjects who increased cycling compared to subjects who decreased cycling. Deaths among cyclists included subjects who were killed in traffic accidents.

COMMUTER CYCLING IN FLANDERS

de Geus, B., Joncheere, J., Aerts, I., Breynaert, J., Hellemans, S., Meeusen, R.

Vrije Universiteit Brussel, Belgium

On population level, the substantial health-enhancing potential of physical activity can be accomplished preferentially by incorporating physical activity into the daily life routine. Physical active commuting to work (PACW) provides a promising mode for such activity.

However, before PACW can be recommended, some questions have to be answered.

The Policy Research Centre Sport, Physical Activity and Health, funded by the Flemish Government started a four year project were several research questions concerning PACW were put forward: (1) does a substantial number of people within the Flemish working population have motivational and practical possibilities for PACW?; (2) what are the factors favouring or hindering PACW?; (3) and is there a difference in perception between those who cycle to work on a regular basis, and those who never cycle to work?; (4) what is the effect of cycling to work on physical and psychological parameters; (5) is there a dose-response relation between the energy expenditure and the measured physical and psychological parameters; and (6) what is the intensity of cycling to work at a self-chosen intensity?

In order to answer the first three questions a self-administrated questionnaire was used. The questionnaire inquired about certain factors such as distance and frequency of travelling to work, demographic and anthropometric data, psychosocial factors, environment and transport.

To investigate the possible effects of commuter cycling on physical performance and functional status and the quality of life, an one year intervention study was set up in Flanders. Sixty-five untrained subjects cycled to work at least three times a week to their workplace over a one-way distance of minimum two kilometres. All subjects were tested on three occasions in order to measure their maximal aerobic capacity and maximal external power. During the same day a RAND Short Form-36 (SF-36) questionnaire was filled in to assess functional status and well-being or quality of life and venous blood samples were collected after overnight fasting for total cholesterol, HDL cholesterol, LDL cholesterol, and VLDL cholesterol, triglycerides, uric acid and CRP. In order to calculate the dose, cycling data (frequency, distance, and duration) and participation in physical activities (type, duration and intensity) were recorded and written down in dairies during the whole period.

To answer the last question, a field study was set up to investigate what the intensity is of cycling to work on its own pace and whether this spontaneously selected physiological loading meets the requirements of HEPA.

Acknowledgement:

This study is funded by the Flemish Government.

Policy Research Centre Sport, Physical Activity and Health.

ENVIRONMENTAL FACTORS AND HUMAN POWERED MOBILITY FOR CHILDHOOD SCHOOL TRAVEL

Bringolf-Isler, B., Mäder, U., Ruch, N., Grize, L., Braun-Fahrländer, C.

Institute of Social and Preventive Medicine of the University of Basel, Switzerland

Introduction: Environmental factors influencing human powered mobility (HPM) for school travel has become an important Public Health topic. Very limited data exist about travel patterns of schoolchildren in Switzerland and about the extent of walking or bicycling to school. Therefore the SCARPOL study surveyed the commuting mode of Swiss children and determined which objective and subjective factors influence active commuting.

Method: The present study included 1345 Swiss children of three different age groups (kindergarten/1st class, 4th class and 8th class students) living in three communities (Bern: German speaking, Payerne: French speaking an Biel-Bienne: mixed language community). Parents responded to a questionnaire about the children's common commuting mode to school. For 1096 children the home address was available allowing us to allocate GIS-data about the home and the school environment (geographic information system) to these children.

Results: Overall, the prevalence of commuting by car or by bus appears to be rather low among Swiss children (21% in summer and 24% in winter) but differs between the language areas. Whereas in Bern more than 90% of children use HPM to get to school, only 75% do so in Biel-Bienne and less than 60% in Payerne. The reason for this difference cannot be reduced to cultural differences. According to the GIS-data children from Payerne have significant longer ways to school than children from the other two communities and they have to cross more dangerous crossroads. This fact is important because parents who perceive the way to school as dangerous accompany their children more often and this influences the mode of transport to school. In contrast to studies from Anglo-Saxon countries only 5% of Swiss parents are worried about violence by adults the children may experience on their way to school whereas nearly 90% perceive traffic as a major hazard for their children.

Conclusion Although passive commuting is still not very common among Swiss school children efforts are necessary to maintain active commuting rates or even to increase them. To encourage human powered mobility for children's commuting to school a broad range of environmental and family related factors have to be taken into account.

Invited symposium (IS)

IS1-03 Exercise and oxidative stress - "St. Moritz"

MOLECULAR MECHANISMS OF APOPTOTIS AND OXIDATIVE STRESS IN MUSCLE; ROLE OF EXERCISE INTERVENTION'

Leeuwenburg, C., Judge, S., Seo, A.Y., Hofer, T., Kalani, R., Jang, Y.M, Selman, C., Phillips, T., Prudencio M, Carter, C, Pahor M, Sung, B., Chung HY, Kim, J.H., Kwak, H.B., Lawler J, Smith, A, Hagen T, Speakman JR

University of Florida, Pusan National University, Texas A&M University, Linus Pauling Institute, Oregon State University, University of Aberdeen, United States

Aging causes a dysregulation in redox status due to an enhanced oxidant production and reduced antioxidant protection, which may lead to changes in specific signaling pathways including a pro-inflammatory response and altered tissue morphology. We investigated whether long-term voluntary exercise and mild 8% calorie restriction (CR) could attenuate these changes in the heart, liver and skeletal muscle. Four groups of male Fischer-344 rats were compared: young (6 mo) ad libitum fed (YAL), old (24 mo) ad libitum fed (OAL), old lifelong calorie restricted (8%CR: OCR) and age-matched old lifelong 8% CR with daily voluntary wheel running exercise (OExCR). After the age of 6-mos, running activity was maintained at an average of 1145  248 meters/day until all animals were sacrificed at 24-mos of age. Daily energy expenditure, as determined by the doubly-labeled water technique, was approximately 70% higher in runners compared to sedentary rats. In general, we found that oxidant production (hydrogen peroxide (H2O2), nitric oxide (NO•), and peroxynitrite (ONOO-)) was increased with age in several tissues, and moderate CR and wheel running exercise were able to attenuate the age associated increases. In addition, antioxidant status in tissues and in plasma (sulfhydryl (-SH), glutathione (GSH) and total antioxidant status) was decreased with age, and exercise and CR were also able to attenuate the age-associated decline. Moreover, old rats had significantly increased nuclear presence of NF-κB and in connection, increased levels of regulatory cytosolic phosphorylated I-κBα and decreased dephosphorylated I-κBα in the liver, suggesting an increased inflammatory response. Interestingly, a significant increase in liver RNA oxidation (8-oxo-7,8-dihydroguanosine) in the old ad libitum fed rats was detected and DNA oxidation (8-oxo-7,8-dihydro-2'-deoxyguanosine) also tended to increase. The age-associated increase in oxidative stress and upregulation of pro-inflammatory proteins was attenuated in the tissues from both the CR and the exercise + CR groups. Moreover, lifelong exercise + 8% CR showed a marked decrease in plasma CRP levels compared to 8% CR, while levels of CRP in 8% CR were also markedly lower. We also showed that lifelong voluntary exercise and mild caloric restriction preserve fast-twitch muscle morphology in the aging plantaris. In addition, both 8%CR and exercise protected against the large increase (+373%) in connective tissue found in OAL plantaris when compared with YAL. Furthermore, exercise protects skeletal muscle mass and muscle morphology against the effects of aging, while mild caloric restriction lessens age-induced changes in muscle morphology. In summary, lifelong exercise and 8% caloric restriction reduce oxidative stress and pro-inflammatory effects of aging in rats. This research was supported by grants to CL from the National Institute on Aging (AG17994 and AG21042) and an American Heart Association Fellowship to SJ (0215053B) and TH (0525346B).

CAN OXIDATIVE DAMAGE INDUCE GENE REGULATION? ROLE OF EXERCISE

Radák, Z.

Semmelweis Univeristy, Hungary

The ability to respond for stress plays and important role in the quality of life and effects the lifespan as well. So, it goes for a single cell and normal cellular metabolism is continuously jeopardized by internal and external stressors. Protection of cellular DNA, which contains all of the necessary codes for cell components, is vital for cells for survival. Although, nuclear and mitochondrial DNA is continuously damaged, the well constructed DNA repair systems are able to minimize the extent of damage. The protein p53 is induced by DNA damage and stabilize and activates several genes that causes cell arrest in G1, prior to the S-phase, to provide sufficient time to repair

DNA before replication takes place to prevent genetic instability. Therefore, it is not surprising that p53 regulates genes that are involved in nucleotide excision repair (NER) and base excision repair (BER). The later one is mainly specialized for repairing the oxidative damage to DNA caused by reactive oxygen species (ROS). Available information suggest, that the level of p53 is positively correlates with the activity of certain BER-enzymes. Conversely, p53 knockout cells show a very limited activity of 8-oxoguanine DNA glycosylase (OGG1), the enzyme which preferentially repair 8-oxodG in the DNA (Chatterjee et al. 2005). Interestingly, in certain cell lines H2O2 could not induce OGG1, while addition of p53 resulted in increased activity and content of OGG1. Therefore, it appears that DNA damage itself, has a potential to induce the activity of BER enzymes, via p53 and possible by other factors as well. Extensive contractions has been shown to up-regulate a number of genes, including p53, hence it cannot be ruled out that exercise-induced oxidative damage to DNA itself can activate the repair process resulting in increased activity of DNA repair enzymes.

Needless to say, that ROS are also targeting proteins and all of the amino acids residues are sensitive to modifications caused by ROS. Accumulation of oxidative protein damage can be prevented by increased degradation of modified proteins by proteasome complex, and the age-associated increase in carbonyls, marker of oxidative damage to proteins, is generally accompanied by decreased activity of proteasome. It is suggested that exercise-induced activation of proteasome, is at least some part, mediated by the generated oxidative damage to proteins.

THE ROLE OF REACTIVE OXYGEN SPECIES GENERATED BY SKELETAL MUSCLE IN SIGNALLING ADAPTIVE RESPONSES TO CONTRACTIONS

Jackson, M.J., Close, G.L., McArdle, F., Vasilaki, A., Pye, D., Palomero, J., McArdle, A.

University of Liverpool, United Kingdom

Skeletal muscle has a unique ability to adapt rapidly to changes in the pattern of activity that it performs. Following unaccustomed and demanding contractile activity numerous structural and biochemical changes in muscle have been recognised to occur. During contractile activity skeletal muscle cells generate increased amounts of reactive oxygen species (ROS) through a number of different pathways and we have obtained data that indicate these contraction-induced ROS modulate at least some of the adaptive responses that occur in skeletal muscle following contractile activity. This process involves activation of redox-regulated transcription factors, such as AP-1, NFB and HSF-1 and leads to increased expression of cytoprotective proteins that protect muscle cells against potential damage following subsequent rises in ROS activity.

MOLECULAR SPECIFICITY OF THE LOCAL TRAINING RESPONSE IN HUMANS

Flück, M., Schmutz, S., Hoppeler, H.

University of Berne, Switzerland

Background: It is commonly accepted in Sports that the adaptive potential of skeletal muscle to a given type of training is preset by the specific training state. Aerobic capacity may constitute a main determinant of the degree of adjustment for muscle oxidative metabolism with endurance training as it largely defines the relative metabolic stress with repetitive muscle contractions.

Hypothesis: The muscle gene transcript response to acute endurance exercise relates to the aerobic training state and allows a grading of the local exercise responsiveness of individuals.

Methods: Meta analysis was carried out on published results from Schmutz et al (Pflugers Arch 451(5): 678-87, 2006). During this protocol, six not-specifically trained young male volunteers pursued 6 weeks of ergometer training, 5-times a week for 30 minutes at 65% of the maximal workload (Pmax). Before and after the training, body composition, cardiovascular and respiratory performance of the subjects was characterized. Local adaptations to training were determined by ultrastructural analysis of vastus lateralis muscle and by gene expression profiling of 220 muscle-relevant transcripts throughout the first 24 hours of recovery from a 30-minute bout of exercise which matched the intensity of the 6-week training. Expression data were related to pre-biopsy values and verified for major patterns in the transcript response by public available cluster algorithms.

Results: Training improved the initial maximal power output [298 ± 22 Watt] and maximal oxygen consumption [VO2max; 42.3 ± 6.0 ml/min/kg] by 12% and 9%, respectively. This was reflected by a doubling of steady-state levels of transcripts for oxidative metabolic and related redox mechanism in vastus lateralis muscle in correspondence to a 40%-enhanced total mitochondrial volume density after training. The acute muscle response of gene transcripts to endurance exercise at the same relative intensity was blunted in the endurance-trained state. A virtually unchanged transcript expression pattern after the first exercise also discriminated the fittest individual with exceptional respiratory and cardiovascular values, i.e. a VO2max of 56 ml/min/kg, from the other untrained subjects.

Conclusion: The data support the contention that the systemic oxidative capacity modifies the molecular training response in humans. Thereby training responders appear tentatively identifiable from the analysis of the time-course of the gene response during recovery from a single bout of exercise.

Discussion: A cohort study with a well-matched human population is indicated to validate the use of combined molecular-biological and respiratory diagnostics in the prediction of the efficiency of endurance training.

Invited symposium (IS)

IS1-04 On the coordination dynamics of skill acquisition: a neglected dimension of expertise - "Albertville"

TIME SCALES AND EVOLVING LANDSCAPE MODELS OF MOTOR LEARNING

Mayer-Kress, G., Liu, Y., Newell, K.

Penn State University, United States

In physics, the analysis of time scales is a powerful tool to characterize the nature of systems that might otherwise not be accessible to us. Spectra of light from distant stars represent the internal time-scales of atoms and molecules and thereby provide us with insight not only of the composition of the stars but also their distance and most recently their rhythmic modulation reveals much information about

planets circling that star. Half-life times and growth rates - the other canonical manifestation of time scales in nature - can be observed in many pre-historic and ecological systems and tell the expert characteristic properties of the hidden processes.

Our approach to motor learning with an evolving landscape paradigm attempts to apply the powerful tools from physics to the realm of human movement. Instead of focusing on a reductionist approach of analyzing mechanical degrees of freedom we shift our attention to the extraction of characteristic time scales from learning/performance data.

From the observation of behavioral and performance data, analytical methods from the theory of non-linear dynamics of complex systems allows us to estimate the dimension of the processes generating the data. The method, known as time-delay reconstruction constitutes a significant generalization beyond traditional degrees of freedom based on mass spring models. For instance dimensions of single mechanical degrees of freedom (single finger joint) can vary over a large range as a result of psycho-physiological factors etc.

The Bernstein notion of redundancy of degrees of freedom is generalized in a landscape model to a concept of motor degeneracy in the sense that contour lines in a landscape, corresponding to a smooth continuum of different behavioral patterns (geographical points in the landscape) can produce identical performance outcomes (elevation values in the landscape). This geometrical interpretation allows a quantitative description of movement variability at invariant performance levels corresponding to Bernstein's release of degrees of freedom for skilled athletes.

We present a re-analysis of several classical data sets from the motor learning literature - such as the seminal paper 1926 paper by G.S. Snoddy - and illustrate our method with computer simulations that lead to predictions for novel experiments. The modeling effort that we explore is based on discrete, multi-dimensional iterative maps, which we find both conceptually more intuitive and not relying on the mathematically more convoluted concept of differential equations. One advantage of iterative maps is that they provide explicit time-scales in the modeling process and are naturally adopted to computational implementation.

A main future challenge is the theoretical understanding of the complete learning process involving both practice sessions as well as internal dynamics during rest periods. We present preliminary theoretical efforts along those lines.

HIT THE TARGET - HOW TO HANDLE STOCHASTIC INFLUENCES IN GOAL ORIENTED

Müller, H.

Saarland University, Germany

A central ability of the motor system is to achieve specified goals with great reliability, like we see in expert dart throwers, basketball players or shooters. This is only partly due to the fact that the extent of uncontrolled fluctuations can be reduced over practice. Furthermore there are two more components contributing to improved performance. A method is presented that decomposes this improvement into three orthogonal factors: "Tolerance", "Covariation" and "Reduction of stochastic noise". Central to this decomposition is that performance success is investigated in relation to variables in execution. Execution variables define a task space where successful performances form a subset or solution manifold.

In a virtual skittles task I will demonstrate that the actors improvement over a long sequence of trials, indicated by increasing accuracy in hitting the target, can be accounted for by the three factors mentioned: reduction of noise and Tolerance and, to a lesser degree, covariation. Different from that, the use of covariation provided considerable contributions in Darts and a boule-throwing task. This is particularly remarkable since, both ballistic movements where too short to allow sufficient closed-loop error processing. Data will be presented that are in favor of an alternative explanation. With ongoing practice learners increasingly approach an "equifinal trajectory".

Consequences of the observed phenomena to our understanding of error processing in the learning of goal oriented tasks will be discussed.

DYNAMICAL INFORMATION UNDERPINS ANTICIPATION SKILL IN PERCEIVING TENNIS SHOTS

Huys, R., Smeeton, N., Beek, P., Williams, M.

CNRS & Université de la Méditerranée, France

What information underpins visual anticipation skill in a complex discrete sport task? We examined this question in the context of anticipation to tennis shots from the premise that the invariant information resides in the dynamical features inherent within macroscopic kinematic patterns. In Experiment 1, we used principal component analysis to analyse three-dimensional kinematic data gathered from six skilled tennis players as they performed passing shots to different locations on the court. Five components captured more than 96% of the data's variance. No single component or combination of components was uniquely associated with a specific shot. However, significant differences in the eigenvector coefficients for the first five components were observed, especially as a function of shot direction. Thus, whereas shot-specific properties are allocated locally with varying degrees of variability, the same low dimensional dynamical structure governs the control of different tennis shots. In Experiment 2, we assessed the contribution of these dynamic features to anticipation skill. Skilled and less skilled tennis players anticipated the direction of simulated shots presented on a computer screen. Only dynamical features were manipulated and compared with a control condition in the form of the original shots. Simulations were generated by including components 1 to 5 in a cumulative manner. Skilled players were more accurate in anticipating shot direction than their less skilled counterparts. Furthermore, performance was not significantly different from the control condition when at least three components were included in the simulations. Moreover, the less skilled players tended to improve their performance under these simulations. In Experiment 3, the first five individual components and various combinations of components were used to create the simulations while we controlled the variance included in these simulations. Only the combination of components 1 and 3 and components 2 and 3 allowed for accurate perception of shot direction. These results indicate that multiple (i.e., three) low-dimensional dynamical components inform about shot direction and suggest that anticipation skill entails the extraction of these dynamics from high-dimensional displays.

Invited symposium (IS)

IS1-05 Physiotherapy in sport - facts or myth - "Berlin ABC"

SPORTS PHYSIOTHERAPY INTERVENTIONS OF ANKLE SPRAINS. WHERE IS THE EVIDENCE

Clijsen, R., Taeymans, J., Clarys, P.

Akademie Physiotherapie Thim van der Laan Landquart , Switzerland

Epidemiological data show a high injury incidence of the lateral capsular ankle ligaments. About half of the ankle injuries occur during sporting activities, due to an inversion trauma. Although inversion injuries of the ankle are a common problem in physical therapy, there is a converse variety of treatment strategies and differences in therapy outcome. There still seem to be a lack of evidence-based physical therapy strategies for this problem. The aim of this study was to scrutinize to reported literature for the effectiveness of the physical therapy in patients with ankle sprain.

Relevant studies were collected by conducting a literature search using the online databases; MEDLINE, PubMed, Pedro, and the Cochrane Database of Systematic Reviews. The following keywords were used: ankle, ankle injuries, acute ankle sprain, exercise therapy, physical therapy and ankle sprain, review, guidelines for physical therapy, cryotherapy, ultrasound and laser therapy. The selection criteria were randomised trails, clinical trails, review articles, and meta-analyses.

A total of 36 studies met these criteria; among them were 18 articles, 3 reviews and 15 CCTs.

For the diagnosis there seems to be no correlation between the medical classification of injury severity and the prognosis of recovery or between the severity of the ankle ligament injury and clinical findings. This may be partially caused due to the lack of a proper diagnosis definition of ankle sprain. Especially the use of a functional score, as often used in physical therapy, within the first five days after the initial injury is a valid and reliable diagnostic method to distinguish between mild and severe injury.

In general, there is no or only marginal evidence for the effectiveness of different physical therapies such as cryotherapy, electrotherapy and ultrasound. There is body of evidence that functional treatment is much more effective than immobilisation. Because there is a wide variety of treatment modalities and because in most studies multiple treatment regimens are used, no conclusions can be drawn concerning the effectiveness of specific treatment.

For chronic ankle problems, literature indicates that a conservative treatment is superior compared to surgery. There is intermediate evidence about therapy effectiveness of chronic ankle problems. The therapy should involve an exercise program, training proprioception, muscle strength, ADL activities and normalizing mobility. Most studies conclude that there is a lack of valid instruments for a standardized assessment of the different therapy interventions in physical therapy. Inconsistent definition of both treatment aims and therapy outcome impede an estimation of the effectiveness of different forms of conservative therapy.

Reference

Kerkhoffs et al. Different functional treatment strategies for acute lateral ankle ligament injuries in adults:
A systematic review. Acta Orthop Scand. 2003 Feb.

MECHANICAL AND NEUROMUSCULAR EFFECTS OF EXTERNAL ANKLE STABILIZERS

Alt, W., Brand, S.

University of Stuttgart, Germany

The major reason for recurrent ankle sprain is chronic instability. Large prospective and retrospective studies have demonstrated the prophylactic effects of taping and of individual ankle joint orthoses. Many other studies revealed a postexercise loss of mechanical stability.

It seems that besides external mechanical stabilization, neuromuscular stabilization could contribute to protect the ankle from injury. Stabilizing effect of external ankle support should be assed by injury simulation while recording velocity and magnitude of displacement. Many authors used "trap door" mechanisms or special "tilt platforms" in order to simulate an ankle injury by degrees of 20 to 50 degrees of inversion. Only few studies investigated the electromyography recordings (EMG) of neuromuscular activity during injury simulation - and if EMG was recorded then only latencies or maximum amplitudes were considered. In order to investigate neuromuscular or sensorimotor function of external ankle stabilizers it seems much more interesting to calculate the reflex induced integrated EMG activity during testing with and without ankle support (Alt et al., 1999). Testing a series of different ankle stabilizers in 6 different studies (tape, bandages, orthoses and shoes) a significant reduction of the induced ankle displacement magnitude could be observed for all tested ankle stabilizers with significant differences among the different stabilizers. Reflex induced EMG of lower leg muscles (m. peroneus long., m. tibialis ant.) was reduced by 5 to 15% compared to the integrated EMG without ankle stabilizer. The ratio of emg-reduction and mechanical reduction also showed significant differences. Thus one could conclude that these ankle stabilizers had different neuromuscular stimulation effects during the simulated injury. Despite improved experimental setups with increasingly complex trapdoor mechanisms the vast majority of the methods still simulate traumata under static conditions. In order to simulate the real traumatic paradigm more realistically, setups should include a dynamic situation (landing or leaping movements) without prior knowledge of the subject, which side and what movement will be induced. We managed to construct an experimental setup similar to Ubell et al. (2003) which we believe takes us one step closer to the real traumatic incidence. Our subjects wear shoes with interchangeable soles attached via a simple locking mechanism. Unaware of the character of the sole subjects perform two-footed landings and are tested under the conditions of inversion right or inversion left or no inversion.

References

Alt, W., H. Lohrer, and A. Gollhofer.

THE EFFECTS OF ANKLE TAPING ON PROPRIOCEPTION: A SYSTEMATIC REVIEW

Cabri, J., Esteves, J., Sousa, J.P., Oliveira, R.J., Donaghie, M.

Technical University of Lisbon, Portugal

Objectives: to look for the evidence to support or challenge the use of ankle taping as a prophylactic measure or in the treatment of ankle injuries was undertaken.

Methods and Material: The literature search was carried out using three databases: PubMed, Physiotherapy Evidence Database (Pedro) and the Cochrane Library. The search was limited to articles published from 1985 to 2005 in the English language. The search terms used were: "ankle tape" or "ankle taping" combined with "proprioception" or "proprioceptive" or "joint position sense" or "kinaesthesia" or "postural sway" or "peroneal reaction time" or "peroneal latency".

Three independent trained physiotherapists were asked to review each article according to the review criteria of the Pedro Database. The reliability of Pedro scale rating is reported elsewhere [1]. All reviewers were provided with a data sheet for each article, containing the eleven Pedro criteria. Accordingly, each publication was evaluated and received a rating from 0 to 10. After the rating procedure, a consensus meeting was held where the reviewers could exchange their opinions where disagreement existed with respect to the ratings.

Results: A total of 89 references were identified from the searches. Through a number of selection procedures, only nine papers were withheld for rating. The Pedro rating scales ranged from 3.3 to 5.7 (mean) and from 3 to 6 (modus). No real randomized controlled studies were found.

With respect to the measurements of proprioception, peroneal reaction time after sudden movement (inversion of plantar flexion or a combination of both) was measured in six of the studies, whereas movement reproduction or detection were used in two. Only one of the selected reports dealt with postural sway as a measure of proprioception.

Five studies reported that ankle tape had no effect on the proprioception measurements, in one study a decrease in postural sway was found before exercise but no differences were observed after exercise, two referred that ankle tape may influence positively proprioception and consequently the ankle dynamic stability and, one publication found a delayed peroneal reaction time with ankle tape.

Discussion: As it is evidenced in this systematic review there is no extensive collection of studies investigating the effects of ankle tape on proprioception available. Better-designed, randomised controlled trials with higher methodological quality are required come to conclusive results on the effects of ankle taping on proprioception.

1. Maher, C.G., et al., Reliability of the PEDro scale for rating quality of randomized controlled trials. Phys Ther, 2003. 83(8): p. 713-21.

Oral presentation (OP)

OP1-01 Physiology 1/10 - "Oslo"

MUSCLE ACTIVATION DURING CYCLING AT DIFFERENT CADENCE: EFFECT OF MAXIMAL STRENGTH CAPACITY

Bieuzen, F., Hausswirth, C., Brisswalter, J.

University of Toulon-Var, France

The purpose of this study was to examine the influence of maximal strength capacity on muscle activation, during cycling, among three randomly selected cadences: a low cadence (50 rpm), a high cadence (110 rpm) and the freely chosen cadence (FCC). Two groups of trained cyclists were selected from their different maximal isokinetic voluntary contraction values (MVCi) of lower extremity muscles as following: Fmin (lower MVCi group) and Fmax (higher MVCi group). All subjects performed three four minutes cycling exercises at a power output corresponding to 80 % of the ventilatory threshold under the three cadences. Neuromuscular activity of vastus lateralis (VL), rectus femoris (RF) and biceps femoris (BF) was studied quantitatively (integrated EMG, EMGi) and qualitatively (timing of muscle bursts during crank cycle). Cadence effects were observed on the EMG activity of VL muscle and on the burst onset of the BF, VL and RF muscles. A higher EMG activity of VL muscle was observed for the Fmin group than the Fmax group at all cadences. At FCC and 110 rpm, the burst onset of BF and RF muscles of the Fmax group started earlier in the crank cycle than the Fmin group These results indicate that in addition to the cadence, the maximal strength capacity influence the lower extremity muscular activity during cycling.

NEUROMUSCULAR FATIGUE DURING PROLONGED TENNIS PLAYING

Girard, O., Lattier, G., Micallef, J.P., Millet, G.P.

University of Montpellier, Faculty of Sport Sciences, France

Introduction: Although alterations of neuromuscular function and origin of strength loss after prolonged continuous exercises (i.e. running, cycling or ski skating) have been investigated, only scarce information is available on the impairment of performance resulting from neuromuscular fatigue in activities with discontinuous high-intensity load profile such as racquet games. The aim of this study was therefore to examine the time course of impairment in neural and contractile processes of knee extensors (KE) muscles during a prolonged tennis match play. Methods: Maximal voluntary contraction (MVC) and maximal voluntary activation level (%VA) of KE muscles were measured during brief interruptions before (T0), during (30, 60, 90, 120, 150 and 180 min: T30, T60, T90, T120, T150, T180) and 30-min after (T+30) a 3-h tennis match in 12 trained players. Changes in muscle excitability were assessed by examining the characteristics of the M-wave (i.e. duration, amplitude, surface) of vastus medialis and vastus lateralis muscles and the twitch contractile properties (i.e. peak twitch, twitch contraction time, half relaxation time, maximal rate of twitch tension development and relaxation) at the same time intervals. Finally, short (0.75-s) tetanus at 20 Hz and 80 Hz were electrically evoked (model DS-7, Digitimer Stimulator, UK) and peak tetanus tension at 20 Hz (P20) and 80 Hz (P80) were recorded. The torque (Captels, FR) and EMG data (MP30, Biopac, CA) were stored (2000 Hz) with commercially available software (Acqknowledge 3.6.7, Biopac, CA). Results: MVC decreased from 250 ± 32 N.m-1 at T0 to 219 ± 48 (-13%; $P < 0.001$), 227 ± 48 (-9%; $P = 0.011$) and 222 ± 34 N.m-1 (-10%; $P < 0.01$) at T150, T180 and T+30, respectively. %VA gradually decreased throughout the exercise from T0 until T150 (83.9 ± 5.6 vs. 74.3 ± 13.2%; -11%; $P = 0.12$) before returning near initial values at T180 (85.1 ± 6.1%). No change in M-wave duration and amplitude nor in contractile properties was observed. P80 did not change significantly with exercise whereas P20 decreased by 12%; so the P20/P80 ratio was 12% ($P < 0.001$) lower in the fatigued state. The MVC/P80 ratio declined significantly (-16%; $P < 0.01$) from T0 to T180. Discussion/Conclusions: These findings indicate that changes in sarcolemmal excitability or at the crossbridge level cannot explain muscle fatigue during prolonged tennis playing. Rather, central activation failure and alterations in excitation-contraction coupling (low-frequency fatigue) are probably the main mechanisms contributing to the moderate impairment of the neuromuscular function during this activity. It is postulated that the coupling effects of accumulation of H+ and Pi, known to limit Ca2+ release, to reduce Ca2+ sensitivity and to decrease the number of strong binding cross bridges are probably among the most underlying causes.

INFLUENCE OF ENHANCED VISUAL FEEDBACK ON POSTURAL CONTROL AND SPINAL REFLEX MODULATION

Leukel, C., Taube, W., Gollhofer, A.

University of Freiburg, Germany

Introduction

Postural balance depends on many interactive processes within the central nervous system. The visual system is an important sensory source which helps to stabilize posture. Reduced visual feedback was shown to decrease postural stability and reduce the excitability of the spinal reflex system (Hoffman and Koceja 1995). Therefore, it was hypothesized that enhanced visual feedback should increase postural stability. The aim of the present study was to compare the influence of normal and enhanced visual feedback on postural stability and the excitability of the spinal reflex system.

Methods

13 healthy subjects participated in the study. Enhanced visual feedback was achieved by pointing on a blackboard with a handheld laser pointer. Stance stability was tested on a spinning-top which intensified the requirement in maintaining balance. Postural sway (center of pressure) of the standing subjects was measured with normal and enhanced visual feedback. The excitability of the spinal reflex system was ascertained with H-Reflex stimulation of the soleus muscle. The entire sway paths as well as the peak to peak amplitude of the H-Reflexes and M-waves were calculated as dependent variables for each condition. A Wilcoxon signed-rank test was used to examine differences between the conditions. An α-level of 0.05 was accepted. Data are shown as mean±SEM values.

Results

Sway path

Enhanced visual feedback resulted in less postural sway compared to normal visual feedback (176.0±13.6 cm vs. 189.3±13.5 cm, $p = 0.03$).

H-Reflexes

Enhanced visual feedback resulted in higher H-Reflex amplitudes than normal visual feedback (0.75±0.11 mV vs. 0.65±0.10 mV, $p = 0.001$). There were no differences in the stimulation intensity between the conditions. Six out of 13 subjects showed distinct M-waves with normal (0.23±0.08 mV) and enhanced visual feedback (0.23±0.08 mV, $p = 0.60$).

Discussion

The most prominent finding of this study is that enhanced visual feedback caused a significant increase in postural stability and an increase of the H-Reflex amplitudes. The spinal reflex system is thought to be suppressed when stance is unstable, probably to avoid reflex-mediated joint oscillations (Katz et al. 1988, Koceja and Mynark 2000). However, enhanced visual feedback which stabilized posture may have released the restrictions of the spinal reflex system. Presynaptic inhibition is the most likely mechanism for the change in the excitability of the Ia-afferents (Katz et al. 1988). It may be argued that constraints in the visual perception of body sway disallowed the system to minimize postural sway.

References

Hoffman MA & Koceja DM (1995). Brain Res 700, 303-307.

Katz R, Meunier S, Pierrot-Deseilligny E (1988). Brain 111, 417-437.

Koceja DM & Mynark RG (2000). Int J Neurosci 103, 1-17.

A COMPARISON OF CORE BODY TEMPERATURE MEASUREMENTS DURING PROLONGED, MODERATE-INTENSITY CYCLING AT 20°C AND 35°C

Mündel, T., Carter, J.M., Wilkinson, D.W., Jones, D.A.

The University of Birmingham, United Kingdom

The aim of the present study was to compare three different measures of core body temperature (Tcore) during exercise since there are practical problems associated with each method and, sometimes, uncertainty as to which is the appropriate measure. Seven trained males (VO2max: 61 ± 7 ml/kg/min; mean ± SD) completed two 60-min cycling trials at 65% peak aerobic power at either 20°C (CON) or 35°C (HOT) (33 ± 2% relative humidity; mean ± SE), which constituted a relative intensity of 69 ± 2% and 71 ± 2% VO2max ($p < 0.05$). Measures of core temperature were made with oesophageal (Toes) and rectal (Trec) thermistors and of the gastro-intestinal tract temperature (Tgi) with a temperature-sensitive disposable radio-pill. Mean weighted skin temperature remained constant during the trials (CON: 30.1 ± 0.5°C, HOT: 32.7 ± 0.2°C; $p < 0.001$). During CON, all three measures of Tcore increased by ~1°C in the first 20 min but thereafter Toes began to plateau and was significantly lower than Trec and Tgi at all subsequent time points, with values at 60 min of 37.7 ± 0.1°C, 38.4 ± 0.1°C and 38.2 ± 0.2°C, respectively ($p = 0.01$). During HOT, resting Toes was lower than Trec and Tgi (36.5 ± 0.1°C compared to 37.0 ± 0.1°C; $p < 0.01$). The initial rise in Toes during HOT began to slow by 20 min, so that values were significantly lower than Tgi and Trec after 30 and 40 min, respectively ($p = 0.001$). Values at fatigue were: Toes: 38.3 ± 0.2°C, Trec: 38.8 ± 0.2°C and Tgi: 38.7 ± 0.2°C ($p < 0.05$). In summary, Toes displays a more rapid response during the initial stages of cycling in thermo-neutral conditions and in the heat. However, as exercise progresses Trec and Tgi approach Toes and continue to rise to significantly higher values. As a consequence, during lower limb exercise, there appears to be a mis-match between core temperatures measured at different deep body locations.

Oral presentation (OP)

OP1-02 General 1/1 - "Turin ABC"

DEFINING 'OLYMPISM' IN THE DISCOURSE OF THE LATE/ HIGH MODERNITY

Chatziefstathiou, D.

Canterbury Christ Church University, United Kingdom

The aim of this paper is to attempt to define 'Olympism' in late or high modernity, after identifying and evaluating the changing nature of the values associated with the ideology of Olympism in the discourse of the modern Olympic movement. Moreover, it will also seek to

address and highlight some of the key challenges that Olympism is facing today. The paper draws arguments from the findings of a large-scale study that evaluated the changing nature of the ideology of Olympism in the modern era. The method adopted was that of Ethnographic Content Analysis (ECA), a variation of the qualitative content analysis (Altheide 1996), conducted upon the writings of key sets of actors (Baron Pierre de Coubertin, Carl Diem, invited lecturers of the International Olympic Academy). The multi-causal approach of globalisation theories, which takes into account the association of Olympism and the Olympic Movement with contemporary globalisation processes and the form of society and governance they are generating, has provided an adequate explanatory framework in understanding the articulation of values associated with the ideology of Olympism in late or high modernity.

This study demonstrated how the values associated with the ideology of Olympism have changed against the contemporaneous historical, socio-political and economic contexts during the period of one hundred and eleven years (1887-1998). Values such as amateurism and women's exclusion have now been considered outdated, whereas new values such as environmentalism have been incorporated in the Olympic agenda. The nature of Olympism has been a contested one, full of inconsistencies and paradoxes throughout the modern history of the movement. The ideal of internationalism has, to a degree, been subverted by the national structure of the Olympic Games and the projection of nationalist values which has become strongly associated with the fabric of the Games, especially during the last four decades. Moreover, the ideals of universalism, multiculturalism and equality have been undermined by elitist, racist and ethnocentric references of the key players of the Olympic movement, and several practices evident in the Olympic Games such as doping, commercialisation and professionalisation. Finally, the study has highlighted the culturally diverse meanings and values associated with Olympic sport in the contemporary world, and emphasised that one of the key challenges facing those who value Olympism in a multicultural and multipolar world is the construction of consensus around its values. Olympism may be defined not as a set of immutable values, but as a process for consensus construction in terms of values in the world of global sport, since, as the last century of Olympism has illustrated, one of the few 'constants' on which one can rely is change.

References

ALTHEIDE, D.L., 1996. Qualitative Media Analysis. California, USA: Sage.

DECONSTRUCTING OLYMPIC GAMES

Sentuna, B.

Middle East Technical University, Turkey

The aim of this paper is to present and figure out and link the concepts of deconstruction an Olympic Games. It is made up of three parts. First part of this paper deals with the presentation of the concept of Deconstruction and the philosophy of Derrida. Second part of this paper aims at, presentation of the concept of avenir and the deconstruction of the crucial text of Olympic philosophy, The Olympic Charter. The third part of this paper deals with the philosophical concept of Derrida, host, guest and ghost and their transfer to the Olympic taxonomy. The last part and conclusion part of this paper deals with the synthesis of this philosophical analysis and considers possible alternatives on the crisis points in the form of What should be done?

Deconstruction is popularly known as Derrida's theory in recent philosophy. It is nearly impossible and unnecessary to give a definition of deconstruction. On the other hand what it does can be figured out. . It acts together with binary oppositions, present in the context and finds the dominant and the critical element Deconstruction mainly deals with what is at hand, present at hand and, reconsiders the dominance resulting from, logo centrism, power, and politics and considers the way to resolve it, especially in the texts, taking history of philosophy into account.

The deconstruction point about the Olympic Games is mainly the "peace" ideal of the Olympic Games. Peace for Derrida is "avenir": that is future to come as it is in, democracy, and justice. It is possible as an experience of impossible which is a very hard concept. It is both linked with the political philosophy and the history of philosophy. The concept of avenir will be examined in this paper together possible experience of the impossible. The Olympic ideal of peace as it is stated in the Olympic Charter will be the main text to be deconstructed.

Another focus will be on the, strange and hard concepts of Derrida, host, guest, and ghost. Derrida not only puts these concepts into philosophical taxonomy but also puts the relations between them. The interesting and the differentiating character of this paper is, when transferred to the Olympic terminology they turn out to be Host City and the Guest Countries, and possibility of ghost interventions such as nationalism. The philosophical background of the Derridian concept will be given and their relation with the Olympic Games will be established. What does it mean to be host? What does mean to be guest and what are possible ghosts? With respect to Olympic Games are the main questions of this part of the paper.

The conclusion part of this paper is aimed at a synthesis of the deconstruction and the possible new way of presenting the Olympic ideas. The possible solutions will be discussed in detail about the Olympic Charter and the politics. Both regarding the peace and the education of the youth and also regarding the host city and the guest countries and the possible ghosts.

ESCALATION OF VIOLENCE AT THE MAKSIMIR STADIUM IN 1990 – THE BEGINNING OF WAR IN EX-YUGOSLAVIA?

Custonja, Z.

University of Zagreb, Croatia

A day after the first democratic election results in Croatia after World War II were announced, the football match between FC Dinamo, Zagreb, and FC Red Star, Belgrade, was to be held in Zagreb at the Maksimir Stadium. The match has never been played.

Main purpose of the paper is to explain historical circumstances connected with the political moment of the never played football match on 13th of May, 1990. Hooligan riots and escalation of violence, intervention of police, as well as social and historical significance of the mentioned match will be investigated. In the paper the primary and secondary sources will be used, that is, a copy of TV broadcasting and Sports News, the leading daily sport's paper in Croatia.

The "Biggest incident in the history of Yugoslav football" (Sports News, 15th of May 1990, p. 3) must be seen and discussed in a wider social and political sense. In a situation when Croatian Democratic Union had won first free and democratic elections in Croatia with independence of the state of Croatia as its main political platform, when nothing could had stopped fall of communism in Yugoslavia, and, on the other hand, when Slobodan Milosevic publicly had been speaking about Big Serbia, the football match between the greatest Croatian and Serbian football teams never had any chance to stay in the boundaries of sport.

Delije, the Red Star supporters, started to break down billboards above them before the beginning of the match. They managed to crash the fence and entered the south stand sitting area on the stadium. There were few hundreds supporters of Dinamo. Most of them started to run towards exits while some retaliated. On the TV broadcast record it is clearly visible, and it was later confirmed in the official police report, no one from either the security or the police did even try to stop the Red Star supporters from demolishing the south part of the

stadium or did anything to prevent or stop the inevitable clash of opposing supporters. At that moment Bad Blue Boys, the hard core Dinamo supporters, from the north stand started to throw stones on the police, demolished the fence and entered the pitch. Massive fight between them and the policemen started.

There are enough indices to conclude that the Red Star supporters were politically manipulated and instructed to provoke the supporters of Dinamo. Their aim was to present Dinamo supporters as violent and aggressive nationalistic people who fought against police, law and social order, and, consequently, against Yugoslavia. Main purpose of the provoked hooligan riots at the Maksimir stadium was destabilization of political scene in Croatia and prevention of peaceful and democratic transition of communist government to the new democratically elected government.

Sources

1. Sports News (1990), 15th of May, volume XLVI, No. 10124.
2. Sports News (1990), 16th of May, volume XLVI, No. 10125.
3. TV broadcast record of football match between FC Dinamo, Zagreb and FC Red Star, Belgrade.

PERFORMANCE PREDICTION IN ENDURANCE SPORTS

Kleshnev, V., Whyte, G.

English Institute of Sport, United Kingdom

Performance predictions in endurance sports (running, swimming, rowing, etc) can be useful in a number of ways: In shorter terms it defines tactical plans of the race. In longer terms it can be used for setting up targets and intensity zones for training. Team managers and head coaches use so called "prognostic" or "gold standard times" for athletes' selection and optimization of squads.

Factors affecting performance in endurance sports are: training volume and profes-sionalism; training methods; technique development; equipment development; using drags and doping control.

Environmental factors (water and air temperature, wind speed and direction) have sig-nificant influence in rowing and canoeing. These factors have random nature, which creates high uncertainty and difficulties in performance prediction in these sports. We analysed long term 1900-2005 trends of world records in similar endurance events: rowing, 1500 and 3000m running and 400m swimming. The trend lines in all sports have quite similar patterns. We can define five common periods:

Before 1920. Fast growth of performance 1-1.5% per year, which can be explained by initial development of sporting technique and training methods.

1920 – 1950. Slow growth (0.5% per year) caused by two World Wars, amateur status of the athletes and lower competition due to separation of the East and West sport systems.

1950 – 1980. Very fast growth of performance 1-2% a year. Eastern block joined Olym-pic sport in 1952. Sport became a political factor and professional activity, which boomed de-velopment of training volume, methods and use of drags in sport. This performance growth was even faster in women, because it coincided with initial development in some women's events.

1980 – 1996. Slower growth 0.5-0.8% a year. Training volume approached its biological limit; effective training methods became widely known, improvement of the drag control. Rowing performance continue to grow relatively faster (1.5% a year) than in athletics and swimming. The reasons were equipment development (plastic boats and oars, big blade, etc.) and active FISA position in wider promoting of rowing and popularisation of modern training technologies.

T5 1996 – now. Stable period and even decreasing of performance, which can be seen in the latest trends of the yearly world best times in athletics.

We can speculate that the reasons could be further development of doping control methods (such as blood doping test) and sociological factors. Nevill and Whyte (2005) believe that "many of the established …endurance running world records are nearing their limits. …the athletic and scientific community may continue to explore greater performance gains through use of pharmacology and the evolving science of gene doping.

Oral presentation (OP)

OP1-03 Sports Medicine 1/4 - "Berlin DE"

LONG-TERM THERAPY: A KEY ROLE TO TREAT OBESITY IN ADOLESCENTS

Prado, W.L., Tock, L., Caranti, D.A., Piano, A., Cristofalo, D.M., Lederman, H., Siqueira, K.O., Stella, S.G., Tufik, S., Mello, M.T., Dâmaso, A.

São Paulo Federal University, Brazil

Actually is well established that exercise is an essential non-pharmacological therapeutic to control obesity, but in literature we didn't find many researches using long-term therapy (>24 weeks). The purpose of this study was to analyze the effects of long-term treatment on body composition measurements in obese adolescents. We evaluated 18 boys and 22 girls aged between 13 and 19y with IMC>30 wt/ht2. Body composition variables were asses by pletismography; visceral and subcutaneous fat by ultrassonography. All patients were performed 24 weeks of moderate aerobic training, intensity corresponding ventilatory threshold, 3 times each week. After basic statistics, no differences were founded for neither variable, for this reason, both boys and girls were analyzed together. Despite no differences on IMC, body mass and fat%, this adolescents decreased visceral (3,58+ 1,20 to 2,75+ 0,75cm*), subcutaneous (3,14 +0,60 to 2,93+ 0,83cm*), fat mass (40,26+ 8,57 to 34,99+ 12,07kg*) and augment lean body mass (57,86+ 6,84 to 62,30+ 12,10*kg). We can conclude that long-term therapy was a powerful strategy to treat obesity in adolescents.

LOW PHYSICAL ACTIVITY LEVEL AND INCREASED BODY FATNESS IN CHILDREN AND ADOLESCENTS WITH TYPE 1 DIABETES

Trigona, B., Farpour-Lambert, N.J., Keller-Marchand, L., Oehrli, M., Martin, X., Beghetti, M., Schwitzgebel, V.

University Hospital of Geneva, Switzerland

BACKGROUND: Physical activity is recognized as an important component of the treatment of type 1 diabetes patients. However, little is known about their physical activity level. OBJECTIVE: To measure physical activity and fitness level in children and adolescents with type 1 diabetes, and to evaluate their relationships with body fatness. METHODS: Cross sectional study including 41 children and adolescents with type 1 diabetes and 61 matched healthy controls (mean age 10.5 +/- 2.6 yrs). Subjects were matched for gender, age, height, and pubertal stage. We measured 7-day physical activity count using an accelerometer Actigraph MTI; past 12-month physical activity by a questionnaire and maximal aerobic capacity (VO2peak) by a maximal treadmill test. In addition, we calculated body mass index (BMI) and assessed the percentage of body fat by DXA. RESULTS: Children with diabetes had higher BMI (18.6 +/- 2.7 vs 17.2 +/- 2.4 U, p=0.009), body fatness (22.1 +/- 7.9 vs 21.2 +/- 7.2 %, p=0.008) and lower 7-day physical activity count (305.0 +/- 91.1 vs 354.1 +/- 104.2 cpm, p=0.03) compared to controls. In the diabetic group, 34.9% were overweight and 16.3% were obese. Body fatness was negatively correlated with physical activity (r=-0.35, p=0.031) or VO2peak (r=-0.62, p=0.001). CONCLUSIONS: Children and adolescents with type 1 diabetes have reduced physical activity level and increased body fatness. As physical activity is known to reduce cardiovascular diseases risk factors, these patients should be encouraged to participate in sports.

BODY MASS INDEX, FUNCTIONAL CAPACITY AND COGNITION ACCORDING TO PHYSICAL ACTIVITY LEVEL: FOLLOW-UP LONGITUDINAL ELDERLY'S STUDY

Ferreira, M., Matsudo, S.M., Matsudo, V.K., Ramos, L.

São Paulo Federal University - UNIFESP and Physical Fitness Research Laboratory from São Caetano do Sul CELAFISCS , Brazil

PURPOSE: to compare the body mass index (BMI), functional capacity and status cognitive or cognition among elderly people according to the physical activity level (PAL). METHODS: Sample consisted of 949 elderly people from 67 to 100 years old (x: 74.9  6.7 years) derived from the first follow-up (1993/1994) of a prospective longitudinal survey, called EPIDOSO, started in 1991/1992 at São Paulo City, Brazil. PAL was determined through questions about frequency (times/week) and duration (min/week) of PAs. BMI was calculated based in body weight and body height; cognition function assessed by Mini-Mental State Examination (MMSE) and functional capacity (FC) through the AVDs and AIVDs scale. Subjects were divided in three groups according to PAL: a- Regularly Active: those who met the current PA guidelines: vigorous PA: 3d.wk-1, 20 min/day; or moderate activity: 5d.wk-1 30 min/day; b- Insufficiently Active: subjects below that recommendation; and c- Sedentary: those who did not report any PA. Statistical analysis used was one way ANOVA, Bonferroni test and delta percentual. RESULTS: The regularly active elderly people group (n: 110) reached better values of FC (0.95 points; - 57.7%; p <.01) compared to the sedentary elderly group (3.64 points) and better values for cognition (27.77; 9.63%; p <.01) compared to the sedentary elderly people group (25.33 points). The insufficiently active elderly people group (n: 52) also achieved better values in FC (1.54 points; 62.10; p <.01) and cognition (28.06 points; 1%; p <.01) compared to the sedentary elderly group (n: 787). There were not significant diference in BMI among all groups (sedent: 26.95; Insuf. Active: 27.13; Reg. Active: 27.13 kg/m2). CONCLUSION: PA level seems to have a positive relationship with performance on cognition and functional capacity tests of elderly population from a developing country.

PHYSICAL EXERCISE INCREASES ADIPONECTION RECEPTOR-1 EXPRESSION LEVELS AND IMPROVES INSULIN SENSITIVITY IN KKAY MICE

Huang, H., Tada Iida, K., Sone, H., Yamada, N., Ajisaka, R.

University of Tsukuba , Japan

Background and aims: Adiponectin is an adipocytes-derived factor, which plays pivotal roles in lipid and glucose metabolisms in skeletal muscle and liver 1). Recently, two adiponectin receptor types were identified. Adiponectin Receptor 1(AdipoR1) is abundantly expressed in skeletal muscle, whereas Adiponectin Receptor 2(AdipoR2) is predominantly expressed in liver2). Potential pathophysiologic role for alterations in AdipoR1 has been supported by the correlation between receptor expression and insulin resistance. This study aimed to investigate the effects of acute and chronic physical exercises on AdipoR1 mRNA expressions in skeletal muscle and liver and insulin sensitivity of mice.

Materials and methods: First, we used 8-week old male mice (C57BL6J, n=12) to investigate acute exercise effects on AdipoR1 expression of skeletal muscle and liver with treadmill running protocol. Furthermore, we divided 8-week old male obese/diabetes mice (KKAy, n=12) into exercise training group and control group. The mice were accustomed to the treadmill running exercise for 8 weeks. We evaluated insulin sensitivity by Intravenous Glucose Tolerance Test (IVGTT) and Intraperitoneal Insulin Tolerance Test (IPITT), and underwent Northern blot analysis for AdipoR1 mRNA expression in skeletal muscle and liver. All of the protocols were approved by the institutional animal care and use Committee at University of Tsukuba.

Results: The acute exercise increased AdipoR1 mRNA expression levels 1.1-fold at 2h and 1.4-fold at 16h after exercise bout in skeletal muscle, and 1.3-fold at 2h after exercise bout in liver ($p<0.0493$, $p<0.005$, and $p<0.0257$, respectively). The 8-week exercise training improved insulin resistance but not changed plasma adiponectin concentration and adiponectin mRNA expressions in white adipose tissue. However, the expression levels of AdipoR1 mRNA was approximately 1.8-fold greater in the skeletal muscle, 1.3-fold in the liver of the exercise training group as compared to the control group ($p<0.0006$, $p<0.0215$, respectively). In addition, AdipoR1 mRNA expression levels were associated with Acly Coenzyme A Oxidase (ACO), Carnitine Palmitoyl Transferase 1(CPT1), and Peroxisome Proliferator-Activated Receptor Alpha (PPARa) mRNA expression levels in liver, but not in skeletal muscle. Therefore, the increase of AdipoR1 expression by physical exercise in skeletal muscle may be independent transcriptional regulation, not through PPAR family.

Conclusion: Both acute exercise and 8-week exercise training induced a significant increase of AdipoR1 mRNA expression levels in skeletal muscle and liver, and it may contribute to improving insulin sensitivity in KKAy mice.

References

1) Yamauchi, T., et al. Adiponectin stimulates glucose utilization and fatty-acid oxidation by activating AMP-activated protein kinase. Nat, Med. 8: 1288-1295, 2002.

2) Yamauchi, T., et al. Cloning of adiponectin receptors that mediate antidiabetic metabolic effects. Nature. 423: 762-769, 2003.

THE EFFECT OF EXERCISE AND OXIDANT-ANTIOXIDANT INTERVENTION ON THE LEVEL OF NEUROTROPHINS AND FREE RADICALS IN CEREBELLUM AND SPINAL CORD OF RATS

Siamilis, S., Jakus, J., Nyakas, C., Silye, G., Radák, Z.

Semmelweis University, Budapest, Hungary, Hungary

Reactive oxygen species (ROS) are unavoidable products of oxygen utilization and it has been shown that when central nervous system cells are exposed to ROS there is an increased production of neurotrophins particularly brain-derived neurotrophic factor (BDNF) and glial cell line-derived neurotrophic factor (GDNF). In addition, it is also known that neutrophins can improve brain function and increase the viability of neuro cells. Exercise training has a capability to significantly improve memory and other functions of the brain with effecting the redox state and neurotrophin content.

In this study we endeavor to establish a cause and effect relationship between BDNF, GDNF levels and ROS concentration in cerebellum and spinal cord in exercise study.

We tested the hypothesis that alteration of ROS concentration by H2O2, antioxidant treatment or by exercise differently modulates the BDNF, and GDNF level and physiological function. Methods: Thirty-six, 5-months old male Wistar rats were randomly assigned to one of six experimental groups: non-exercised control injected with saline (NEC), non-exercised injected with H2O2 (NEH), non-exercised injected with PBN (NEP), exercised control injected with saline (EC), exercised injected with H2O2 (EH), and exercised injected with PBN (EP).The treatment protocol consisted of 10 weeks involuntary running 5 days/week with moderate intensity 27 m/min on treadmill, between weeks 9th and 10th all groups were injected subcutaneously with saline, H2O2 and PBN respectively every other day one hour prior to running. Results: Hydrogen peroxide injection resulted in an increased BDNF concentration in spinal cord of NEH and EH groups. Exercise alone had little effect in BDNF production. The ESR indicated a significantly higher ROS concentration in the spinal cord of these groups. The BDNF concentration in spinal cord was significantly correlated with the ESR signal. The GDNF production in the same tissue did not affected by exercise but it was increased in NEH group. In the cerebellum hydrogen peroxide injected groups had both BDNF and GDNF concentrations elevated significantly. Once more the effect of exercise alone was inefficient in inducing increment in these two neurotrophins. Interestingly the ROS concentration in cerebellum was negatively correlated with both BDNF and GDNF concentration. Conclusions: These results suggest that involuntary exercise itself did not enhance BDNF and GDNF production in spinal cord but rather oxidants were more or less responsible for this increment. ESR suggests that the ROS concentration in spinal cord determine more or less the level of BDNF production in this tissue. On the other hand, results of ESR in cerebellum are more complex suggesting that this tissue reacts in opposite fashion in ROS concentration as compared to spinal cord suggesting that further investigation is needed in establishing cause and effect relationship between neurotrophins and ROS.

Oral presentation (OP)

OP1-04 Biomechanics 1/4 - "Turin DE"

SOLEUS AND MEDIAL GASTROCNEMIUS SPINAL REFLEXES MODULATIONS DURING MAXIMAL VOLUNTARY CONCENTRIC AND ECCENTRIC MUSCLE CONTRACTION

Duclay, J., Pousson, M., Martin, A.

INSERM ERM 207, France

During voluntary contraction, the combined H-reflex and first volitional wave (V-wave), which is an electrophysiological variant of the H-reflex (Aagaard et al., 2002), can be used as a tool to evaluate the modulation of the spinal loop. Despite their different magnitudes, the Hmax/Mmax ratios of soleus (SOL) and medial gastrocnemius (MG) were modulated in the same manner during passive lengthening and shortening actions (Pinniger et al., 2001). This suggests that H-reflex modulation, observed at rest, was not related to muscle composition. To our knowledge, no study yet identified how the MG H/M ratio is modulated by dynamic maximal voluntary contraction (MVC).

The aim of the study was therefore to investigate if H-reflex and V-wave behaviour, observed during passive and active dynamic actions, differs between, SOL and MG due to the well known differences between these two muscles.

Experiments were performed on 16 healthy males. Maximal H-reflexes and M-waves were evoked at an ankle angle of 90° during passive shortening and lengthening actions (i.e., Hmax MmaxR, respectively) and during maximal voluntary concentric and eccentric plantar-flexion (i.e., Hsup MmaxA, respectively). During both concentric and eccentric contraction, supra-maximal stimulus intensity was used to record the V-wave (V). The Hmax/MmaxR, Hsup/MmaxA and V/MmaxA ratios were calculated in order to assess the efficacy of the synaptic transmission.

At rest, the Hmax/MmaxR ratio was significantly reduced during passive lengthening, whatever the muscle. During passive shortening, the SOL Hmax/MmaxR ratio was higher than the corresponding MG Hmax/MmaxR ratio ($P<0.001$), while during passive lengthening these ratios were not significantly different for the two muscles. Whatever the muscle, the Hsup/MmaxA ratio was higher ($P<0.001$) than Hmax/MmaxR during lengthening actions. The SOL Hsup/MmaxA ratio was lower ($P<0.001$) during eccentric than during concentric MVC, while the MG Hsup/MmaxA ratios were not influenced by the muscle action type. During shortening, the Hmax/Mmax and Hsur/Msur ratio of the soleus were higher than corresponding gastrocnemii ratio ($P<0.001$), while during lengthening these ratios were similar for any muscle. The V/MmaxA ratio did not change with the muscle or muscle action type.

SOL H-reflex seems to be more affected by presynaptic inhibition and the homosynaptic post activation depression phenomenon than MG during passive lengthening. During eccentric contraction, the increase in H-reflex, supports the concept that the spinal loop is specifically modulated by the supra-spinal center and/or neural mechanisms at spinal level (Duclay and Martin, 2005). Concerning the MG, these modulations would be sufficient to compensate for the reduction of the efficacy of the transmission in the Ia afferent -  motoneuron synapses observed during the lengthening of the muscle.

References

Aagaard P et al. (2002). J Appl Physiol 92, 2309-2318

Duclay J and Martin A. (2005) J Neurophysiol 94: 3555-3562, 2005

Pinniger GJ (2001) J Physiol 534, 913-923.

AGE RELATED EFFECTS OF SUBMAXIMAL FATIGUE ON THE MUSCLES' NEUROMECHANICAL PROPERTIES AND ON THE POSTURAL STABILITY AFTER FORWARD FALLS

Mademli, L., Arampatzis, A.

Sport University Cologne, Germany

It is generally accepted that stumble rates increase in old age and that the related injuries represent a serious social problem [1]. Further it is reported that the age related degeneration in the neuromuscular system affects the ability of the humans to regain balance after a sudden perturbation [2]. However little is known about the influence of muscular fatigue on the neuromechanical properties of the muscle tendon unit (MTU) and the related ability of the sensorimotor system to restore balance after a sudden perturbation in ageing. This study aimed to examine (a) whether submaximal fatigue has an age specific effect on the neuromechanical properties of the lower extremity MTUs and (b) whether the fatigue related changes in the neuromachenical properties have an age specific effect on the recovery behaviour after an induced forward fall.

Twelve young and twelve older male subjects participated in a series of four experiments: The first two examined the effects of submaximal fatigue on the mechanical properties and architecture of the triceps surae (TS) and quadriceps femoris (QF) MTU. The third one measured the activation level of the TS before, during and after submaximal fatigue. Finally, the fourth experiment examined the mechanics during forward falls before and after submaximal muscle fatigue, where the subjects were asked to recover balance with one single step. Statistics were done using a two way ANOVA (age x fatigue).

The old adults had lower maximum moment and tendon stiffness of the TS and QF MTU, shorter gastrocnemius medialis fascicles ($p<0.05$), but longer time to failure during fatigue. Submaximal fatigue did not alter the tendon compliance of the examined MTUs ($p>0.05$). At the end of fatigue both groups showed similar activation deficits and afterwards a similar muscle strength recovery behaviour. The ability to regain balance with a single step was reduced in old subjects as compared to young ones (51.4 vs. 80.5%). This was related to the TS and QF MTUs capacities ($R=0.531$), which correctly classified 76% of the subjects into single and multiple steppers. Submaximal fatigue did not affect the ability to restore balance in any group. Both groups were able to decrease the horizontal velocity of the centre of mass in a similar way as prior to fatigue by adjusting the knee flexion amplitude. However the gear ratios at the ankle joint were higher after fatigue, indicating mechanical disadvantages for the TS muscle. Concluding: Submaximal fatigue had no age specific effect on most of the examined neuromechanical parameters or on the compensations done to regain balance after sudden perturbation. The presence of postural corrections after fatigue suggests that the relationship between sensory signals and motor commands was being updated to match with the actual state of the capacities of the MTUs in the lower extremities.

References:

1. Blake et al. (1988) Age Ageing 17:365-72

2. Thelen et al. (1997) J Gerontol A Biol Sci Med Sci 52:M8-13.

CHANGES IN JUMP PERFORMANCE AND MUSCLE ACTIVITY FOLLOWING PROLONGED FOOTBALL-SPECIFIC EXERCISE

Oliver, J.L., Armstrong, N., Williams, C.A.

University of Exeter, United Kingdom

The aim of the study was to determine whether participation in prolonged football-specific exercise led to decrements in jump performance and alterations to muscle activity. Ten adolescent boys (15.8 ± 0.4 y) completed three jump tests before and after 42 min of football-specific intermittent exercise performed on a non-motorised treadmill. Participants performed a squat jump (SJ), countermovement jump (CMJ) and drop jump (DJ) from a height of 35 cm on a force plate. Simultaneously bipolar surface electromyography (EMG) was used to monitor the activity of the vastus lateralis (VL), biceps femoris (BF), tibialis anterior (TA) and soleus (SOL) muscles during the jumps. All data were sampled at a rate of 1000 Hz. The raw EMG signal was digitally high-pass filtered at 20 Hz, rectified and low-pass filtered at 50 Hz to produce a linear envelope using Butterworth 4th order zero lag filtering. The average EMG activity was determined for the total ground contact period and also for preactivation (100 ms preceding ground contact) and short latency component (SLC, 30-60 ms preceding ground contact) during the DJ. Following the prolonged exercise jump height was significantly reduced by 1.4 ± 1.5 cm in the SJ ($P < 0.05$), 3.0 ± 2.9 cm in the CMJ ($P < 0.05$) and 2.3 ± 1.7 cm in the DJ ($P < 0.01$). Impact force during the DJ significantly increased with fatigue by 364 ± 301 N ($P < 0.05$). The change in total EMG activity during ground contact did not significantly change during the SJ (-13.6 ± 28.6 %), whereas the reduction in muscle activity approached significance for the CMJ (-17.3 ± 23.6 %, $P = 0.065$) and the reduction was significant during the DJ (-19.1 ± 17.1 %, $P < 0.05$). Reductions in DJ total EMG activity were caused by significant reductions (all $P < 0.05$) in VL, TA, and BF activity (-32.7 ± 31.1, -21.2 ± 34.5 and -23.0 ± 26.8 %, respectively), whilst there was a non-significant increase in SOL activity (14.2 ± 33.5 %). There were no significant changes in preactivation (-1.6 ± 16.9 %) or the SLC (-17.1 ± 27.9 %) following prolonged exercise. Increases in impact force during the DJ reflect a reduced tolerance to impact with fatigue and may reflect a reduced ability to store and utilise elastic energy during the DJ and CMJ when fatigued. Greater reductions in EMG activity during the stretch-shortening cycle (SSC) jumps support the influence of proprioceptive feedback mechanisms resulting from muscle stretch. However, there was no significant change in the SLC, nor preactivation, during the DJ. Whilst SOL activity was maintained, decrements in VL, BF and TA activity during the DJ support the possibility of changes in whole limb muscle recruitment with fatigue, which could be a response to the impact and muscle stretch experienced during the DJ. In conclusion, both jump performance and muscle activity decreased after the prolonged football-specific exercise, with decrements greatest in the jumps that utilised the SSC.

ACUTE CHANGES IN HAMSTRINGS MUSCULO-ARTICULAR VISCOUS PROPERTIES INDUCED BY CYCLIC AND STATIC STRETCHING

Nordez, A., McNair, P.J., Casari, P., Cornu, C.

Universtity of Nantes, Nantes Antlantique Universities, France

Introduction

Passive stretching exercises are commonly performed in sports and rehabilitation. The acute effects of stretching on the musculo-articular viscoelasticity are a topic of continued interest to researchers. While several studies have assessed changes in passive torque or stiffness following stretching interventions [1,3]; changes in viscosity have received little attention in the literature. The ramifications of changes in viscosity are related to damping and hence the shock absorbing ability of the musculo-articular unit. This study was subsequently designed to measure changes in musculo-articular viscosity induced by passive cyclic and static stretching.

Material and methods

Eight healthy subjects were placed on a Biodex® dynamometer with the hip angle set at 60°. They performed five passive knee extension/flexion cycles before and after six 30s-static stretching repetitions. Energy stored (E) and energy dissipated (ED) were calculated for each cyclic stretching repetition as the area under the loading torque-angle relationship and the area under the loading curve minus the area under the unloading curve respectively. Musculo-articular viscosity was assessed by calculating a dissipation coefficient (DC) as ED divided by E. Surface electromyographic (SEMG) activity of the hamstring muscles were also recorded.

Results and discussion

SEMG activities of hamstring muscles were minimal and not changed by cyclic stretching repetitions nor after static stretching ($p>0.05$). E and ED decreased through cyclic stretching repetitions and after static stretching ($p<0.01$). The DC decreased through cyclic stretching repetitions (-28.8%, $p<0.001$), while it was slightly increased after static stretching (+3.8%, $p=0.037$). The decrease in DC through cyclic stretching repetitions was similar to the findings of Magnusson et al [2]. During cyclic stretching repetitions, passive torque was significantly decreased only in the early portion of the range of motion, while it was significantly decreased toward the end of the range of motion following static stretching.

The decrease in viscosity during cyclic stretching repetitions provided some evidence that the musculo-articular system displays thixotropic behavior. Three physiological mechanisms could explain the musculo-articular thixotropy: i) Stable actin–myosin bridges could participate in the passive tension and be broken during cyclic stretching repetitions, ii) the more mobile constituents of muscles (e.g. polysaccharides and water) might be redistributed, iii) collagen fibers might be aligned in the direction of the stress. The lack of a decrease in viscosity following static stretching suggests that different mechanisms have to be considered to explain changes in passive torque following our static stretching protocol.

References

[1] Magnusson. Scand J Med Sci Sports 1998; 8: 65-77

[2] Magnusson et al. Int J Sports Med 1998; 19: 310-6

[3] McNair et al. Med Sci Sports Exerc 2001; 33: 354-358.

RECONSTRUCTION OF THE HUMAN TRICEPS SURAE MUSCLE-TENDON UNIT BASED ON MRT IMAGES

Albracht, K., Baltzopoulos, V., Arampatzis, A.

Institute of Biomechanics and Orthopaedics; Institute for Biophysical & Clinical Research into Human Movement, Germany

Knowledge of the external (volume, shape) and internal (fascicle arrangement) characteristics of a muscle's architecture is required to assess in vivo muscle performance and provide a better understanding of muscle function through modelling. Available data on human muscle architecture is mostly based on cadaver tissue [1, 2], although recent imaging techniques as magnetic resonance (MR) imaging or ultrasonography allow obtaining such parameters in vivo. The triceps surae (TS) has often been modelled in spite of the little information available on its three-dimensional (3D) geometry throughout the entire volume in vivo. Therefore, the aims of this study were to reconstruct the 3D geometry of the TS including its internal architecture and to create a relevant database from in vivo measurements to be used in muscle modelling.

Transversal MR images (4mm contiguous slices) were acquired from the right calf of 10 male subjects (height 1.8 ± 0.4 m, weight 76 ± 6 kg, age 29 ± 6 years) in neutral anatomical position. Seven sets of MR images were needed to cover the entire TS. The boundaries of the three TS muscles were outlined manually for each slice. From these transversal contours a B-Spline muscle model of the MTU was created as proposed by Ng-Thow-Hing (2001). Tibia and Fibula were also digitised and served to define a reference coordinate system. Fascicle length and pennation angle of all three muscles were determined by ultrasonography.

Finally we obtained a geometrical reconstruction of the soleus (SO), the gastrocnemius medialis (GM) and lateralis (GL) providing a detailed 3D description of the TS geometry. The muscle volumes and MTU lengths were 466±54cm3 and 41.5±2.0cm for the SO, 284±45cm3 and 50.0±2.5cm for the GM, and 146±24cm3 and 47.6±2.4cm for the GL. The shapes of the GM and GL were similar whereas the SO shape was obviously different. This is indicated by the fact that the location of the of maximum cross section area in relation to muscle length differed across muscles (SO 62±4% GM 46±7% GL 49±4%). When normalised to the tibia length, muscle length or MTU length the variability of the retrieved parameters ranged from 5 to 10 % across subjects. Only a few parameters as the ratio between fascicle length and muscle length (SO 25% GM 17% GL 13%) showed a higher variability.

The observed non-uniformity of the external and internal architecture between the TS muscles may influence their predicted interactions and therefore underpins the importance of accurate assessment of this parameters for muscle modelling. All together, the reconstructions and the low inter-individual variability of the the parameters determined in the present study indicate that it is possible to assess the architectural characteristics of the TS and to create a scaleable muscle model.

References

1. Agur AM et al (2003) Clin Anat 16:285-93

2. Wickiewicz TL et al (1983) Clin Orthop Relat Res 179:275-83

3. Ng-Thow-Hing V (2001) thesis.

Oral presentation (OP)

OP1-05 Psychology 1/5 - "Turin FG"

SPORT, WELLBEING AND DEVIANT BEHAVIOR: A CROSS-SECTIONAL STUDY WITH SWISS ADOLESCENTS

Moesch, K., Birrer, D., Seiler, R.

Federal Institute of Sports Magglingen & University of Berne, Switzerland

Introduction: Sport is considered an effective means in reducing deviant behaviour in adolescents. Nevertheless, no empirical evidence has found a direct correlation between sport involvement and deviant behaviour (e.g. Brettschneider et al. 2005). This study examines the impact of wellbeing as a mediating variable between sport and deviance. We hypothesised that sport involvement has a positive effect on wellbeing, and high wellbeing reduces deviant behaviour. Gender differences were also predicted.

Method: 250 male and 292 female adolescents from the German speaking part of Switzerland aged 12 to 18 consented to participate in the study and completed a batch of questionnaires. Sport involvement was measured with the Sport and PHysical activity INdeX (SPHINX) developed by Brettschneider et al. (2005). The SPHINX integrated five variables including both attitudes toward sport and overt sport behaviour. Wellbeing was assessed with the questionnaire for adolescents (BFW, Grob et al., 1991). Deviance was measured through five different scales (Heitmeyer, 1998; Tillmann et al., 2000): attitudes towards and justification of deviance, delinquent behaviour, psychological and physical violence. These five variables were summarised to one single factor through a rank order procedure. For descriptive statistics, the five scales were examined separately. The proposed SEM was calculated for both genders, using generalised least square (GLS) estimation.

Results: As hypothesised, girls showed significantly lower values than boys in all deviance scales with gender explaining variances between 2.9% and 12%. For both genders, the SEM revealed a positive effect of sport involvement on wellbeing. The regression coefficients were .37 and .33, respectively, with marginally higher values for girls. Further, regression coefficients -.45 (girls) and -.48 (boys), respectively, revealed a negative relationship of wellbeing on deviance.

Discussion: In agreement with the hypothesis, results revealed that wellbeing might be a mediating variable in the relationship between sport involvement and deviance. However, it should not be overlooked that the Fit Indices were only moderate. More research is needed to elucidate the role of sport as well as other possible mediators on deviant behaviour.

Brettschneider, W.-D., Brandl-Bredenbeck, H. P., & Hofmann, J. (2005). Sportpartizipation und Gewaltbereitschaft bei Jugendlichen: Ein deutsch-israelischer Vergleich. Aachen: Meyer & Meyer.

Grob, A., Lüthi, R., Kaiser, F., Flammer, A., Mackinnon, A., & Wearing, A. (1991). Berner Fragebogen zum Wohlbefinden Jugendlicher (BFW). Diagnostica, 37, 66-75.

Heitmeyer, W. (1998). Gewalt. Weinheim: Juventa.

Tillmann, K.-J., Holler-Nowitzki, B., Holtappels, H.-G., Meier, U., & Popp, U. (2000). Schülergewalt als Schulproblem. Weinheim: Juventa.

RELATIONSHIP BETWEEN STPI-Y SCALES AND LIFESTYLE DEFENSE MECHANISM INVENTORY MEASURES AT MALE AND FEMALE PE STUDENTS

Levente, B., Sipos, K.

Semmelweis University Faculty of Physical Education and Sport Sciences, Hungary

Introduction:

This study reports on examination results on two recently standardized test; State-Trait Personality Inventory-Y (STPI-Y) and Lifestyle Defense Mechanism Inventory (LDM), aiming to get information about some characteristic features of different level of high school athletes. In the earlier study we compared STPI (Spielberger, at al., 1980, Hungarian version Oláh, 1987) results of male (N=59) and female (N=48) PE students in a smaller population. The gender difference in STPI was found in State Anger, and Trait Anxiety: males had higher Anger ($p<.02$) and lower Anxiety level ($p<.05$) than females (Kudar, 2003).

Subjects:

253 PE students (120 second year student in the academic year of 2003/2004 and 133 second year students in 2004/2005; average age: 20,38 years; SD 1,78) 115 males and 138 females are active in different sports. The Hungarian versions of STPI-Y and LDM scales were administered in classroom situation. We have compared the groups of top level and leisure-time athletes and have accounted relationship between the STPI-Y and LDM scales. SPSS program was applied for the statistical analysis of data.

Method

State–Trait Personality Inventory-Y (Spielberger, 1995, Hungarian version Sipos et al., 2004). STPI-Y contains: State/Trait Anxiety, -Curiosity, -Anger, and –Depression scales. The Lifestyle Defense Mechanism Inventory (Spielberger, 1987) has two scales: Rationality-Emotional Defensiveness (R/ED) and Need for Harmony (N/H) scales. Both LDM scales have two subscales: R/ED has Rationality (R) and Anti-emotionality (A), while N/H has Harmony (H), and Self-sacrifice (S)

Results

The results show gender differences for trait anxiety in both samples (Group A: 2003/2004 year; and group B: 2004/2005 year). The male PE students are less anxious than females, In the group A they are less curious-, in the group B they are less depressed than females

Concurrent validity: the three "negative" emotions (anxiety, depression, and anger) of STPI-Y correlates significantly in negative direction with R/ED scale results of LDM inventory for both male and female samples. Trait curiosity correlates positively with both LDM scales for females while such connection has not occured among males. Correlation of STPI-Y State anger scale scores and the LDM scales results reveals the sensitivity of the LDM scales. State anger and R/ED scores go parallel, State anger and N/H values have inverse correlation only for males.

Conclusion:

In both gender groups the higher level of negative emotions (anxiety, anger, and depression) goes parallel with the lower level of both coping mechanisms (R/ED and NH). These negative correlations are much stronger at males than at females. But in the female group there are strong positive correlations between the curiosity and the two coping strategies. It seems that negative emotions prevent the males to use coping skills, while the positive emotion of curiosity (openess in other words) assists the females to use both LDM strategies.

AN INTERVENTION-STUDY BASED ON THE TRANSTHEORETICAL MODEL

Pfeffer, I.

University of Leipzig; Faculty of Sport Science, Germany

Physical activity has positive effects on several health parameters. Despite this knowledge, only 10-15% of the adults in the western civilised countries are regularly physically active (Sallis & Owen, 1999). Thus, to encourage people to an active lifestyle is a central challenge in health sciences.

The transtheoretical model (TTM) conceptualises behaviour change as a process based on three central constructs: five stages of change, processes of change (cognitive and behavioural) and cognitive variables (self-efficacy and decisional balance). The processes of change describe why and how a person can progress from one stage to the next. The TTM was originally developed in health psychology, but has become popular in exercise psychology as well. But, according to the results of a meta-analysis, Rosen (2000) states, that the postulated stage-specific use of the processes is probably not transferable to exercise behaviour.

To challenge the findings of Rosen (2000), the present study examines effects of two different psychological interventions based on the TTM (cognitive and behavioural) on postulated psychological variables and stage progression. A longitudinal quasi-experimental study with treatment-control group design (pre-, post-test and follow-up) was planned. Participants were 113 individuals (97 females) which were not regularly physically active before. They took part in 12-week endurance courses. Measures were standardised scales of self-efficacy (motivational and coping self-efficacy), decisional balance (expected positive and negative consequences) and processes of change (cognitive and behavioural processes). The stages of change were measured by a standardised algorithm.

The results of a MANOVA with repeated measures (independent variable (iv): intervention; dependent variables (dv): self-efficacy, decisional balance and processes) show, that there is no effect of intervention on self-efficacy, decisional balance and processes. However, there is a significant time-effect for these variables. Data show an increase in use of both, cognitive and behavioural processes, an increase in coping self-efficacy, and a decrease in expected negative consequences over time. A second MANOVA with repeated measures (iv: stage transition; dv: as before) shows a significant main effect of stage transition. Improvers use significantly more behavioural processes than non-improvers and are much more confident to be able to continue exercising regularly as well as to cope with difficult situations. There is also a significant interaction effect stage transition*time. Improvers show an increase in behavioural processes and motivational self-efficacy, while non-improvers level off.

Rosen, C. (2000). Is the sequencing of change processes by stage consistent across health problems? A meta-analysis. Health Psychology, 19, 593-604.

Sallis, J. F., & Owen, N. (1999). Physical activity & behavioral medicine. Thousand Oaks, CA: Sage.

ARE FALLS INFLUENCED BY PERSONALITY, SEX, AND AGE?

Engelhard, K., Kleinert, J., Bock, O.

German Sport University, Germany

According to the BAuA statistics 38% of the registered accidents without fatal consequences were commuting accidents. Previous studies provided inconclusive evidence about the reasons for falls. Based on the ideas of Marbe (1923) the present study investigates whether there is support for a personality based disposition for falls.

30 young (M = 25.40; SD = 3.22) and 30 old people (M = 65.52; SD = 4.47) participated in the study. Walking speed was 0.8 m/s for seniors, and 1.2 m/s for younger participants. While walking on a treadmill, they had to cross obstacles both as a single task (OC_S) and with a concurrent secondary task (signal detection task; OC_C). Up to six weeks after the experiment participants completed questionnaires regarding the personality traits fear, and locus of control. A cluster analysis based on the questionnaires resulted in two groups, which could be characterized as being less anxious and rate rather low on external locus of control (cluster 1) versus being rather anxious and rate rather high on external locus of control (cluster 2). Influence of age, sex, and cluster on motor performance (number of obstacle contacts) in OC_S, and OC_C were examined.

We found a statistically significant effect for condition (OC_S > OC_C; $p < .01$). but none for age ($p = .24$), or sex ($p = .20$). Influence of personality just bordered on statistical significance (cluster 1< cluster 2; $p = .07$). Thus, results indicate that despite not reaching statistical significance, personality does influence motor performance more than sex and age. Therefore, development of prevention programs has to consider personality as a relevant factor.

Literature:

Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA). (2005). www.baua.de/info/statistik/statistik.html. 27.02.2006.

Marbe, K. (1923). Über Unfallversicherung und Psychotechnik. Praktische Psychologie, 4 (9), 257-264.

THE RELATIONSHIP BETWEEN ATHLETIC SELF-PERCEPTIONS, EXERCISE MOTIVATION, AUTONOMY, SOCIAL CONNECTEDNESS, AND PHYSICAL ACTIVITY IN OLDER ADULTS

Rose, E., Stewart, A., Cox, K., Puddey, I.

Edith Cowan University, Australia

One of the most important changes in the Australian population in recent decades is that people are living longer. In the interests of physical and psycho-social health in older age, and reduced strain on resources, programmes have been designed to encourage adults to have better quality of life through physical activity. The key to success of such initiatives may lie in motivational theory that links self-perceptions, self-determination, autonomy, and social relationships to level of participation in physical activity. We hypothesized that higher levels of athletic self-perceptions would be positively related to self-determined aspects of motivation, autonomy, social connectedness, and higher levels of physical activity. The findings presented are from a pilot of the Physical Activity Time for Health study designed to increase physical and psycho-social benefits in older adults. Volunteers (male, n = 21; female, n = 25) (age range 50 to 80 years; M = 71.2, SD = 5.84) recruited from senior interest groups and the larger community completed the a) Adult Self-Perception Profile, b) Social Connectedness Scale - Revised, c) Measure of Actualization of Potential - Autonomy, (d) Exercise Motivation Scale (7 sub-scales, measuring motivation from self-determined to externally self-determined), and e) Physical Activity Scale for the Elderly. Associations were analysed using Pearson's Product Moment Correlation. Significance was set at $p < .05$. The mean physical activity level score was 175.3 (SD = 71.41) indicating an active group. Only athletic self- perceptions were positively related to level of physical activity ($r = .38$, $p = .009$). Athletic self-perceptions were inversely related to the externally determined dimensions of exercise motivation: amotivation ($r = -.32$, $p = .032$), external regulation ($r = -.43$, $p = .003$), and introjected regulation ($r = -.32$, $p = .028$). In contrast, athletic self-perceptions were positively related to more self-determined dimensions of exercise motivation: integrated regulation($r = .31$, $p = .038$), intrinsic motivation to learn ($r = .35$, $p = .017$), intrinsic motivation to achieve ($r = .39$, $p = .008$), and intrinsic motivation to experience, ($r = .35$, $p = .019$). There was no significant relationship between athletic self-perceptions and identified regulation ($r = .03$, $p = .829$). Athletic self-perceptions were positively related to autonomy ($r = .43$, $p = .003$) and to social connectedness ($r = .39$, $p =. 008$). This study supports previous findings, that individuals with high athletic self-perceptions are generally more autonomous, more socially connected, and are more likely to be self-determined in their motivation towards physical activity. Importantly, they also have higher levels of physical activity. In designing programmes to promote physical activity, there is need to consider enhancement of older adults' athletic self-perceptions and implications for self-determination, autonomy, and social connectedness in exercise.

11:40 - 13:10

Invited symposium (IS)

IS1-06 Perception and decision making in sports - "Lausanne"

COGNITIVE AND PERCEPTUAL MECHANISMS SUPPORTING EXPERT ANTICIPATION AND SITUATIONAL ASSESSMENT

Ward, P.

Florida State University, United States

In the absence of differences in the structure of heuristic search between chess players at the expert and grand master level (de Groot, 1965), Chase and Simon (1973) focused on large individual differences in the encoding and recall of briefly presented chess positions as a function of expertise. This pioneering research on expertise spawned a host of studies examining recall and recognition, and the associated knowledge assumed to be responsible for superior performance. However, numerous examples now exist across various domains where experience and tests of recall and recognition performance do not adequately capture or explain expert superiority (Ericsson & Lehman, 1996). Accordingly, this presentation is primarily concerned with the utility of the expert-performance approach to elicit superior performance on representative tasks as opposed to domain-general tests, such as memory and visual function, and then to examine the perceptual-cognitive processes underpinning such superiority. In the first experiment, elite and sub-elite soccer players from 8 to 18 years of age were tested on a battery of domain-specific simulations and domain-general tests that assessed the visual, perceptual and cognitive skills underpinning superior game-reading. Rather than being endowed with superior visual function or relying upon superior recognition of patterns, elite players made more accurate predictions about future events through anticipating an opponent's next move and making a superior situational assessment (see Ward & Williams, 2003). In a subsequent study, the most predictive simulation tasks (anticipation and situational assessment) were combined to assess the nature of the cognitive and perceptual mechanisms supporting performance. Concurrent think-aloud reports were recorded while elite and sub-elite adult soccer players made anticipations and assessed designated game situations with and without continued perceptual access (see Ward, Ericsson, & Williams, 2006). Elite players demonstrated superior accuracy on each task. The data provide support for a dual function in long-term working memory (Ericsson & Kintsch, 1995). Elite players representations facilitate direct access to information necessary to make immediate predictions as well as provide memory support (e.g., planning, monitoring, and evaluation) for performance. As opposed to explanations of expertise based on automatic and pattern-recognition-type processes, the data support explanations of expert performance based on complex representations and comprehension-type mechanisms (e.g., Kintsch, 1988, 1998; Ericsson & Kintsch, 1995). Discussion is offered on how mechanisms, such as the situation model, might be used to generalize across performance in traditional and more dynamic and real-world domains that often necessitate operation under time pressure and stressful circumstances.

IDENTIFYING THE CRITICAL INFORMATION SOURCES UNDERPINNING SKILLED PERCEPTION IN SOCCER

North, J.S., Williams, M.

Liverpool John Moores University, United Kingdom

Anticipation is essential to elite performance in sport. Pattern recognition is thought to be central to anticipation skill (Williams et al., 2006). We present a series of experiments designed to identify the features underpinning anticipation and pattern recognition skill in soccer. In Experiment 1, skilled and less-skilled players' visual search behaviours were assessed when recognising patterns of play in film and point light display format. In Experiment 2, retrospective verbal reports were collected immediately post-performance to identify the cognitive mechanisms underlying performance. In Experiment 3, a temporal occlusion paradigm was used to assess the critical time period for information extraction during pattern recognition. Finally, the relationship between anticipation and pattern recognition was examined. Initially half the participants passively viewed dynamic soccer sequences, while the other half had to anticipate pass destination. Participants later performed a recognition task. Visual search behaviours were recorded to compare processes underpinning anticipation and recognition and performance was correlated across the tasks. It was predicted that skilled soccer players would utilise the relational information between players to recognise patterns rather than more superficial display features. If pattern recognition is an essential component of anticipation, performance on the tests was predicted to be correlated and the processing strategies not to differ.

Skilled players were better at anticipating and recognising patterns of play regardless of whether sequences were presented in video or point light format. Visual search data showed that information from central attacking players was particularly important. Verbal report data indicated skilled players showed greater awareness of a wider range of players and spent less time thinking about the ball and player in possession than less-skilled players. Superior performance was observed when responding to clips lasting 3 sec rather than 1 or 5 sec. Elite performers develop task specific knowledge structures that facilitate effective anticipation and pattern recognition in soccer (Ericsson & Kintsch, 1995). Skilled performers view the display in the same manner whether asked to anticipate or not. However, the processing strategies underpinning anticipation and recognition are fundamentally different. Also, the relationship between anticipation and recognition is not strong. In conclusion, skilled soccer players utilise relational information between players when perceiving patterns of play. However, pattern recognition may not be an essential component of anticipation.

Ericsson, K. A., & Kintsch, W. (1995). Long-term working memory. Psychological Review, 102, 211–245.

Williams, A. M., Hodges, N. J., North, J. S., & Barton, G. (2006). Perceiving patterns of play in dynamic sport tasks: Identifying the essential information underlying skilled performance. Perception, 35, 317-332.

DECISION-MAKING SKILLS IN YOUTH SOCCER

Vaeyens, R., Lenoir, M., Williams, A.M., Philippaerts, R.M.

Ghent University, Belgium

Skilled perception precedes and determines appropriate decision-making in sport. This assumption has stimulated researchers in the perceptual-cognitive domain to implement an information-processing framework in their quest to isolate the fundamental characteristics of expertise (Williams et al., 2002). Thus far, progress in identifying the important mechanisms underlying decision-making skill has been

fairly limited, especially in youth soccer. The aim in this paper is to examine the validity of a film-based test for measuring decision-making skill in soccer. Moreover, differences in visual search behaviour and practice history profiles are discussed.

Participants included 87 youth soccer players (13.0-15.8 yrs) varying in skill and experience (elite, sub-elite, regional level and non-soccer group). We used 33 realistic film simulations involving offensive microstates of play, i.e., 2 vs. 1, 3 vs. 1, 3 vs. 2, 4 vs. 3, and 5 vs. 3 offensive situations. Performance was assessed using movement-based response measures (decision time and response accuracy) and an eye movement registration technique. In a subsequent analysis, 40 youth soccer players were assigned to a successful (S) or unsuccessful (U) group based on their test performance.

As predicted, significant differences in performance were observed between players and non-players and across three groups of soccer players matched on playing experience but differing in skill level. The majority of the soccer players were classified in agreement with the skill level grouping. Kappa analysis showed a fair kappa value (κ = .26, P = .51, p < .005). For the S and U group categorization, analysis revealed a substantial kappa value and a high proportion of agreement (κ = .62, P = .82, p < .001). More pertinent visual search strategies enabled S youth soccer players to exhibit superior decision-making skill, as characterized by faster decision times and greater response accuracy, when compared with their U counterparts. Overall, successful decision-makers employed a search pattern involving more fixations of shorter duration, spent more time fixating the player in possession of the ball and alternated gaze more frequently between this player and other areas of the display.

The current results suggest that film-based tests can be used to discriminate players of comparable experience level and that tactical proficiency determines, at least partially, both the observed visual search behavior and the processing requirements imposed on youth soccer players in dynamic offensive team simulations. Successful players may use the player in possession of the ball as a central point of reference to explore the information in open offensive microstates of play.

Williams, A. M., Ward, P., Knowles, J. M., & Smeeton, N. J. (2002). Perceptual skill in a real-world task: Training, instruction, and transfer in tennis. Journal of Experimental Psychology: Applied, 8(4), 259-270.

ENHANCING THE RESPONSE SPEED, ACCURACY, AND DECISION MAKING OF SENIOR TENNIS PLAYERS USING A PERCEPTUAL SKILLS TRAINING PROGRAM

Janelle, C., Caserta, R.

University of Florida, United States

Senior athletes encounter numerous physical and psychological barriers that render participation in dynamic sports increasingly difficult as they age. Athletes of all ages who successfully participate in open sports such as tennis must be able to efficiently gather, sort, and process massive amounts of information to anticipate, make decisions, and respond appropriately. Researchers have suggested several factors that permit performance maintenance and improvement in master level athletes (Starkes, Weir, & Young, 2003). This seminal work has implicated perceptual and cognitive skills as requisite for the preservation of expertise. As such, perceptual skills training (PST) would be expected to benefit senior level athletes, particularly those involved in an open sport such as tennis. Though PST has consistently been shown to benefit sport performance among college-aged and young adult athletes in a wide range of reactive sports, whether and to what extent PST might benefit senior athletes remains unknown. The primary purpose of this investigation, therefore, was to determine if PST (i.e., situation awareness, anticipation, and decision-making) improved on-court performance in older adults when compared to a physical training program (i.e., stroke and footwork development). We hypothesized that senior tennis players trained with situation awareness, anticipation, and decision-making would demonstrate enhanced perceptual-cognitive skills (i.e., respond faster and more accurately as well as make more appropriate decisions during tennis match situations) when compared to those provided with physical or no training. Senior tennis players (N = 27, males n = 10), were randomly assigned to one of three groups who were provided with (1) PST, (2) physical skills training, and (3) no training, respectively. Prior to training, each participant was individually pretested in a 4-game singles match against a PTR certified tennis professional. After the respective week long training sessions (40 minutes daily), each participant was posttested in another 4-game singles match against the same tennis professional. Results indicated that participants receiving PST had significantly faster response speeds, higher percentage of accurate responses, and higher percentage of correct performance decision-making in posttest match situations. Findings provide clear evidence that perceptual-cognitive skills can be trained in aged individuals. Given that seniors represent a segment of the population that might benefit most from enhancement of perceptual skills, implications and suggestions for future research are offered.

Reference

Starkes, J. L., Cullen, J. D., & MacMahon, C. (2004). A life-span model of the acquisition and retention of expert perceptual-motor performance. In A. M. Williams & N. J. Hodges (Eds.), Skill acquisition in sport: Research, theory, and practice (pp. 259-281). New York, NY: Routledge.

Invited symposium (IS)

IS1-07 What is wrong with obesity? - "Innsbruck"

INTRODUCTION

Schuetz Y., CH

Without abstract submission.

PHYSICAL ACTIVITY BEHAVIOUR: AN UPDATE

Oppert, J-M.

University Pierre et Marie Curie-Paris6, France

Obesity affects an increasing number of individuals worldwide and is associated with serious health risks. Body weight gain over time depends on a complex interplay of behavioural, environmental and genetic factors. It is generally accepted that physical inactivity is an important factor in the development of obesity. This however has to be put in the nutritional context of the population under study. Independent of physical activity level, sedentary behaviours such as television viewing have been associated with obesity and related meta-

bolic complications. Decreasing sedentary behaviour as well as increasing the level of habitual physical activity appear therefore warranted for obesity prevention.

In patients, physical activity is recognized as an integral part of obesity management. A major benefit of physical activity is the association with better long-term weight maintenance of weight loss. Physical activity has also been shown to substantially decrease the risk of obese subjects for metabolic and cardiovascular disease. A critical, and still unresolved, question is the optimal volume of physical activity that would allow prevention of weight regain in obese patients. A progessive, step-by-step, individually-tailored approach to increasing physical activity is needed in the long-term management of the obese patient. One of the challenges in this area is to better understand how to improve adherence over time.

FOOD BEHAVIOUR : NEW APPROACHES

Golay, A.

Geneva University Hospital, Switzerland

Prevention of weight regain must be integrated in the follow-up of an interdisciplinary programme of weight loss and maintenance.

Therapeutic patient education is a patient-centred approach, focused on obese patients' needs, resources, values and strategies. It allows obese patients to improve their knowledge and conceptions not only concerning their chronic illness and eating disorder, but also their weight loss programme. It brings a better quality of life, a greater therapeutic compliance and a reduction in weight regain. The most difficult part of therapeutic education occurs when patients must change their behaviour.

Motivational interviewing techniques contribute greatly and allow both the preparation and support of patients during progressive "step by step" change. The work on resistance to change is fundamental, and ambivalence must be discussed and negotiated. Patients become partners and we become "coaches". The negotiation of objectives must allow patients to choose their own strategies, which normally should cost them the least possible psychologically and bring them the maximum benefit.

Psycho-social obstacles coming from patients and their environment are very common and should be detected. Emotions, negative thoughts, cognitive restriction, cognitive distortions are approached by cognitive-behavioural therapy.

Finally, the motivational interviewing and the cognitive-behavioural approaches are perfect complements to therapeutic education for long term weight loss maintenance with more than 50 % success over 5 years. The patients become active and co-responsible for their own weight maintenance programme with the aim of improving their quality of life as well as reducing potential relapse.

Invited symposium (IS)

IS1-08 The impact of neuroscience on sports - "St. Moritz"

INTRODUCTION

Swinnen, S.P., BE

Without abstract submission.

PLASTIC CHANGES IN BRAIN ACTIVATION AS A RESULT OF LEARNING A NEW MOTOR SKILL: DYNAMICS OF LEARNING-RELATED INCREASES AND DECREASES IN BRAIN ACTIVATION

Swinnen, S.P., Puttemans, V., Wenderoth, N.

K.U.Leuven, Belgium

Functional magnetic resonance imaging was used to trace the shifts in brain activation from an initial to a skilled and finally over-learned stage. Performers were scanned prior to training (PRE) and after one (MID) and two weeks (POST) of intensive practice on a new bimanual coordination task. Kinematics revealed major improvements during the intitial stages of practice whereas performance leveled off towards the end of practice. The analysis of the brain activations revealed increases as well as decreases that were associated with the development of skillful performance. Activation was found to decrease in bilateral ventrolateral-prefrontal cortex, bilateral opercular areas, the right ventral premotor and supramarginal gyrus, and the anterior cingulate sulcus during the initial stages, and in the supplementary motor area (SMA) during the automatization stage. These changes are hypothesized to reflect decreases in attention-demanding sensory processing as well as suppression of preferred coordination tendencies as a prelude to acquiring new coordination modes. Conversely, learning-related increases were observed in the primary motor cortex, posterior cingulate zone, putamen and right anterior cerebellum. Importantly, motor cortex and posterior cingulate activation decreased again to initial level during automated performance whereas only the putamen and anterior cerebellum remained more activated across both learning and automatization stages, supporting the crucial role of subcortical areas in long-term motor memory formation for coordination tasks. The results will be discussed in view of the neural correlates of building central movement representations as a result of practice and experience.

CENTRAL ADAPTATIONS TO STRENGTH TRAINING AND IMMOBILIZATION

Nielsen, J., Jensen, J.L., Petersen, T.H., Geertsen, S.P.

Institute of Exercise and Sport Sciences, Denmark

Optimization of the connectivity of neuronal circuitries in the motor areas of the brain and spinal cord is the basis of improved task performance during motor learning. We have recently demonstrated that learning a new visuo-motor skill is accompanied by increased excitability of the corticospinal projections, increased corticomuscular coherence and depression of the central component of the stretch reflex of the trained muscle (Perez et al. 2004; 2005). Here, we investigated whether adaptations at spinal and cortical level also accompany strength training and immobilization.

10 healthy human subjects strength trained the ankle dorsiflexor muscles 3 times a week for 4 weeks. 1RM increased by 8% ($P < 0.001$) and 14% ($P < 0.001$) following 2 and 4 weeks of strength training, respectively. No changes were observed in the threshold and size of motor evoked potentials (MEPs) in the tibialis anterior (TA) muscle. There were also no changes in the suppression of the voluntary TA.EMG following the training, indicating that there were no major changes in corticospinal drive. Functional magnetic resonance imag-

ing (f-MRI) also failed to demonstrate any significant changes in the blood flow in the primary motor cortex following training. These findings indicate that strength training is not accompanied by similar changes at cortical level as seen during motor skill training.

Following two weeks of immobilization of the ankle joint a significant increase of the soleus H-reflex was observed. Soleus MEPs on the other hand were unchanged. Post-activation depression of the Soleus H-reflex decreased following immobilization, suggesting that the increase of the H-reflex was caused by changes in the probability of transmitter release from Ia afferent synapses secondary to reduced afferent activity during the immobilization.

References:

Perez MA, Lungholt BK, Nielsen JB. Presynaptic control of group Ia afferents in relation to acquisition of a visuo-motor skill in healthy humans. J Physiol. 2005 Oct 1;568(Pt 1):343-54.

Perez MA, Lungholt BK, Nyborg K, Nielsen JB. Motor skill training induces changes in the excitability of the leg cortical area in healthy humans. Exp Brain Res. 2004 Nov;159(2):197-205.

NEURAL CORRELATES OF RHYTHMIC AND REACTIVE SENSORIMOTOR COORDINATION

Oullier, O., Jantzen, K.J., Steinberg, F., Kelso, J.A.

Université de Provence-CNRS (Marseille, France) & Florida Atlantic University (Boca Raton, USA), France

Previous imaging studies have reported differences in the neural networks supporting synchronized (moving on the beat) and syncopated (moving off the beat) sensorimotor coordination. Syncopation generates greater BOLD amplitude across a broad network that includes SMA, premotor cortex, cerebellum and basal ganglia. These regions are often ascribed roles in planning, preparation and timing leading to the hypothesis that while synchronization is carried out automatically, syncopation is planned on a movement by movement basis. This hypothesis suggests syncopated movements may be carried out in a discrete as opposed to rhythmic fashion.

Here we investigate neural similarities and differences in the networks engaged for the performance of synchronized, syncopated and reactive movements. BOLD activity was measured while subjects (n=11) executed rhythmic or discrete sensorimotor coordination patterns. Subjects timed uni-manual finger opposition movements with respect to an auditory metronome delivered a constant rate (1.25 Hz). In the rhythmic tasks, subjects moved with each beat of the metronome (synchronization) or in between each beat (syncopation). In the discrete task, subjects were asked to react only after the occurrence of each beep (reaction).

When statistically compared to synchronization, reaction and syncopation demonstrate increased BOLD activity across a number of common brain areas. Greater activity for these two conditions was mainly located into the cingulate gyrus, the thalamus, the middle frontal gyrus and the SMA illustrating the additional preparation and planning necessary to perform these two modes of coordination compared to the more automated synchronization pattern.

While syncopation and reaction share some common neural features, reaction is distinguished by activity within a distinct fronto-parietal network. When the discrete (reactive) condition was compared to synchronization and syncopation significant differences were found in frontal and parietal areas as well as the thalamus and the cerebellum. Brain imaging studies have reported coactivation of the prefrontal and parietal cortices in task involving working memory and response selection. It may be that the activity in these areas reflects the stimulus driven nature of the reaction movement. The fact that activity is not seen during syncopation may indicate that the off-the-beat movements, while coordinated with the metronome are performed based on an internal representation of the coordination task and not directed solely by external stimulus input.

In line with recent studies, we found than in addition to areas involved in rhythmic coordination (synchronization), a specific network of activity underlies discrete tasks (reaction). This indicates that in spite of sharing common additional premotor and planning processes compared to purely rhythmic coordination (synchronization), syncopation differs from a purely discrete/reactive task.

Invited symposium (IS)

IS1-09 Theories of participation in sport and exercise - "Albertville"

INTRODUCTION TO THEORIES: WHAT, WHY, WHEN AND WHERE

Biddle, S., UK

Without abstract submission.

SELF-CONCORDANCE AND THE DEVELOPMENT OF HABITUAL PHYSICAL ACTIVITY

Fuchs, R., Seelig, H.

University of Freiburg, Germany

According to the Motivation-Volition-Model (MoVo-model; Fuchs, 2005) two aspects of goal intentions sensu Gollwitzer (1999) can be distinguished: goal strength and goal self-concordance. In previous studies goal strength has been shown to be a strong predictor of physical activity whereas the empirical status of goal self-concordance (Sheldon & Elliot, 1999) is still undetermined. Based on longitudinal data (N= 210) with two points of measurement (time interval: 10 weeks) two models were tested: Model A considers goal self-concordance to be an antecedent of goal strength which in turn predicts physical activity; model B conceptualizes goal strength and goal self-concordance to be concurrent factors in predicting physical activity. Structural equation analyses (AMOS 4.0) support model B suggesting that goal self-concordance and goal strength are two distinct components of goal intentions relevant to the adoption and maintenance of habitual physical exercise.

References:

Fuchs, R. (2005). Körperliche Aktivität als Gesundheitsverhalten [Physical activity as health behavior]. In R. Schwarzer (Hrsg.), Gesundheitspsychologie (Reihe: Enzyklopädie der Psychologie). Göttingen: Hogrefe.

Gollwitzer, P. M. (1999). Implementation intentions. American Psychologist, 54, 493-503.

Sheldon, K. M. & Elliot, A. J. (1999). Goal striving, need-satisfaction, and longitudinal well-being: The self-concordance model. Journal of Personality and Social Psychology, 76, 482-497.

CAN TEACHERS REALLY MOTIVATE SCHOOL CHILDREN TO BE ACTIVE IN LEISURE TIME? STUDYING AUTONOMOUS MOTIVATION ACROSS CONTEXTS

Hagger, M.S.

University of Nottingham, United Kingdom

Given the evidence supporting the health benefits of regular vigorous physical activity to the health of young people, researchers have adopted social psychological models to investigate the psychological influences on physical activity behaviour. These models aim to use existing networks, such as physical education (PE), to promote physical activity. This paper will report four studies adopting the trans-contextual model, a social cognitive approach that aims to investigate the motivational influences on young people's physical activity intentions and behaviour in PE and leisure-time contexts. The purpose of the model is to investigate whether promoting autonomous (intrinsic) forms of motivation in a PE context will influence autonomous motivation and intentions to engage in physical activity in a leisure-time context. The first study tested the effectiveness of the model in explaining physical activity intentions in a sample of school children (N = 295). Perceived autonomy support influenced physical activity behaviour indirectly through a motivational sequence involving autonomous motivation in both contexts, and attitudes, perceived behavioural control (PBC), and intentions in a leisure-time context. These findings provided preliminary support for the trans-contextual model. In a second study, an identical design was used to study the generalizability of the model in national samples from Greece (N = 93), Poland (N = 103), and Singapore (N = 133). The study found few sample-specific differences and supported consistency in the effects of the model across cultures. A third study augmented the model to include perceived autonomy support toward leisure-time from peers and parents. Testing this model using a three-wave design in samples from Britain (N = 210), Estonia (N = 268), and Hungary (N = 235) revealed that perceived autonomy support from PE teachers had a pervasive effect on autonomous motivation and leisure-time physical activity intentions independent of the influences of perceived autonomy support from the other sources. A final study provided an experimental text of the trans-contextual model. High school students (N = 87) were presented with health-related activities in their PE lessons under three conditions: an information-only condition (control), a planned behaviour condition (supporting attitudes and PBC), and a trans-contextual model condition (supporting autonomous motivation). Results indicated that participants in both experimental conditions had elevated levels of intention with the planned behaviour condition exerting its effects on attitudes and the autonomy support condition showing effects through leisure-time autonomous motives. Together these results support the trans-contextual model to explain the processes underlying the transfer of motivation from a PE context to a leisure-time physical activity context and also as a framework for intervention.

MOOD REGULATION: AN UNDERESTIMATED MOTIVE FOR UNDERSTANDING EXERCISE BEHAVIOUR

Taylor, A.H.

Exeter University, United Kingdom

Many behaviours (eg, sugar snacking, cigarette smoking) are driven by the need for self-regulation of mood but a search of the research literature reveals no clear framework for understanding mood regulation as a motive for exercise behaviour. The only extensive literature is within the context of exercise addiction (ie, the need to maintain positive affect and avoid negative affect resulting from withdrawal).

From a public health perspective there is a need to understand how mood regulation drives physical activity and inactivity. Rest is commonly seen as a way to achieve relaxation, and recover from daily stress and general fatigue. A framework is needed to understand how best to promote exercise for acute and chronic mood regulation, under different emotional states. For example, perceived stress and fatigue have been shown to increase some behaviours (eg, sugar snacks, caffeine, alcohol and cigarette use) thought to act as stimulants and relaxants and reduce others (eg, physical activity)(eg, Steptoe et al, 1996).

Using a multi-dimensional conceptualisation of affect (eg, two-dimensional Circumplex model: activation and valence) recent evidence is fairly convincing that low-moderate intensity exercise (eg, brisk walking) can increase activation and valence (Ekkekakis & Acevedo, 2006). If, during states of deactivation, exercise can mimic other products traditionally used as stimulants, then mood regulation could be promoted as a primary motivational force.

Interest in multiple health behaviour change in the field of public health is growing. Thayer et al, (1993; 1994) suggested that exercise regulated mood, to then reduce ad libitum smoking and snacking. Recent experimental work has shown that exercise can acutely reduce cigarette cravings, mood and physical withdrawal symptoms (Taylor & Katomeri, 2006) even when faced with stress and cigarette cues. Understanding how exercise may mimic possible psychobiological processes involved in motivating other behaviours may provide an insight into understanding how best to promote exercise for mood regulation.

References

Steptoe A et al (1996). Stress, social support and health-related behavior: A study of smoking, alcohol consumption and physical exercise. J of Psychosomatic Research, 41, 171-180.

Ekkekakis P & Acevedo E (2006). Affective responses to acute exercise. In E Acevedo & P Ekkekakis (2006). Psychobiology of Physical Activity (pp. 91-109). Champaign, Il: Human Kinetics.

Thayer RE et al (1994). Self-regulation of mood: Strategies for changing bad mood, raising energy and reducing tension. J of Personality & Social Psychology, 67, 910-925.

Thayer RE et al (1993). Mood and behaviour (smoking and sugar snacking) following moderate exercise: A partial test of self-regulation theory. Personality & Individual Differences, 14, 97-104.

Taylor AH et al (2006). Effects of walking on cigarette cravings and affect in the context of Nesbitt's paradox and the circumplex model. J of Sp & Ex Psych, 28, 18-31.

Invited symposium (IS)

IS1-10 Neuromuscular skeletal muscle and aging - "Berlin ABC"

ADDRESSING THE NEURONAL MUSCULAR AND HORMONAL ALTERATIONS WITH AGE AND THEIR FUNCTIONAL CONSEQUENCES

Narici, M.V.

Manchester Metropolitan University, United Kingdom

Old age is notoriously associated with muscle wasting and weakness. From 20 to 80 years of age, about 40% of muscle mass is lost (1). This process, known as sarcopenia, has a multifactorial origin since it involves neuropathic, nutritional, hormonal, immunological and lifestyle factors. The neuropathic changes, chacterised by alpha motoneuron loss due to decreased superoxide dismutase activity, result in a progressive decline in motor unit number. In addition, apoptosis of muscle fibres, due to activation of proteolytic pathways involving a cascade of caspases, also plays a role in the loss of muscle mass (1). Among the nutritional factors, a decrease in food intake (although diet restriction may be beneficial for longevity!) and in vitamin D level (frequently associated with raised level in parathyroid hormone) contribute to sarcopenia (1). Probably the most significant hormonal changes responsible for a progressive withdrawal of anabolism are decreased levels of growth hormone (GH), insulin-like growth factor-1, testosterone and dehydroepiandrosterone sulfate (DHEAS). Although the effects of GH replacement in old age remain controversial, supplementation of IGF-1 increases lean body mass and muscle protein synthesis in older individuals (2). As for testosterone, its levels fall by about 50% from 20 to 80 years of age and this is associated with a decrease in appendicular muscle mass and strength (3). Instead, testosterone supplementation increases lean body mass and strength in hypogonadic patients (4) and in older men with low testosterone levels of (5). Similarly, DHEAS levels decline by about 10% per decade and its circulating levels are correlated with muscle strength and cross-sectional area in men aged 60-79 years (6). Among the immunological factors contributing to increased catabolism, the levels of inflammatory cytokines, TNF-alpha, IL-1 and IL-6 all increase in old age. Sarcopenia, can also arise from a reduction in physical activity (PA) level. This phenomenon, more widely spread than generally recognized, contributes together with a fall in anabolic hormones, to muscle fibre atrophy, particularly of fast-twitch fibres. The decrease in fibre number and size are a major cause of muscle weakness in old age. However, the losses of muscle strength and power typically exceed those of muscle size and volume, pointing to deterioration in muscle quality. Several factors contribute to this phenomenon, but recent evidence shows that this likely originates from the combined action of muscular, tendinous and neural changes.

1) Narici & Maganaris (2006) J Anat 208 (in press)

2) Butterfield et al. (1997) Am J Physiol 272, E94-99.

3) Bramgartner et al. (1999) Mech Ageing Dev 107:123-36.

4) Ferrando et al. (2002) Am J Physiol Endocrinol Metab 282, E601-607.

5) Bhasin (2003) J Gerontol A Biol Sci Med Sci 58, 1002-1008

6) Valenti et al. (2004) J Gerontol A Biol Sci Med Sci 59, 466-472.

PHYSICAL ACTIVITY AND NEUROMUSCULAR FUNCTION IN AGING

Gollhofer, A., Granacher, U.

University of Freiburg, Germany

In different studies clear evidence has been provided that the aging neuromuscular system is associated by structural and functional changes which lead to a general slowing down of neuromuscular performance. As a consequence, the process of aging is associated with decreases in muscular strength, reduced RFD (rate of force development), and alterations in reflex pathways on the afferent and on the efferent side. These impairments are partly caused by selective decline of large alpha-motoneurons accompanied by selective atrophy of type-II skeletal muscle fibres. Age-related changes in reflex activity have been attributed to desensitization of muscle spindles [Mynark&Koceja 2001], demyelination of sensory axons, with a subsequent decrease in number of sensory neurons, changes in presynaptic inhibition [Earles et al 2001], and a reduction in number of alpha- and gamma motoneurons.

Functionally, these degenerative processes also affect postural control. They are partially responsible for the dramatically increase of the risk of falling in old age. Several studies investigating the effects of heavy resistance (HR) training on maximum voluntary contraction (MVC) and rate of force development (RFD) observed, that HR training results in an increase in maximal as well as explosive force production capacity. Studies concentrating on the effects of a sensorimotor training (SENSO) in aged subjects revealed that SENSO training leads to increased RFD and improved postural stability due to an increase in reflex activation (Gollhofer 2003). In recent controlled studies the selective impact of HR- and SENSO training on reflex characteristics in the elderly has been verified (Granacher&Gollhofer 2006). The results clearly indicate that SENSO training has an impact on spinal motor control mechanisms in the elderly. Improvements in perception and procession of afferent information could be responsible for the increased reflex activity. Due to these adaptive processes, selective intervention programs seem appropriate for fall preventive training in elderly people.

References

Earles D, Vardaxis V, Koceja D. Regulation of motor output between young and elderly subjects. Clin Neurophysiol 2001;112:1273-1279.

Gollhofer A. Proprioceptive training: considerations for strength and power production. In: Komi PV, editor. Strength and Power in Sport. Oxford: Blackwell Publishing, 2003:331-342.

Granacher U, Gollhofer A. Training induced adaptations in characteristics of postural reflexes in elderly men. Gait&Posture 2006 (in press).

Mynark RG, Koceja DM. Effects of age on the spinal stretch reflex. Journal of Applied Biomechanics 2001;17:188-203.

IMPROVED MENTAL HEALTH AND QUALITY OF LIFE IN PHYSICALLY ACTIVE ELDERLY?

Conzelmann, A.

University of Berne, Switzerland

The paper deals with the effects of physical activity on mental health and quality of life in elderly people. "Mental health" will not primarily be considered under a medical perspective (being free of "mental illness") but rather be regarded as an equivalent to subjective (physical,

psychic and social) well-being. „Quality of life" refers to the satisfaction with personally relevant spheres and therefore focuses on a cognitive aspect of subjective well-being.

During the last decades numerous studies have explored the effects of physical activity on health and subjective well-being. The results show that effects on health-relevant parameter such as lower risk for heart attacks or better function of vital organs can be established much easier than positive effects on subjective well-being (e.g. Fuchs, 2003). Whereas physical activity influences health parameter in a direct way, the interrelations with subjective well-being are more complex for various reasons. (1) Besides physical activity other factors (e.g. sociodemographic variables) influence subjective well-being, thereby implying that the isolated consideration of physical activity as an influence is insufficient to explain the variance of subjective well-being. (2) Biographical life experiences form the basis of an individual understanding of the effects of physical activity on subjective well-being. Thus, great heterogeneity in aging courses does exist, becoming manifest in different forms and fates of getting old(er) (Thomae, 1987). (3) Subjective well-being is rather dependent on subjective domain evaluations than on objective life conditions. Thus, subjective health is a useful (direct) predictor for subjective well-being, again being influenced, however, by the number of contracted illnesses (Smith et al., 1999). In this context, physical activity can be seen as an indirect influence. Evaluations and estimations are cognitive processes dependent on cognitive traits such as competence and control beliefs or attribution style.

Consequently, the influence of physical activity has to be considered under a differential perspective, including the whole lifespan and taking cognitive processes into account. Complex models, for example up-to-date theories on successful aging (e.g. the SOC-model; Baltes & Baltes, 1989) are promising approaches.

Oral presentation (OP)

OP1-06 Physiology 2/10 - "Oslo"

PLASMA LEVELS OF TNF-α AND ADHESION MOLECULES IN ATHLETES WITH SICKLE CELL TRAIT AND α-THALASSEMIA: EFFECTS OF TWO EXERCISE MODALITIES

Monchanin, G., Serpero, L., Connes, P., Ngongang, J., Tripette, J., Wouassi, D., Bezin, L., Francina, A., de la Peña, M., Massarelli, R., Gozal, D., Thiriet, P., Martin, C.

UFRSTAPS - Université Claude Bernard- Lyon1, France

Sickle cell anemia (SCA) is caused by the mutation of hemoglobin (Hb) A into HbS. This mutation leads to polymerization and red blood cell (RBC) shape changes during Hb deoxygenation. Sickle cell trait (SCT) carriers is the heterozygous form of SCA. SCT is usually asymptomatic, although it has been associated with increased risk of sudden death and diminished physical performance under stressful physiological conditions. Some authors reported that the co-existence of SCA with α-thalassemia occurs frequently in the Black population, and such co-existence may in fact be protective for SCA or SCT subjects. We recently reported that SCT carriers exhibited impaired blood rheology at rest, and that such alterations were dampened by the co-existence of α-thalassemia [1]. Since these impairments are thought to increase blood flow resistance in microvessels, they could accelerate endothelial dysfunction and vascular injury [2].

To examine the effects of 2 exercise modalities on circulating tumor necrosis factor α (TNF-α), vascular cell adhesion molecule-1 (VCAM-1) and intercellular adhesion molecule-1 (ICAM-1) in sickle cell trait (SCT) athletes with or without α-thalassemia, 6 athletes with SCT, 7 athletes with both SCT and α-thalassemia (SCTAT) and 7 control athletes (CONT) performed an incremental test on cycloergometer followed 72 hours later by a 60-min endurance exercise with a workload set at 70% Ppeak. We assessed levels of soluble sICAM-1, sVCAM-1 and TNF-α at rest, after exercise and 1, 2 and 24 hours after exercise.

Although, CONT and SCTAT groups exhibited similar basal plasma levels of inflammatory and adhesion molecules, SCT group had higher sVCAM-1 basal concentrations. Incremental exercise resulted in a significant increase of sVCAM-1 in all subjects, which remained elevated only in the SCT group during the recovery period. Endurance exercise increased sVCAM-1 and sICAM-1 in SCT group only, with no difference emerging between SCTAT and CONT groups.

In conclusion, our findings support the concept that SCT athletes might be at risk for microcirculatory disturbances. Although this vascular dysfunction has never been demonstrated to induce vaso-occlusive crisis in SCT subjects at rest, this dysfunction should be amplified under stressful physiological conditions and could raise the risk for vaso-occlusion events several hours after exercise [3]. Finally, Alpha-thalassemia might be considered protective among exercising SCT subjects.

References

1. Monchanin, G., et al., Hemorheology, sickle cell trait, and alpha-thalassemia in athletes: effects of exercise. Med Sci Sports Exerc, 2005. 37(7): p. 1086-92.

2. Turchetti, V., et al., Endothelium and hemorheology. Clin Hemorheol Microcirc, 2004. 30(3-4): p. 289-95.

3. Belcher, J.D., et al., Critical role of endothelial cell activation in hypoxia-induced vasoocclusion in transgenic sickle mice. Am J Physiol Heart Circ Physiol, 2005. 288(6): p. H2715-25.

EFFECT OF ORAL CONTRACEPTIVES ON PATELLAR TENDON COLLAGEN SYNTHESIS AT REST AND IN RESPONSE TO EXERCISE

Hansen, M., Langberg, H., Koskinen, S., Petersen, S.G. , Døssing, S., Magnusson, S.P., Kjær, M.

Bispebjerg Hospital, Copenhagen, Denmark , Denmark

Introduction: Women are in a higher risk of sustaining curtain kind of injuries and diseases related to the collagen-rich tissue of the skeletal muscle system compared to men. This study was design to exam whether use of oral contraceptives (OC) and thereby enhanced level of ethinyl-estradiol affect tendon collagen metabolism, in vivo, at rest, and in response to strenuous exercise. Based on animal and in vitro studies we hypothesis that OC would have an inhibiting effect on tendon collagen synthesis.

Material and Method: Healthy, young women; oral contraceptive users (OC)(n=8) and never-OC-users (n=8) in the follicular phase of the menstrual cycle, when the level of estradiol is low, were studied the day after 1 h of 1-legged kicking exercise at 67% of Watt max. Microdialysis catheters were placed in the peritendinous space in front of the patellar tendon. The collected dialysate was analyzed for aminoterminal propeptide of type I collagen (PINP), a marker of collagen formation. Cross-Sectional Area (CSA) of the patellar tendon was

measured by magnetic resonance imaging. Besides, fractional protein synthesis rates (connective tissue, myofibrillar protein and tendon tissue), whole body protein synthesis, protein oxidation and protein degradation were measured by infusion of stabile isotope labeled amino acids ([1-13C]leucine, [13C]proline) followed by biopsies (rest and 24h post ex) from mm. vastus lateralis and patellar tendon.

Results: At rest no differences between OC-users and never-OC-users in PINP in the dialysate were observed. However, the never-OC-users experienced an exercise–induced increase in collagen synthesis (PINP (ng/ml) Mean +/- SD, Rest 7.9 +/- 2.9 vs Exercise; 11.3 +/- 5.6, $p < 0.05$), whereas no significant change was observed in the OC-group (Rest 5.9 +/- 3.5 vs. Exercise; 6.6 +/- 3.4, $p = 0.49$). No differences in the patellar tendon CSA was observed between OC-users and never-OC-users. Discussion/Conclusion: A stimulating effect of exercise on tendon collagen synthesis has earlier been shown in young men. For the first time in vivo an inhibiting effect of OC was observed on the exercise-induced increase in tendon collagen synthesis. However, in the situation with naturally low level of estradiol we were able to detect a stimulating effect of exercise on tendon collagen synthesis. No difference in tendon CSA was detected, but the change in collagen turnover may influence collagen density and biomechanical properties of the tendon. Forthcoming results will hopefully shed light on additionally aspects of the effects of OC on protein metabolism.

COMPENSATING LOSS OF FORCE BY STIMULATION OF THE NA,K-PUMP IN RAT SKELETAL MUSCLE

Mikkelsen, U.R. 1, Gissel, H. 2, Fredsted, A. 2, Clausen, T. 2

1 Copenhagen University Hospital, Bispebjerg, 2 University of Aarhus, Denmark

Intensive exercise leads to loss of muscle force, which may be long-lasting and associated with muscle cell damage. Muscle cell excitability and the ability to generate force depend on maintenance of the Na+ and K+ gradients across the cellular membrane. The Na,K-pump actively extrudes Na+ and accumulates K+ in an electrogenic fashion resulting in a membrane potential of -75 mV. Following fatiguing stimulation there is a rundown of Na+ and K+ gradients resulting in depolarization of the membrane and loss of force. This study aimed to investigate the effect of the following agents on force recovery. The Na,K-pump is activated by cAMP and we use beta-2-agonists (epinephrine and salbutamol) that act via beta-2-receptors and G-protein to activate adenylyl cyclase converting ATP to cAMP, calcitonin gene related peptide (CGRP) which increases cAMP by binding to specific CGRP-receptors, and a direct increase in cellular cAMP by adding dibutyryl (db)-cAMP. We test the hypothesis that excitation-induced loss of force can be compensated by beta-2-agonists.

To simulate the loss of force following intense exercise extensor digitorum longus (EDL) muscles from 4-wk old rats were fatigued for 5-60 min using intermittent 40 Hz stimulation. Following stimulation, force recovery and membrane potential were measured during 4 hrs recovery. The above-mentioned agents were added during recovery.

Following 30-60 min of stimulation tetanic force was reduced to ~10 % of the prefatigue level, followed by a spontaneous recovery to ~20 %. Loss of force was associated with a decrease in K+ content, gain of Na+ and Ca2+ content, leakage of the intracellular enzyme lactic acid dehydrogenase (LDH, 10-fold increase), and depolarization (13 mV). Stimulation of the Na,K-pump with either the beta-2-agonist salbutamol, epinephrine, CGRP, or cAMP improved force recovery by 40-90 %. Epinephrine significantly improved force recovery (by 47 %) at concentrations down to 10-8 M, which is close to the plasma level (0.6 x 10-8M) reached in running rats. The beta-blocker propranolol abolished the effect of epinephrine on force recovery but not that of CGRP, proving that the action of epinephrine is via its specific receptors. The salbutamol-induced force recovery was associated with repolarization of the membrane potential (12 mV) to the level measured in unfatigued muscles. The rise in LDH-release (loss of cellular integrity) caused by fatiguing stimulation was unaffected by addition of salbutamol, thus the force recovery induced by salbutamol cannot be attributed to resealing of the cell membranes.

Conclusion: In muscles exposed to fatiguing stimulation leading to loss of force, cell membrane leakage and depolarization, beta-2-agonists or CGRP induces repolarization and improves force recovery due to a cAMP mediated stimulation of the Na,K-pumps. This may prove important in many situations where force is lost due to fatigue or loss of cellular integrity.

ACUTE DOPAMINE REUPTAKE INHIBITION ENHANCES PERFORMANCE IN WARM, BUT NOT TEMPERATE CONDITIONS

Roelands, B., Hasegawa, H., Watson, P., Buyse, L., De Schutter, G., Piacentini, M.F., Meeusen, R.

Vrije Universiteit Brussel, Belgium

Introduction

Previously, we reported that acute dual dopamine/noradrenaline (DA/NA) reuptake inhibition (bupropion) significantly altered the hormonal response to exercise in temperate conditions (Piacentini, 2004) and significantly improved time trial performance in the heat (30°C; Watson, 2005). The aim of the present study was to determine which neurotransmitter system is responsible for the improved performance in the heat. Therefore we studied the effects of acute administration of a DA reuptake inhibitor.

Methods

Eight healthy well-trained male cyclists (Age 26,0±4,7y; Ht 182±6cm; Body Mass 77,9±6,4kg; Wmax 361±18W) participated in this study. Subjects completed a preliminary maximal exercise test, a familiarization trial and four experimental trials, two temperate (18°C) and two warm trials (30°C), in a double blind-randomized crossover design. Subjects ingested either a placebo (PLAC; lactose 20mg) or Ritalin (RIT;20mg) one hour before the start of exercise. Subjects cycled for 60 min at 55% Wmax, immediately followed by a time trial to measure performance. Core temperature (Tcore), skin temperature, heart rate, sweat loss, ratings of perceived exertion (RPE), thermal comfort, blood lactate and hormonal data were recorded. Statistical analysis were conducted using two-way (temperature-by-drug) repeated measures ANOVA to evaluate differences between and within trials. The significance level was set at $p<0,05$.

Results

Exercise performance was not influenced by RIT in temperate conditions ($P=0.397$), but subjects completed the TT 16% faster in the RIT trial (38.1±6.4min) than in the placebo (45.4±7.3min; $P=0.049$) when exercise was performed in a warm environment. Power output was higher in the RIT trial in the heat, compared to the PLAC trial ($P<0.05$). Tcore was not different between conditions in the temperate trials. In the heat Tcore was significantly higher at rest ($P=0.009$), at the start of exercise and throughout the TT ($P<0.05$) in the RIT trial. Throughout the TT with RIT heart rates were significantly higher during exercise in the heat at all times ($P<0.05$). After the 60 minutes of fixed intensity exercise in the heat subjects' RPE were significantly higher ($P=0.034$) in the placebo than in observed in the RIT trial.

Discussion/Conclusion

These data indicate that acute RIT administration enhanced performance by 16%. No such effect was apparent under temperate conditions. The present findings support previous work suggesting that higher DA activity increases tolerance to exercise in the heat (Bridge, 2003), increased catecholaminergic neurotransmission enhances exercise performance in a warm environment (Watson et al. 2005) and that dopamine may influence thermoregulation during exercise (Hasegawa, 2000).

References
Piacentini MF et al (2004). Br J Sports Med 38(2):129-33
Watson P et al (2005). J Physiol 565.3: 873-883
Bridge MW et al (2003). Eur J Appl Physiol 89: 451-459
Hasegawa H et al (2000). Neurosci Lett 289 : 161-164.

CALCIUM CONTENT AND EXPRESSION OF CALPAIN AND CALPASTATIN IN HUMAN SKELETAL MUSCLE FOLLOWING REPEATED BOUTS OF ECCENTRIC EXERCISE

Overgaard, K., Vissing, K., Fredsted, A., Schjerling, P.
University of Aarhus, Denmark

Introduction
Skeletal muscle adapts markedly to a single bout of eccentric exercise, providing protection against muscle damage in subsequent bouts of eccentric exercise (repeated bout effect). The cellular processes, responsible for this repeated bout effect, are unknown. We showed previously that prolonged running increased muscle calcium content (1). Furthermore, expression of the calcium activated protease calpain 2 was observed to be up-regulated and expression of calpain 1 and 3 down-regulated following downhill running (2). Thus, some of the muscle damage following eccentric exercise may be mediated by calcium induced calpain activity and a reduction in calpain activity may be part of the repeated bout effect. Calpastatin is an important endogenous regulator of calpain activity. Therefore, we investigated the hypothesis that following a second bout of eccentric exercise muscle calcium accumulation and expression of calpain would be reduced and/or the expression of calpastatin would be increased.
Methods
Biopsies were obtained from the vastus lateralis muscles of 14 male volunteer subjects performing two bouts of 30 min step exercise separated by 8 weeks (3). Isometric knee extensor MVC was measured with a strain gauge transducer and soreness of the knee extensor region was evaluated on a visual analog scale. Muscle calcium content was measured by atomic absorption spectrophotometry (1). Calpain 1, 2 and 3 and calpastatin mRNA levels were measured by Northern blotting.
Results
Muscle strength in the eccentrically exercised muscles was maximally reduced by 15±2% 3h after bout 1 and was less reduced (by 9±2%, $p<0.05$) after bout 2. Muscle soreness was maximal 48h after step exercise and was lower following the bout 2 as compared with bout 1 (47±5mm vs 30±5mm, $p<0.05$). Total muscle calcium content did not change following either bout 1 or bout 2 ($p>0.05$). Calpain 2 and calpastatin mRNA increased by 41±10% and 66±12%, respectively, and calpain 1 and 3 mRNA were unchanged after bout 1. Bout 2 induced similar mRNA changes for all calpain isoforms and for calpastatin.
Discussion/Conclusion
Total muscle calcium content was not increased after 30 min stepping. However, free cytosolic calcium determines calpain activation and this may change without changes in total muscle calcium content. Interestingly, both calpain 2 and calpastatin mRNAs were up-regulated indicating an influence of eccentric activity on calpain/calpastatin regulation. The overall pattern of calpain and calpastatin mRNA regulation was very similar between the two bouts despite a significant repeated bout effect on soreness and strength. Thus, our hypothesis was not supported. However, measurements of protein levels are required to determine more specifically the possible role of calpain regulation in the repeated bout effect.
References
1) Overgaard K et al., J. Appl. Physiol., 2002, 92, 1891-8
2) Feasson L, et al., J Physiol, 2002, 543, 297-306
3) Newham DJ et al., Muscle Nerve, 1983, 6, 380-5.

Oral presentation (OP)

OP1-07 Sociology 1/1 - "Turin ABC"

NATIONAL VS. INTERNATIONAL SPORTS COVERAGE

Sattlecker, G., Dimitriou, M., Müller, E.
University of Salzburg, Austria

Many authors criticized sports coverage for different reasons. Two main arguments for that were the preference of national sport and the absence of many kinds of sport in the reporting (see Weischenberg 1978, 188ff, Wernecken 2000, 321ff and Loosen 2004, 13). Most of the surveys took place in Germany, Austrian and Swiss studies are rather seldom. The aim of this study was to compare the current sports coverage in the German speaking countries Austria, Germany and Switzerland. The survey should not only show the differences between the three countries and types of newspaper but also the connection between the two variables. Therefore, three newspa-pers of each country – a tabloid, a quality newspaper and a regional paper – were analyzed within an artificial week in March 2004. The different kinds of sport and the nationalism of the coverage were used as variables for the study. The survey employed content analysis of 2089 articles and 653 photos in the following newspapers: Kronen Zeitung, Standard, Salzburger Nachrichten (Aus-tria), Bild, FAZ, Kölner Stadtanzeiger (Germany) and NZZ, Blick and Tagesanzeiger (Switzerland). It could be expected that soccer was the dominant sport while ice hockey and tennis were at least among the top four in each country. Concerning the other most popular kinds of sport regional aspects can be observed. In Austria alpine skiing was number two, in Germany basketball ranked third whereas in Switzerland tennis was number three. This all could be a consequence of the per-formances of national athletes because sportsmen of these countries are extraordinarily successful in the kinds of sport mentioned above. Zubayr and Gerhard (2004, 39ff) also stated that the popu-larity of sport is in close connection to the successes of national athletes. Between the three types of papers no essential differences could be made up. Concerning national sports coverage, the survey showed that at least 50 percent up to 77 percent of the sports articles and from 66 up to 88 percent of the photos had national athletes as a subject. The variance analysis showed signifi-cant differences between quality papers and the two other types. Therefore, the tabloid and re-gional papers had a higher percentage of national articles and photos. Regarding the three ana-lyzed countries, significant differences between Germany and the two other nations can be stated. Austrian and

Swiss newspapers published more international articles than their German pendants while there was no difference between the photos of the three countries. The results within the three nations showed that the kinds of sport had an influence on the national character of the re-porting. The focus on the German soccer league is responsible for the high percentage of national sports coverage in this country while the concentration on skiing in Austria and tennis in Switzer-land lead to a higher percentage of international sport in these papers.

'GO GENDER BUT NOT ONLINE'. THE SPORTS COVERAGE OF GENDER IN SELECTIVE INTERNET PORTALS

Dimitriou, M., Sattlecker, G., Müller, E.

University of Salzburg, Austria

New technologies, in particular their applications in the field of Internet, digital television and mobile telephony, produce also new distribution platforms and services for the delivery of sports content. Online media have grabbed the attention of communication researchers in the second half of the 1990s, but the focus to date has been primarily on media audiences and their use of these new forms. On the other hand, there have been a number of studies regarding the relationship between sport and gender in television and in print sports coverage.

This study will analyze the type and the themes of reporting and the gender orientation in the online sport coverage. On the other side, this paper examines the extent that selective internet portals use available technologies, including multimedia and interactivity, for the presentation of gender in the sports coverage.

The study employed content analysis of four online sport portals - BBC-sport (GBR), T-Online Onsport (GER), NBC-sport (USA) and Sport1 (AUT) - at two seven-day time periods during March-May 2004 and 2005. In order to select the sport sites to be coded, the Nielsen / Net Ratings top 20 sport news list (GBR, GER, USA) and the OEWA - Austrian Web Analysis- (AUT) were consulted to determine the most prominent sport news sites. To explore this more systematically, the contents of the websites were coded by two principle dimensions. The content transparency evaluated and measured by the presence or absence of six criteria of gender themes (achievement, private, sport background, finance, ethic, aesthetic appeal). In addition websites were coded according to their information transparency, using two categories including such as use of multimedia (three criteria: photo, audio, video) and the appearance of the type of sports reporting (six criteria: results/statistics, commentary, interview/profiles, report, news and other forms).

According the content transparency, the analysis illustrated that all online sport portals focused on men's sport. In concrete the study showed that the presentation of men's sport correlates with themes as achievement, sport background and finance. The internet sites used more textual features by men's subjects and selected more pictures and multimedia possibilities to present the women's sport. Regarding the type of reporting, the online sport portals emphasized more on the categories of the "report" and "interview/profile" in case of men's themes and preferred "news" concerning the woman's stories.

Several studies show that women are dramatically under-represented in the print media, radio and television. The domination of men's sport is also a defining characteristic of the online sport journalism. Finally, the intensive use of the typical advantages of the multimediality and the "news" as single type of reporting for present women's sport documented increasingly the tendency of stereotyping and trivialization in the online sport coverage.

YOUNG PEOPLE, SPORT AND LEISURE: A STUDY OF CONTEMPORARY YOUTH LIFESTYLES

Smith, A., Green, K., Lamb, K., Thurston, M.

University of Chester, United Kingdom

In Britain, as elsewhere, over the past two or three decades there has been growing concern over the extent to which sport and physical activity are becoming increasingly rare features of contemporary youth lifestyles. Indeed, the belief that young people have dramatically reduced their participation in sport and physical activity – both inside and outside of the educational context – and have, as a consequence, become increasingly 'unhealthy' has become something of a received wisdom. What is particularly striking about this belief is its near universal acceptance across a range of societies in the Western world and beyond for, in both more and less developed societies, there is a broad consensus that declining participation in sport and physical activity – alongside the growing prevalence of 'unhealthy' diets, declining levels of daily physical activity and an increasing preference for engaging in sedentary leisure activities that revolve, in particular, around new media technologies – are the main causes of a 'health crisis' said to be emerging as defining characteristics of contemporary youth lifestyles. Notwithstanding these concerns, Coalter (2004: 79) has noted recently that, at present, much of the existing research on young people, sport and leisure has consistently failed to explain adequately or provide 'any clear understanding of sport's (and physical activity's) place in participants' lifestyles'.

This paper reports the original findings of a sociological study conducted with 15- and 16-year-olds from seven mixed secondary schools in the north-west of England, the object of which was to advance our understanding of young people, sport and leisure, and of the relationships between various aspects of young people's lives. In doing so, the paper reports upon data generated by questionnaires completed by 1010 young people and focus groups conducted with 153 of these youngsters. The findings revealed that for many young people participation in sport, and particularly 'lifestyle activities', was an integral aspect of both their school and leisure lives. It was also clear however, that for many young people, and particularly the more frequent participants, playing sport and doing physical activity was just one component in their generally busy leisure lives, which did not prevent them from engaging simultaneously in more sedentary activities (such as prolonged TV viewing and playing computer games) and commercially-oriented leisure activities, as well as consuming legal and illegal drugs. In this regard, it is argued that it is only possible to understand adequately where sport and physical activity fits into young people's lives by examining those lives 'in the round', and by locating the young people themselves within the various networks of relationships to which they have belonged in the past, and which they continue to form in the present.

DO WOMEN PLAY A ROLE IN TEAM SPORTS?

Capranica, L. 1, Piacentini, M.F. 1, Giannini, A. 1, Tiberi, M. 3, Tessitore, A. 1+2

1 IUSM of Rome, 2 Vrije University of Brussels, 3 Asur Marche, Italy

Introduction

Recently, several international actions have been taken to promote participation of women in sport, equal media prominence, and equal sport career opportunities (European Parliament, 2003; International Olympic Committee, 2004). However until now, there is a lack of gender disaggregated data in sport. Thus, the aims of this study were: 1) to have a gender perspective in Italy of the women's role in Basketball and Volleyball, and 2) to measure the women's coverage of the largest circulating Italian basketball and volleyball magazines.

Methods

Only athletes and professional positions (president, vice-president, coach, assistant coach, secretary, marketing manager, organization manager, communication manager, and staff) of clubs competing in the three major championships included in the official list of the Italian Basketball and Volleyball federations were considered. The coverage of the largest circulating Italian basketball (I Giganti del Basket) and volleyball (Hi-Tech Volley) magazines was analyzed by five indicators: the number, the size and the page placement of articles, the size and the type of the photograph, classified into men-only (M), women-only (F), and mixed-gender (FM) categories. Chi-Square was applied to test gender differences ($p<0.05$) in the professional involvement and ANOVA to the area of articles and photographs.

Results

In 2003 the male basketball athletes outnumbered (n =165900; percentage: 85%) their female counterpart (n = 30162; percentage: 15%), while the relative picture for volleyball was 70362 (28%) and 184743 (72%) for male and female athletes, respectively. Professional positions were 1260 for basketball and 1711 for volleyball, with a significantly higher representation of men (89%) than women (11%) for both sports. Coaches were mostly men (basketball: 98%; volleyball: 96%) while the highest percentage of women was found for the secretary position (basketball: 23%; volleyball: 46%).

From June 2002 o May 2003 the magazine Hi-Tech Volley published 68 articles (women's volleyball = 10%, man's volleyball = 13%, technical = 77%), mostly written by men journalists (97%), and 72 photographs (women's volleyball = 40%, man's volleyball = 60%). The magazine I Giganti del Basket published 112 articles (women's basketball = 2%, man's volleyball = 6%, technical = 92%), written only by men journalists, and 151 photographs (women's basketball = 8%, man's basketball = 92%). For both magazines, no gender difference was found relative to the area and placement of the articles. Similarly, no gender difference was found relative to the area and type of the photographs.

Discussion

The present data suggest that the women's role in sport is mainly restricted to their participation as athletes. Furthermore, media coverage does not reflect sport participation.

References

European Parliament (2003). European Parliament Resolution 2002/2280(INI), June 5.

International Olympic Committee (2004). 3rd World Conference on Women and Sport.

Oral presentation (OP)

OP1-08 Sports Medicine 2/4 - "Berlin DE"

THE EFFECTS OF HEAVY VERSUS LIGHT RESISTANCE TRAINING INTENSITY ON MUSCLE HYPERTROPHY AND STRENGTH

Pedersen, T.G., Reitelseder, S., Holm, L., Aagaard, P., Kjær, M.

Bispebjerg Hospital, Denmark

Introduction: Regular heavy resistance training (HT) is potent to induce muscle hypertrophy and increase muscle strength among male adults. However the muscular adaptations following regular light resistance training (LT) are sparsely investigated and remain unclear. Therefore we investigated the longitudinal effects of HT vs. LT on muscle mass and morphology, comparing the effects of the two training modes. Methods: 12 moderately active young male subjects performed 36 sessions of supervised HT and LT aimed at the quadriceps muscles (Q). HT was performed at 70% of 1 repetition maximum (RM) and LT at 15.5% of 1RM with a setup designed to equalize the total weight lifted. Measurements of isokinetic and isometric muscle strength and contractile rate of force development (RFD) were conducted in the isokinetic KinCom-dynamometer and anatomical cross sectional area (CSA) at three locations of the thigh, distal, mid and proximal, were determined by magnetic-resonance imaging (MRI) scans, before and after the 36 training sessions. Results: The HT leg increased concentric isokinetic Q-strength from 217.8 +/- 12.1 to 243.8 +/- 13.6 Nm (+/- S.E.M.) ($P<0.05$) and eccentric Q strength from 277.7 +/- 15.5 to 329.0 +/- 22.5 Nm ($P<0.01$). The isometric Q strength increased from 253.4 +/- 13.3 to 290.0 +/- 17.1 Nm ($P<0.01$). Contractile RFD determined within 200 ms relative to onset of contraction seemed to increase from 919.0 +/- 76.8 to 1075.2 +/- 77.6 Nm/s ($P=0.068$). No significant changes in strength were found following LT. The HT leg increased CSA significant at all locations ($P<0.05$-0.001). The LT leg increased CSA at the proximal ($P=0.01$) and at the distal location ($P=0.056$). However at the proximal location the HT increased CSA more than LT ($P<0.05$), 7.5 % vs. 3.2 %, respectively. With the three locations pooled as a total CSA both HT and LT increased CSA significantly, ($P<0.001$ and $P<0.01$, respectively). Discussion/Conclusion: Results from this study show that regular LT (15.5% of 1RM) can potentially increase muscle mass measured on muscle CSA following 12 weeks of training, however this limited training period may not provide stimulus great enough to increase muscle strength and power. If the training intervention is aimed at strength- and power gains conventional HT (70% of 1RM) is more effective.

THE EFFECT OF TRAINING INTENSITY ON MYOFIBRILLAR PROTEIN SYNTHESIS MEASURED AT REST AND ACUTELY AFTER HEAVY RESISTANCE EXERCISE

Reitelseder, S., Pedersen, T.G., Holm, L., Døssing, S., Pedersen, S.G., van Hall, G., Kjær, M.

Bispebjerg Hospital, Denmark

INTRODUCTION: The mechanisms of skeletal muscle protein synthesis are affected by individual training status and acute exercise. Though, to which extent different training intensities function upon these mechanisms remains unclear. For that reason we determined the effect of 12 weeks of heavy (HT) versus light (LT) resistance training on the myofibrillar protein fractional synthesis rate (FSR) at rest and acutely after a bout of heavy resistance exercise. METHODS: Moderately active young male subjects (n=11, 24.7 +/- 1.1 yrs (mean +/- S.E.M.), 23.8 +/- 1.0 BMI) underwent two fasting and diet-controlled studies (pre- and post training). A primed (0.8 g/kg BW) continuous infusion (1 g/kg BW/hr) of 1-13C leucine was administered and vastus lateralis myofibrillar FSR was determined at rest and post an acute bout of heavy resistance exercise during which periods venous KIC enrichment was at steady state. The post training study was performed 4 days after the last training session. The acute heavy resistance exercise bout was performed with the same total load at the post training study as in the pre training study with each repetition at 70% of 1 repetition maximum and a pre training basis of 10 sets of 8 repetitions. In between the study days the 12-week supervised and progressive training period (3 d/wk) was completed with one leg

performing HT (10 sets with 8 repetitions at 70% 1RM) and the contra lateral leg performing LT (10 sets with 36 repetitions at 15.5% 1RM). The training setup was designed to equalize the total load lifted by each leg and all exercise was performed in a leg-extension machine. RESULTS: A mean isotopic KIC enrichment of 5.3 +/- 0.4% was reached with no difference from the pre- to the post training study. Myofibrillar FSR pooled for both legs pre training were at rest and post acute exercise 0.067 +/- 0.026 and 0.140 +/- 0.027 %/hr, respectively (P=0.067). Neither HT nor LT induced any change in resting FSR. After the training interventions post exercise FSR were for HT and LT 0.078 +/- 0.033 and 0.116 +/- 0.021 %/hr, respectively (P=0.270, Kruskal-Wallis test comparing all acute post exercise FSR values). CONCLUSION: The outcome of the two different training interventions indicated a training intensity dependent attenuation in the acute post exercise myofibrillar protein synthesis. Therefore in the HT trained state stronger stimuli may be needed to further increase the acute protein synthesis above the actual resting level. LT did not have the same impact to change the response to acute heavy resistance exercise. Possibly due to methodological limitations the raw data were vitiated with a marked dispersion and a few outliers, which might explain the lack of significance.

AGING AND TORQUE-ANGLE RELATIONSHIPS IN ANKLE DORSI-FLEXION AND PLANTAR FLEXION

Simoneau, E., Martin, A., Van Hoecke, J.

Laboratoire INSERM ERM 207 Motricite-Plasticite, France

Introduction

The investigation of one muscle group should always be accompanied with the examination of its antagonist muscle group (Simoneau et al. 2006). This study aimed at examining the effects of joint angle and age on the maximal voluntary contraction (MVC) torques of the agonist and antagonist muscle groups around the ankle, i.e., the dorsi- and plantar-flexors.

Methods

Two groups of healthy male volunteers took part in this investigation: the first consisted of 11 young men (age 24 ± 2 yrs), and the second of 18 older men (age 78 ± 3 yrs). Plantar-flexion (PF) and dorsi-flexion (DF) MVC isometric torques were measured using a dynamometer with the subjects lying supine (knee at 180°) and the ankle at the neutral angle (0°) and in dorsi-flexed (20° DF) and plantar-flexed (20° PF) positions. Simultaneously, surface electromyographic (EMG) activity of the tibialis anterior and of the triceps surae muscles was recorded in order to assess the levels of muscles' activity and coactivation (RMS of the antagonist muscle normalized by its RMS when it acted maximally as agonist). Moreover, the percutaneous electrostimulation of the motor nerves allowed us to quantify mechanical muscular responses (peak twitch: Pt).

Results

The PF MVC and Pt were significantly affected by joint angle and age group. Statistical analyses revealed an angle effect and no contraction type (voluntary or evoked) nor age effect on the shapes of the PF torque-angle relationships. There was neither an effect of joint position nor of age on the agonists' EMG activity.

The DF MVC and Pt were significantly affected by joint angle only. Statistical analyses revealed an angle effect and a contraction type effect on the shape of the DF torque-angle relationship. The EMG activity of the tibialis anterior muscle and the coactivation in DF were joint angle dependent.

Discussion/Conclusion

The shape of the MVC torque-angle relationship in DF appeared to be especially explained by neural factors, whereas the shape in PF seemed to be mainly due to mechanical parameters. These relationships would not be a discriminating factor between the two age groups: the decline in muscle function that has been found to be associated with aging is not joint angle dependent. It is deduced that it would not be relevant to strength train the ankle muscles of older adults at one specific angle. Moreover, measurements at one ankle joint angle, whatever the angle, are thus enough to examine the differences within age groups and to perform a rapid assessment of the imbalance at the ankle joint.

References

Simoneau E et al. (2006). Muscle Nerve 33: 546-555.

REGION SPECIFIC PATELLAR TENDON HYPERTROPHY FOLLOWING RESISTANCE TRAINING

Kongsgaard, M., Reitelseder, S., Pedersen, T.G., Holm, L., Kjær, M., Magnusson, S.P.

Institute of Sports Medicine, Denmark

Patellar tendinopathy (jumper's knee) is a prevalent overuse injury readily observed in jumping athletes. Patellar tendinopathy is characterized by tenderness, pain, swelling, increased blood flow and decreased echogenicity (Khan et al., 1999). In approximately 70% of all cases the injury is present at the proximal region of the tendon and only at the distal region in about 15% of all cases (Ferretti, 1986). The reason for this region specific aetiology is unknown.

Additionally, it remains largely unknown to what extent different loading regimes can induce tendon hypertrophy.

The purpose of this study was to: I) Determine region specific differences in patellar tendon CSA, and II) Investigate possible patellar tendon hypertrophy following two different training loading patterns.

Twelve sedentary, lean and healthy young men (mean age: 25+/-1 yr.) were included. All subjects underwent baseline and post-training assessments: In addition to anthropometric measures, cross-sectional area (CSA) measurements were performed at the proximal-, mid- and distal patellar tendon level following magnetic resonance imaging (MRI) of both knees. Furthermore, subjects had 1RM knee extension strength determined bilaterally. Thereafter, one side was randomly assigned to 12 weeks of heavy resistance knee extension training (HR), and the other side was assigned to 12 weeks of light resistance knee extension training (LR). Both legs underwent the same total work during the training period.

Patellar tendon CSA at the proximal tendon level was significantly less than at the mid- and distal tendon level (104+/-4, 118+/-3 and 127+/-2 mm2 respectively, $P<0.05$). On average, 1RM strength increased by 33% on the HR side, and 18% on the LR side following training. The increase in 1RM strength was significantly greater on the HR side compared to the LR side ($P<0.001$). LR yielded a significant increase of CSA (+5.3%) at the proximal tendon level ($P<0.05$), but not at the mid- (+0.1%) or distal (-0.8%) tendon level. HR yielded a significant increase of CSA (+5.0%) at the proximal and distal tendon (+4.5%) level ($P<0.05$), but not at the mid (+0.5%) tendon level.

To our knowledge this study is the first to show that human patellar tendon CSA varies along the length of the tendon, and that the distal tendon region, which is the most prevalent location of patellar tendinopathy, has a significantly lower CSA than the mid- and distal regions of the tendon. Additionally, no previous studies have reported patellar tendon hypertrophy in humans following an acute training

intervention. All other factures equal, an increased tendon CSA will reduce tendon stress during sporting activities and may reduce the risk of overuse tendon injuries.

- Ferretti, A. et al. (1986). Sports Med. 3, 289-295.
- Khan, K. M. et al. (1999). Sports Med. 27, 393-408.

FOOTBALL INJURIES – APPLICATION OF LAW 12 IN TOP-CLASS TOURNAMENTS

Tscholl, P., O'Riordan, D., Dvorak, J., Gutzwiller, F., Junge, A.

FIFA Medical Assessment and Research Centre (F-MARC), Switzerland

INTRODUCTION:

FIFA's official Laws of the Game state that a free kick will be awarded if "a player tackles an opponent to gain possession of the ball, making contact with the opponent before touching the ball..." unless the tackling player "...plays in a dangerous manner" (Law 12).

This leaves a high degree of liberty on the decision-making of the referees. The objective of this study was to analyse their interpretation of the law in respect of the consequences on the player's health.

METHOD:

Video recordings of 24 representative matches and all injury incidences reported by the team physicians from 6 FIFA tournaments of female players were analyzed for tackle parameters (direction, mode) and referee's decision during the match. For the present analysis, the tackling situations were divided into two groups:

- the ball was touched before the striking player made contact to the ball-leading player (ball-first-tackles)
- first touch occurred to the player, with or without touching the ball after (player-first-tackles)

The injury incidents were only included in the analysis if the ball-leading player was injured by the striking player. Statistical values were obtained by Chi2-test (95% CI).

RESULTS:

3236 tackles (average: 135 tackles per match) and 103 injury incidences (average: 0.6 injuries per match) were analysed. Player-first-tackles occurred 6-times more frequent than ball-first-tackles, however the injury risk was 2.5-times higher for ball-first-tackles (9.3 vs. 3.7 injuries per 1000 tackles, $p<0.001$). The referees sanctioned only 11% of the ball-first and 17% of the player-first-tackles ($p<0.01$). Comparing the non-sanctioned injury incidences, 2.3-times more injuries resulted from ball-first than from player-first-tackles (5.7 vs. 2.4 injuries per 1000 tackles, $p<0.01$). With regard to tackling mechanism, non-sanctioned sliding-in tackles from the front showed a significant higher injury-risk if the ball was played first (4 respectively 34 injuries/1000 tackles; $p<0.05$).

DISCUSSION:

The results show more injuries are caused by contact with the player first. While fewer injuries appear to be caused by the striking player touching the ball first, its injury risk was found to be 2.5-fold higher. The same propensity of injuries was found for non-sanctioned challenges, therefore referees have to penalise more rigorously dangerous tackles, and above all from the front.

Making referees aware of these high-risk tackles could improve the player's safety.

On the other hand players have to be taught techniques as well to evade the impact of ball-first-tackles.

Oral presentation (OP)

OP1-09 Biomechanics 2/4 - "Turin DE"

THE EFFECT OF RUNNING, RESISTANCE STRENGTH, AND VIBRATION STRENGTH TRAINING ON THE MECHANICAL, MORPHOLOGICAL AND BIOCHEMICAL PROPERTIES OF THE ACHILLES TENDON

Legerlotz, K., Schjerling, P., Langberg, H., Brüggemann, G.P., Niehoff, A.

German Sport University Cologne , Germany

Introduction

In spite of the high prevalence of tendon injuries, the adaptation of tendons to physical activity is not yet completely understood. There is especially a lack of information about the adaptation of tendons in response to strength training. The purpose of the study was to analyse the effect of different types of exercise on the mechanical, morphological and biochemical properties of the Achilles tendon.

Materials and Methods

Sixty-four female Sprague Dawley rats (age 10 weeks), were randomly divided into five groups: a non-active age matched control group (AMC, n=20), a voluntary wheel running group (RT, n=20), a low vibration strength training group (LVST, n=12), a high vibration strength training group (HVST, n=6), and a high strength training group (HST, n=6). After one week of acclimatisation a 12 week training period started. The animals of the LVST, HVST and HST groups trained with a specially designed squat machine which required the rats to lift a weight (150 g at the beginning, later 250-450 g) in a squat-like movement to reach a food tube. When the weight was lifted a vibrating plate under the feet of the rats from the LVST and HVST groups was activated. At the end of the training period the rats were decapitated and the Achilles tendons were dissected. The tendon of the right limb was used to determine the cross-sectional area and cell density. The left tendon was initially exposed to cyclically loading to determine the viscoelastic properties, then tested until failure. In a second step, the total RNA in the tendons was isolated and the level of different mRNAs were determined by Northern Blot and RT-PCR. For analysis of the data the one-way ANOVA (post-hoc Tukey) was used to determine significant differences between the groups ($p<0.05$).

Results

The mean daily weight lifting time was 148 ± 92 s in the LVST group, 459 ± 151 s in the HVST group, and 357 ± 155 s in the HST group. The mean daily running distance of the animals of the RT group was 10.1 ± 2.9 km/day. Neither in the hysteresis area nor in the mechanical parameters which were determined by the failure test (Fmax, stiffness, deformation, energy, stress, strain and elastic modulus), nor in the cross-sectional area of the Achilles tendon were any significant differences detected between the different groups. The RT group revealed however a higher level of TIMP1 mRNA compared to the AMC and LVST group. Also the cell density was significantly lower in the RT group compared to the AMC group.

Discussion

The mechanical load which was achieved in the here presented rat model does not appear to be sufficient to create significant changes in the mechanical properties of the tendon - regardless of the type of exercise. Only the running training seems to have had an influence on the cell density and the level of mRNA. But this does not seem to have affected the mechanical properties of the tendon.

NEURAL FACTORS MAY NOT ACCOUNT FOR THE ACUTE ADAPTATION TO REPEATED DAMAGING STRETCH-SHORTENING CYCLE EXERCISES

Martin, V., Ishikawa, M., T.J., Hoffrén, M., Komi, P.V.

Neuromuscular Research Center - University of Jyväskylä, Finland

It is well established that exhausting stretch-shortening cycle (SSC)-type exercises induce a marked alteration of neuromuscular function (e.g. 1), together with the development of symptoms related to inflammatory processes. However, recovery is faster and symptoms are reduced when the damaging exercise is repeated. This acute adaptation has been referred to as the "repeated bout effect" (see 2). While the conditions required to induce a protective adaptation are fairly well understood, the underlying mechanisms are less clear. Several theories have been proposed, and potential mechanisms may be located at the neural, mechanical and inflammatory levels. Neural adaptations would induce better distribution of the workload among motor units, and could include increased motor unit recruitment, decreased co-activation level, as well as preferential recruitment of slow-type motor units. Some evidence exists to keep this neural hypothesis tenable (3). However, there is no experimental evidence for the first two assumptions. Therefore, the purpose of this experiment was to test these hypotheses.

Ten physically active subjects (3 females) performed a hopping task on a force plate until exhaustion, at an intensity set to 65% of maximal ground reaction force. This first exercise bout (B1) was repeated 2 weeks later (B2). Plantar flexors torque, voluntary activation level (AL) measured with the twitch-interpolation technique, and electromyographic activity of tibialis anterior muscle were studied under isometric (ISO) and eccentric (ECC) conditions. Soreness and serum creakine kinase activity (CK) was also assessed. All the variables were measured before (BEF), after (AFT), as well as 2 hours (2H), 1, 2 and 4 days (1D, 2D, 4D, respectively) after B1 and B2.

As expected, soreness and CK peaked at 2D and 1D after B1, respectively ($P<0.001$). After B2, soreness and CK were significantly reduced as compared to B1 ($P<0.001$ and $P<0.05$). Torque varied over time ($P<0.001$) and between exercise bouts ($P=0.01$) in ISO and ECC conditions. Overall, torque was higher during B2 ($P=0.01$). In ECC condition, this effect was also observed for AL values which were higher during B2 as compared to B1 ($P<0.05$). This was not the case in ISO condition. However, AL increase was not correlated to the torque difference between exercise bouts. Finally, neither time nor exercise bout did affect co-activation level.

These results confirm that the acute adaptation to damaging SSC-type exercise is characterized by reduced muscle damage and consequently attenuated the symptoms. However, this study does not support hypotheses suggesting that neural mechanisms could underlie the prophylactic effect of damaging exercise. Rather, it is suggested that mechanical phenomenon may account for this adaptation.

1. Nicol C et al (1996) Eur J Appl Physiol 72 : 401-409

2. McHugh MP (2003) Scand J Med Sci Sports 13: 88-97.

3. Warren GL et al. (2000) Med Sci Sports Exerc 32: 820-829.

COMPONENTS OF THE PROPULSIVE FORCES ON THE HAND IN BREASTSTROKE SWIMMING

Suito, H., Okamoto, A., Takahashi, S., Sano, S., Nunome, H., Ikegami, Y.

Nagoya University, Japan

The purpose of this study was to investigate components of the propulsive forces from fluid forces acting on the hand in breaststroke swimming. Subject was Japanese one elite male breaststroke swimmer. The motion in breaststroke swimming at flow velocity 1.25 m/s of the swimmer was recorded by using two synchronized video cameras. Ten landmarks on the light upper body were digitized at 60 Hz and their three-dimensional coordinates obtained using a DLT method. The fluid forces acting on the hand was estimated using the drag and lift coefficients by Schleihauf (1979). Estimated peaks of fluid forces acting on the hand in the breaststroke swimming were observed between glide phase and out-sweep phase, out-sweep phase and in-sweep phase, respectively. The max of fluid forces acting on the hand was 101.9 N. The ratio of the drag and lift that composes the fluid forces was 53.4 % and 43.6 %, respectively. Furthermore, the propulsive forces in fluid forces were calculated from the propelling element of fluid forces. The peak of propulsive forces on the hand in breaststroke swimming was observed between out-sweep phase and in-sweep phase. The max of the propulsive forces on the hand was 26.8 N. In propulsion forces of the swimmer generated by hand pull, lift forces were dominant. Also, the hand pitch angle between out-sweep phase and in-sweep phase was observed range from 30 to 40 degrees. In conclusion, this study would like to state the following two points. First, the propulsive forces on the hand in elite breaststroke swimmer generated by lift forces. Second, the swimmer was high lift forces were obtained by maintaining optimum hand pitch angle.

References

Shleihauf, R. E. (1979) A hydrodynamic analysis of swimming propulsion., In Terauds, J., Bedingfield, E. W. (Eds), Swimming ., University Park Press, Baltimore : 70-109.

AGONIST MUSCLE ACTIVATION AND ANTAGONIST MUSCLE CO-ACTIVATION LEVELS DURING STANDARDIZED ISOTONIC AND ISOKINETIC KNEE EXTENSIONS

Remaud, A., Guével, A., Cornu, C.

University of Nantes, Nantes Atlantique Universities, France

Introduction

In order to limit muscular tension and to stabilize the joint, the neuromuscular system is able to reduce the level of agonist muscle activation and/or to increase the level of antagonist muscle co-activation, thus controlling the external torque produced at the joint. The aim of this study was to analyze agonist muscle activation and antagonist muscle co-activation levels during standardized isotonic and isokinetic knee extensions.

Methods

Twelve subjects performed two sessions of tests on an isokinetic dynamometer. The first session allowed the subject to be familiarized with isotonic and isokinetic contraction modes. During the second session, maximum voluntary isometric torque (MVIT) was assessed in knee flexion and extension. Then, the subject had to perform 3 sets of 8 isotonic knee extensions at 40% of MVIT. After a 10-min rest

period, the subject had to perform 3 sets of "n" isokinetic knee extensions at a preset velocity similar to the mean velocity measured during the corresponding isotonic set; "n" represented the number of isokinetic repetitions the subject had to achieve in order to equalize the external amount of work performed during the corresponding isotonic set (Remaud et al. 2005). The range of motion was 105° to 25° of knee flexion (0° = leg in horizontal position). Surface electromyographic signals were collected from vastus lateralis (VL), vastus medialis (VM), rectus femoris (RF), semitendinosus (ST) and biceps femoris (BF) muscles during the second session. To assess activation and co-activation levels, RMS values were calculated for each muscle during isotonic and isokinetic contractions and then normalized to the maximal RMS value recorded during MVIT.

Results

In isotonic mode, agonist muscle activation and antagonist muscle co-activation levels were found to be significantly greater (respectively 7.9% and 14.6%) than in isokinetic mode. When both contraction modes were pooled, VL, VM and RF activation levels were not significantly different ($p > 0.05$) but BF co-activation level was found to be 41.9% greater than ST co-activation level.

Discussion/Conclusion

As we found previously (Remaud et al., 2005), our results confirm that a same number of repetitions is necessary in both contraction modes to perform a same external amount of work. The greater agonist activation level found in isotonic mode may explain in part this result. The hamstring muscles seem to adjust their co-activation level to the activation level of the quadriceps muscle. Due to its lateral insertion on the tibia, BF could be more co-activated to protect knee joint from internal tibial rotation induced by the quadriceps muscle during knee extension (Aagaard et al., 2000). These results may help athletic coaches and clinicians to optimize training methods and rehabilitation programs.

References

Aagaard et al. (2000). Scand. J. Med. Sci. Sports 10: 58-67

Remaud et al. (2005). J. Athl. Train. 40: 281-287.

COMPARISON OF CYCLE CRANK TORQUE COMPUTED FROM FORCES APPLIED TO THE PEDALS AND MEASURED WITH AN SRM ERGOMETER

Bailey, M., Nesi, X., Passfield, L., Carter, H.

University of Brighton, United Kingdom

Introduction

This study aimed to use crank torque (CT) calculations to validate the use of two-dimensional force transducers mounted at the shoe-pedal interface.

Methods

A competitive cyclist performed 1-min tests at five different work rates, from 132 to 447 W, using their normal cycling position on a SRM ergometer equipped with the force transducers. During the tests, the subject was asked to maintain cadence at 90 rpm using visual feedback. Markers were applied on either side of the crank spindle, the pedal spindles and the force transducers. Two digital video cameras (50Hz) viewed the sagittal plane. The video data were digitised and smoothed using an Ariel Performance Analysis System to obtain crank angle, pedal angle and crank angular acceleration (CAA). The forces at the pedals were sampled at 50Hz via a 12 bit A/D converter and the CT was sampled at 200Hz from the SRM ergometer (CTsrm). The force and angular position values were interpolated to obtain a sampling rate of 200Hz, and synchronised using peak CAA and CT. The CT was computed from forces applied to the pedal (CTpf) using the crank length and the effective force. For all work rates, the comparison of CT was performed on 8 complete crank revolutions and on the 16 peak torques observed. The CT bias was calculated in absolute units (Nm) and in percentage (CTpf-CTsrm/CTsrm). The precision of bias was shown using 90% confidence limits (90%CL). Wilcoxon and Spearman tests were used to determine difference and correlation between 2 sets of data. A Friedman ANOVA was used to examine the effect of work rate on the CT bias.

Results

Across work rates, the mean ± s.d. peak CTsrm increased linearly from 22.1 ± 0.9 to 80.1 ± 3.9 Nm and the CTpf increased linearly from 23.3 ± 1.2 to 81.9 ± 2.2 Nm. The position of mean ± s.d. peak CTsrm decreased from 114.5 ± 1.8 to 88.6 ± 1.9 degrees similarly the CTpf decreased from 110.5 ± 2.4 to 88.4 ± 2.3 degrees. When comparing complete crank revolutions, the CTpf was significantly different to CTsrm, except at 186W and bias decreased significantly and linearly with workload from 0.20 to 2.03 Nm (6.8 to 7.2%). At each workload, CTpf was strongly correlated with CTsrm (R^2: 0.89-0.98). For the overall tests, the bias was significant (90%CL: 0.69/ 0.52 Nm and 3.0/ 2.0%) and R^2 computed between CTpf and CTsrm was 0.94.

Discussion

Assuming that CTsrm is the "gold standard", the results indicated that CTpf tended to underestimate CT, especially at higher workloads. The crank angle bias analysis indicated that this difference related to lower CTpf values at top and bottom dead centre, whilst the peak CTpf values were slightly higher. Significant differences were observed between the two measurement methods on these preliminary tests, but the moderate 90%CL bias (<1 Nm, <3%) and the strong relationships between the methods, support the potential of the force transducers to be developed into a useful method to study the variation in applied pedal force components.

Oral presentation (OP)

OP1-10 Rowing 1/1 - "Turin FG"

VALIDITY OF HEART RATE TURN POINT TO SET TARGET HEART RATE FOR PROLONGED ERGOMETER ROWING EXERCISE AND SINGLE SCULLING

Hofmann, P., Jürimäe, T., Jürimäe, J., Purge, P., Mäestu, J., Wonisch, M., Pokan, R., von Duvillard, S.P.

Karl-Franzens-University and Medical University Graz, University of Vienna, University of Tartu, Estonia, Texas A&M University - Commerce USA, Austria

To evaluate athletes it is necessary to keep performance tests as specific as possible (2). On-water exercise testing in rowing presents a number of difficulties, particularly in the collection of expired gases, blood sampling and defined loading. For these reasons, laboratory

tests using specific ergometer systems may provide a reliable alternative (2, 3, 6). The HRTP was shown to be a valid method to describe steady state exercise on cycle ergometer (3, 4, 5) but results in rowers are controversial (1). Aim of the study was to evaluate the use of the Heart Rate Turn Point (HRTP) to set target heart rate (THR) for prolonged rowing ergometer (E) and single scull rowing (R). Methods: Ten trained male and female subjects (mean±SD: age 21.3±4.0 yrs; VO2max 4.77±0.62 l.min-1) performed an incremental exercise test and 30 min prolonged E and R. Expired air and heart rate (HR) were measured continuously. During E and R blood lactate concentration (La) was measured at rest and after 5 (E only), 10, 20 and 30 min. The HRTP was determined as the deflection point of the heart rate performance curve. Ventilatory threshold was determined by the second deflection point in minute ventilation (VETP2) associated with the turning points for VE/VO2 and VE/VCO2. Results: No significant differences were found for work rate (W), HR and VO2 between HRTP and VETP2 and they were significantly related (r=0.94, p<0.001; r=0.96, p<0.001). THR for prolonged exercise was set at the HRTP (168±7 min-1). Mean HR, VO2, VCO2 and VE were not significantly different between E and R. La remained at a steady state in both E and R but was slightly higher in E. Tidal volume (VT) was found to be lower and breathing rate (BR) was significantly higher in R. Conclusion: These results suggest that HR at HRTP from an incremental rowing ergometer exercise test is valid to establish a THR consistent with constant metabolic training intensity in prolonged ergometer and single scull rowing.

References

1) Bourgois J, Vrijens J. The Conconi Test : A controversial concept for the determination of the anaerobic threshold in young rowers. Int J Sports Med 1998; 19: 553-559

2) Coen B, Urhausen A, Kindermann W. Sport specific performance diagnosis in rowing: An incremental graded exercise test in coxless pairs. Int J Sports Med 2003; 4: 28-432

3) Droghetti P. Determination of the anaerobic threshold on a rowing ergometer by the relationship between work output and heart rate. Scand J Sports Sci 1986; 8: 59-62

4) Hofmann P, Bunc V, Leitner H, Pokan R, Gaisl G. Heart rate threshold related to lactate turn point and steady state exercise on cycle ergometer. Eur J Appl Physiol 1994; 69: 132-139

5) Hofmann P, et al.: The heart rate performance curve during incremental cycle ergometer exercise in healthy young male subjects. Med Sci Sports Exerc 1997; 29: 762-768

6) Urhausen A, et al.: Heart rate, blood lactate, and catecholamines during ergometer and on water rowing. Int J Sports Med 1993; 14: 20-23.

RELATIONSHIP BETWEEN MECHANICAL POWER DURING MAXIMAL STROKES AND 2000M INDOOR ROWING PERFORMANCE

Veloso, A., Simões, M., Armada-da-Silva, P.

Faculty of Human Kinetics, Technical University of Lisbon, Portugal

Introduction

The general aim of this study was to examine the relationship between power during maximal strokes and performance during a 2000 m rowing test. Both mean and maximal power (Wmean-10MS; Wmax-10MS) obtained during ten maximal strokes were used to explain changes in mean time (T2000), mean velocity (V2000) and mean power (W2000) during a 2000m rowing test.

Methods

Ten male rowers (body mass 79.8 ± 1.7 kg; 183.8 ± 1.8 cm height; age 19.9 ± 1.0 years) volunteered to participate in this study. All subjects were well familiarised with both the ergometer (Concept2, model C) and the exercise tests used in the study.

The ergometer was damped adjusted in setting 3 and calibrated with the drag factor 129. The software e-Row (version 4.0) was connected to PM2+ performance monitor and used to obtain the pace, velocity and mean power of each stroke.

After a 10-min warm-up, subjects were asked to perform ten strokes at a maximal effort (10MS). They then rested for 5 minutes after which they started the 2000m test.

The relationship between variables was obtained by linear regression. The first and last repetitions of the 10MS were excluded from analysis, so results respect only strokes 2nd to 9th.

Results

Time to complete the 2000m test (T2000) was 400.5 ± 15.2 s, with mean velocity and power of 5.0 ± 0.2 m.s-1 and 353.3 ± 41.0 W, respectively. Mean (Wmean-10MS) and maximal powers (Wmax-10MS) during the 10MS were respectively 577.9 ± 107.0 W and 701.6 ± 121.0 W.

Results showed that Wmean-10MS was strongly correlated with T2000 (y = -0.1361x + 479.21, R2 = 0.918), V2000 (y = 0.0017x + 4.0253, R2 = 0.872), and W2000 (y = 0.3567x + 147.14, R2 = 0.868).

Wmax-10MS was also strongly correlated with the analysed variables: T2000 (y = -0.1188x + 483.9, R2 = 0.894), V2000 (y = 0.0015x + 3.9817, R2 = 0.825), and W2000 (y = 0.3067x + 138.06, R2 = 0.821).

Discussion/Conclusion

The results demonstrated that power generated during ten maximal rowing strokes is a strong predictor of performance of 2000m rowing. These results are consistent with previous studies1,2,3 and support the use of the simple 10MS test as a meaningful way of evaluating the performance ability of rowers.

References

1 Bourdin, M; Messonnier, L; Hager, JP and Lacour, JR (2004) Int J Sports Med. 25(5): 368-73.

2 Ingham, SA; Whyte, GP; Jones, K and Nevill, AM (2002) Eur J Appl Physiol. 88(3): 243-6.

3 Riechman, SE; Zoeller, R; Balasekaran, G; Goss and Robertson, RJ (2002) J Sport Sci. 20(9): 681-687.

A SINGLE TEST FOR ASSESSING PHYSIOLOGICAL AND PERFORMANCE PARAMETERS IN ROWERS

Bourdon, P., Buckley, J.

South Australian Sports Institute, Australia

Purpose: To determine the validity of a novel exercise test incorporating incremental exercise and a 2000 m time-trial for assessing blood lactate transition thresholds and rowing performance in well-trained rowers.

Methods: Ten well-trained rowers performed, on separate occasions and in random order, an incremental seven-step rowing test (7-STEP), a 2000 m time-trial (2k), or a combined test involving the performance of six incremental submaximal work loads followed by 15 min of recovery and then a 2000 m time-trial (6+2k).

Results: Absolute peak oxygen uptake (peak VO2) was higher during 6+2k compared with 7-STEP (4.23 ± 0.21 vs 4.14 ± 0.20 l/min, P = 0.02) and was more strongly related to 2000m time-trial performance (r^2 = 0.98 vs r^2 = 0.96). Peak rating of perceived exertion (RPE) was lower during 6+2k compared with 7-STEP (19.4 ± 0.2 vs 19.9 ± 0.1, P = 0.01). There were no differences in time taken to complete the 2000 m time-trials between tests (P = 0.22), nor were there any differences in blood lactate transition thresholds (P > 0.35) or any other test parameters (P > 0.09).

Conclusion: Physiological and performance parameters that have traditionally been assessed using separate incremental and 2000 m time-trial rowing tests can be validly determined during a single exercise test. This single test may provide a more valid assessment of peak VO2 than a standard incremental exercise test, and the finding of a lower peak RPE suggests that it may also be less stressful for the athlete. The adoption of this test would reduce the time and expense associated with the physiological assessment of rowers.

CIRCADIAN RHYTHMS IN VARIOUS METABOLIC RESPONSES TO INCREMENTAL ROWING EXERCISE

Forsyth, J., Reilly, T.

North East Wales Institute of Higher Education and Liverpool John Moores University, United Kingdom

Circadian rhythms in metabolic responses to exercise have been investigated fairly extensively, although there are still discrepancies in the literature regarding whether certain variables, such as maximum oxygen consumption (VO2max) and blood lactate concentration vary rhythmically due to time of day. The purpose of this study was to investigate circadian rhythmicity in various metabolic variables at rest and in response to a multi-stage, 3-min, incremental test to exhaustion on the Concept II rowing. Eleven male, endurance-trained athletes, with a mean (±SD) age of 29.5 (±6.1) years, height of 1.80 (±0.05) m and body mass of 79.5 (±6.7) kg were tested at 02:00, 06:00, 10:00, 14:00, 18:00 and 22:00 h with the order of testing being counter-balanced between subjects and a minimum of two days separating trials. Rectal temperature (Trec) was measured at rest; power output, oxygen consumption (VO2), pulmonary ventilation (VE), heart rate (HR), respiratory exchange ratio (RER) and blood lactate concentration were recorded at rest, throughout the exercise test, and post-exercise. Ventilatory threshold (Tvent) was also determined. A cosinor analysis was performed on group data to detect circadian characteristics of the variables. Significant circadian rhythms were observed for resting values of HR (p=0.01, acrophase 16:52 h), VO2 (p=0.02, acrophase 21:57 h) and VE (p=0.03, acrophase 19:23 h), coinciding in phase with that of Trec (acrophase 17:28 h), but not for maximum values of VO2, VE, power output and HR. Cosinor analysis revealed significant circadian rhythms for pre-test blood lactate concentration (p=0.02; acrophase 09:46 h), and resting and maximum values of RER (p=0.03, acrophase 10:06 h and p=0.03, acrophase 09:02 h, respectively). Blood lactate concentration taken 5 min post-exercise approached significance (p=0.06). Acrophases for these variables (pre- and post-exercise blood lactate concentration and RER) were similar, but were significantly different to that of Trec, suggesting that values were affected by the diurnal pattern of food intake and fasting at night. Power output, VO2 and HR at Tvent did not differ due to time of day, but blood lactate concentration at Tvent did (p=0.009, acrophase 12:16 h), suggesting that there may be a change in blood lactate concentration due to time of day. The results of this study add support to the view that circadian rhythms do exist for certain metabolic variables, in particular VO2, VE, RER and blood lactate concentration, being most apparent at rest, and concur with other studies in that time of day needs to be controlled when making comparisons of metabolic parameters.

HORMONE RESPONSES TO MAXIMAL ROWING BEFORE AND AFTER PROLONGED TRAINING IN ELITE MALE ROWERS

Purge, P., Jürimäe, J., Jürimäe, T.

University of Tartu, Estonia

The assessment of the circulating hormone concentrations during prolonged training has received considerable attention due to its implications for general adaptive mechanisms and for physical conditioning. The purpose of the present study was to examine the effect of a preparatory period on resting anabolic and catabolic hormone concentrations and these hormone responses to maximal 6000-m rowing in elite male rowers. Ten rowers (20.2 ± 2.9 yrs; 192.7 ± 4.9 cm; 91.6 ± 5.8 kg) participated in this study. All rowers had a long and regular endurance training experience (7.0 ± 3.7 years) and they were competing at a national or international level. The subjects were tested before and after the 24-week training period; and body composition, maximal 6000-m performance and maximal oxygen consumption were measured. There was an increase in mean weekly training volume (by 16%; from 13.3±1.9 to 15.4±1.5 h.week-1) at the end of preparatory period. The prolonged training period also increased the aerobic capacity values (VO2max: 6.2 ± 0.4 vs 6.4 ± 0.5 l.min-1; Pamax: 438.8 ± 35.5 vs 459.9 ± 26.2 W). Similarly, 6000-m rowing ergometer performance time was significantly improved (from 1200.8 ± 29.9 to 1188.8 ± 23.4 s) after the training period. Resting testosterone, cortisol, growth hormone and creatine kinase activity values did not differ before and after the 24-week training period and were significantly increased following maximal exercise. Testosterone concentration was significantly lower immediately after the test after the 24-week training period compared to the corresponding baseline value. Testosterone values were reduced to the resting level during the first 30 min of recovery in both measurement sessions. Cortisol values immediately after and after the first 30 min of recovery were significantly lower after the preparatory period compared to the corresponding values obtained at baseline measurement. No differences between measurement sessions were observed in growth hormone concentration. After the preparatory period, creatine kinase activity decreased significantly after 30 min of recovery compared to the value obtained immediately after the test. In conclusion, the results of the present study demonstrated that further improvement in performance capacity in elite male rowers is best reflected by smaller post-exercise increases in testosterone and cortisol concentrations, while resting concentrations of these hormones did not change as a result of training period. Typical preparatory period in elite rowing training also appears to induce faster recovery of increased creatine kinase activity from strenous exercise test.

ADIPONECTIN AND STRESS HORMONE RESPONSES TO MAXIMAL SCULLING AFTER PROLONGED EXERCISE TRAINING IN ELITE ROWERS

Jürimäe, J., Purge, P., Jürimäe, T.

University of Tartu, Estonia

The evaluation of different adipocytokines and stress hormones during prolonged exercise training is of interest due to their implications for general adaptive mechanisms. Prolonged exercise training that has been carried out for several months represents a physical stress condition in which different hormonal responses are apparently linked to changes in physical performance. There is insufficient data

about the responses of specific adipocytokines to prolonged exercise training, and the interrelationship of these adipocytokines and different stress hormones during such training period.The purpose of this study was to investigate the resting and acute exercise-induced hormone responses of male rowers as a result of six-month of volume-extended training season. Body composition, maximal aerobic capacity and on-water 2000-m sculling performance were assessed before and after a 24-week training in elite rowers (n=11; 193.1±5.2 cm; 91.6±5.8 kg; VO2max: 6.2±0.5 l.min-1). Six rowers were selected (SEL; 192.0±6.3 cm; 93.5±7.1 kg; VO2max: 6.4±0.4 l.min-1) and five were not selected (N-SEL; 194.8±4.1 cm; 89.6±4.0 kg; VO2max: 6.0±0.5 l.min-1) for the National Team. Resting adiponectin did not change as a result of prolonged training. Adiponectin did not change after 2000-m rowing at baseline, either. No responses were also observed 24 weeks later in SEL rowers, while a significant decrease (P<.05) was observed in N-SEL rowers. At the same time, leptin also decreased after the first 30 min of recovery in N-SEL rowers. After the training period, immediate post-exercise increases in growth hormone and testosterone were significantly higher in the whole group of rowers. No differences in cortisol responses were observed before and after the training period in SEL and N-SEL rowers. In conclusion, our results extend data about the adiponectin response in athletes after a heavy training period. It appears that resting adiponectin does not change as a result of the heavy training period in highly trained rowers with different performance levels. In contrast, training modifies adiponectin response to an acute bout of maximal exercise depending on the performance level of athletes. Specifically, heavy training period caused significantly higher post-exercise values in rowers with better performance capacity, while significant decreases in post-exercise adiponectin and leptin values were observed in rowers with lower performance capacity. This was thought to reflect the inadequate recovery capacities of these rowers.

INDIVIDUAL DEVELOPMENT OF ROWING SPECIFIC COMPETITION PERFORMANCE IN ORDER TO ENDURANCE PERFORMANCE

Grabow, V., Heyden, G.

Institute for Sport and Science of Sport, Germany

A 2000m-rowing race takes about 6 minutes according to the boat-class at good weather-conditions. Energy distribution of approximately 87 % aerobic, 8 % anaerobic lactic and 5 % anaerobic alactic can be assumed (Hartmann 1987). The present study demonstrates the individual development and connection between rowing specific competition performance and endurance performance. Also it allows conclusions on the individual adaptation of the energy delivering systems.

Within a longitudinal study over a period of 7 yrs 16 top elite rowers (at the beginning: age 20,7 ± 1,4 yrs, height 195,7 ± 3,6 cm, weight 92,4 ± 5,9 kg) took part. All athletes were member of the German National Team. At the beginning, end and during the study each rower performed at least once a year a combined two step test (step duration 8 minutes, 30 seconds rest between the steps) and competition test (step duration approximately 6 minutes) on a concept II (type C) rowing ergometer. Besides the above mentioned parameters average power output (watt), average stroke rate (1/min), heart rate (1/min) and ear capillary blood lactate (mmol/l) was estimated.

Over the time period of the study an average increase of 1,6 kg body weight (BW) was observed. Rowing specific competition performance was improved by 27 watt (+ 5,9%), endurance performance at 4 mmol/l lactate (P4) by 17 watt (+ 5,4%). The share of P4 in the energy provision didn't change significantly and was approx. 69%. But there were clear individual variations of P4, both in the direction of "more aerobic.

14:15 - 15:15

Poster presentation (PP)

PP1-01 Physiology 1-9 - "Exhibition Hall"

CHANGE IN THE CHARACTERISTICS OF THE MUSCLE-TENDON UNIT DURING PASSIVE STRETCHING

Abellaneda, S., Guissard, N., Duchateau, J.

Université Libre de Bruxelles, Belgium

Introduction

The increase in passive tension (PT) during stretching is known to be a limiting factor of the muscle-tendon unit elongation (1). Such limitation rises the question of the structural components involved in the enhancement of PT in vivo. This study examines the changes in muscle architecture during gradual passive stretching and contributes to the discussion of the underlying mechanisms of PT enhancement.

Methods

Twenty subjects (20-24 yrs), participated in the study. During the experiments, the subject layed in supine position, the right foot strapped to a movable footplate. The ankle angular displacement and PT during passive stretching of the triceps surae were measured by means of a potentiometer and a force transducer, respectively. The architectural changes of the Medial Gastrocnemius (MG) and Soleus (Sol) muscles were obtained by ultrasonography. Pennation angles (angle between muscle fascicles and deep aponeurosis) and fascicles length were measured during muscle stretching. The equation of Grieve (2) was used to estimate the relative tendon lengthening compared with the total muscle length change.

Results

PT increased exponentially (r^2=0.9) during the stretching of the triceps surae, from 5.2 ± 1.6 N.m in neutral position (ankle at 90°) to 24.0 ± 2.4 N.m at 30° dorsiflexion. Concomitantly, the pennation angles of the GM and Sol decreased, respectively, from 19.3 ± 3.7° and 13.8 ± 3.6° at 0° to 14.4 ± 3.1° and 10 ± 2.9° at 30° dorsiflexion. In the latter ankle position, fascicles length increased by 40.8 ± 11.7% and 33.9 ± 10.3% in the GM and Sol, respectively, whereas the total muscle-tendon unit lengthened by 7.2% of its initial value. For part of the subjects (n=14), Sol and MG fascicles length increased linearly and tendon curvilinearly (asymptotic horizontal limit) with enhanced dorsiflexion. An opposite behaviour was observed for the other subjects (n= 6).

Conclusion

The subjects showing a curvilinear increase of tendon length and linear increase of fascicles length during ankle dorsiflexion presented a greater ankle flexibility. For this group, tendon elongation can be the limiting factor of muscle stretching. In contrast, for subjects presenting the opposite behaviour, fascicles elongation may be the limiting factor. Indeed, the observation that, at 30° dorsiflexion, tendon

lengthening only attained 2.4 ± 1.4% of its initial value, whereas it reached 4-5% during isometric MVC (3), suggest that this structure was not the major contributor of PT enhancement in the second group. Thus, MG and Sol fascicles should play a key role in PT increase during large amplitude stretching, because greater torque must be generated when their length changes progressively decline (dorsiflexion > 10°). Other structures (joint capsules and ligaments) could have also contributed to limit the stretching of the triceps surae.

1. Guissard et al. Muscle Nerve (2004), 29: 248-55.

2. Grieve et al. Biomech VIA, Baltimore.

A PROPOSED METHOD TO EVALUATE THE ACUTE EFFECT OF AN INCREASED FRACTION OF INSPIRED OXYGEN (FIO2: 0.45) ON THE PARAMETERS OF THE POWER-TIME RELATIONSHIP IN HIGHLY TRAINED ATHLETES

Lemieux, L., Norris, S.R., Smith, D.J., Kolb, J.C.

University of Calgary, Canada

Moritani et al. (1981) had two subjects breathe a hypoxic gas mixture during constant load exercises to establish the power-time relationship via the critical power concept and reported that performance times were diminished. The purpose of this study is to examine the influence of an elevated fraction of inspired oxygen (FIO2: 0.45) on the power-time relationship in highly trained males (subjects are required to have an MAP of 5W∙kg-1 or a VO2max of 62mL∙kg-1∙min-1). Subjects performed one maximal incremental cycle test and twelve constant load tests: three times a series of four exhaustive constant load tests corresponding to approximately 140, 110, 90 and 83% of maximal aerobic power (MAP). Series 1 was performed in normoxia (NORM), series 2 was in hyperoxia (HYPER) (0.45) and series 3 was again in NORM. The order of tests within each series was randomized. Critical power (CP) and anaerobic work capacity (AWC) were determined for each series using the power inverse time model (Whipp et al., 1982) and the work vs time model (Monod and Scherrer, 1965). For each of the constant load sessions, 4 125μL arterialized blood samples were taken at the ear during rest, prior and post wash-in period, as well as immediately post and 3min post exercise. Blood lactate, complete blood gas profile, pulse oximetry (temporal sensor), heart rate and temperature (infrared tympanic) were measured. During the 110% of MAP test in NORM, expired gases were also measured to evaluate if any maturation or confounding effects had taken place during the study. Preliminary results (N=4) indicate that CP increased from 288W in NORM to 303W in HYPER with the work vs time model and increased from 298W in NORM to 313W with the power inverse model. AWC increased from 17452J (NORM) to 19661J (HYPER) using the work vs time model, but the power inverse time model did not reveal a statistical difference between NORM (15703J) and HYPER (16686J). Discrepancies between models may be explained by the low sample size and the level of sensitivity of each model. These preliminary findings indicate that exercising in HYPER not only influences indicators of the aerobic system (CP), but may also influence indicators of the anaerobic system (AWC). HYPER appears to allow subjects to maintain elevated saturation of O2, measured by pulse oximetry and co oximetry, as well as PO2. PCO2, HCO3-, pH, hemoglobin, hematocrit and blood lactate do not appear to be affected by the increased FIO2. (Sample size for this study is likely to reach N=12 in the next few weeks)

References

Monod, H. and Scherrer, J. (1965). Ergonomics 8: 329-337.

Moritani, T., Nagata, A., deVries, H. A., and Muro, M. (1981). Ergonomics 24: 339-350.

Whipp, B. J., Huntsman, D. J., Stoner, N., Lamarra, N., and Wasserman, K. (1982). (Abstract). Fed. Proc. 41: 1591.

SIGNIFICANCE OF THE RESPIRATORY KINETICS DURING RECOVERY IN RELATION TO ENDURANCE PERFORMANCE

Vardaxoglou, K., Frische, M., Stuke, N., Maassen, N.

Medical School, Hannover , Germany

INTRODUCTION:

On the last ECSS Congress we have shown that endurance capacity is related to the increase of the VE (slope) during continuous exercise. To further investigate the relation between Ventilation and performance we examined whether the kinetics of VE during the recovery period after different tests is dependent on the endurance performance.

METHODS:

The kinetics of the ventilatory parameters (Metalyser 3B) were determined during the recovery period of incremental tests until subjective exhaustion (n=46, men of different fitness level Age: 27.6 + 5 years) and endurance tests (80% Wmax; n=23, Age: 27.1 + 2.9 years). Data were fitted to a mono exponential equation with a linear term. The different parameters of the kinetics were correlated to the lactate concentration, to the duration of exercise at constant power and to the [Lac] at different time points of the recovery periods. [Lac] was measured after 1', 3', 5', 7' and 10' of the both recovery periods from the ear lob.

RESULTS:

After the incremental tests, the time constants of VE, VO2, VCO2 do not correlate with the [Lac] at any time point of the recovery period. The time constants of VE and VO2 of the incremental tests do not correlate with the relative power (Watt/Kg) but the VCO2 does ($p<0.05$). The time constants of VO2 and VCO2 correlate with maximal power ($p<0.001$ and $p<0.05$) but the time constant of VE does not. The linear terms show no significant correlation to [Lac] or performance.

After the endurance tests, the time constants of VE do not correlate with the [Lac] after 1' and 3' but correlates with [Lac] after 5', 7', 10' ($p<0.05$) of the recovery period. However, the time constants and the amplitudes of the ventilatory parameters during recovery do not correlate at all with the relative performance (Watt/Kg).

The performance time during the endurance tests correlate negatively with the time constants of VE during recovery ($p<0.01$), the linear term of VE during exercise ($p<0.001$) and with the [Lac] after 1', 3', 5' ($p<0.01$), 7' and 10' ($p<0.001$) of the recovery period. The linear term of the kinetics after the endurance tests is not related to the [Lac].

The linear term of VE during exercise of high intensity correlates very well with the time constant of VE during the recovery period ($p<0.01$).

DISCUSSION:

We found no relationship between the kinetics of VE and [Lac] after the incremental tests. On the other hand a relationship between [Lac] during the late recovery period and the time constant of VE and exists after the endurance test. That is astonishing as the time constant is mainly determined by the early, rapid decrease of VE. Thus a causal relationship between [Lac] in arterial blood and ventilation seems unlikely. The close correlation between the linear term during exercise and the time constant of ventilation after exercise to the endurance time shows a close relation of ventilation to endurance capacity. The physiological mechanism behind that has to be clarified.

RELATIONSHIP BETWEEN ANAEROBIC PERFORMANCE AND MATURATION IN PORTUGUESE AND BRAZILIAN YOUNG BOYS

Ribeiro Jr., D. 1, Tavares, P. 1, Lima, J. 2, Rosado, M.F. 1, Fontes Ribeiro, C.A. 1

1 Faculty of Sport Science and Physical Education, University of Coimbra, Portugal, 2 Faculty of Physical Education and Sports; Federal University of Juíz de Fora, Brazil, Portugal

Despite recognition that studies about anaerobic performance in young people are still sparse, data in the last few years has been strongly produced. In sport competition the anaerobic pathway development, and its comparison with maturation degree, is a key point that could give advantage to some young athletes. Thus, it is of major importance to compare populations of the same age from different countries and/or cultures. However, only a few works were found concerning this approach. Among the published studies, the majority was about female and only one work compared the Brazilian with the French Population (1). Therefore, the aim of this work was to study the influence of maturation degree in the power output of young people from Portugal or Brazil. In order to achieve our goals, male populations were grouped according to their age: Group I (from 10 to 12 years old), Group II (from 13 to 15 years old) and Group III (from 16 to 18 years old). The Brazilian and Portuguese populations were evaluated in their countries by the same research team in order to avoid measurement bias. An anthropometric evaluation of the groups was followed by an indirect maturational evaluation according to Tanner methodology. Young boys from each group performed a Wingate test in order to evaluate the anaerobic peak power and capacity (mean power). For that, a Monark® cycloergometer was used. Before and after the Wingate test a blood drop was collected for lactate analysis. The blood lactate concentration was measured using the Lactate Pro LT-1720®.

From the assessment of maturation (Tanner's stages) we observed that the Brazilian young boys showed a higher development (above normal values) when compared with the Portuguese population (that was under the normal values for each age). The anthropometric measurements showed a normal evolution when compared across the time with the exception of the Portuguese group II that has a higher body mass, percentage of fat and quantity of fat free tissue. This group was also the only one that showed significant differences in the anaerobic output when compared to Brazilian boys. Despite these differences no correlation was observed between maturation degree and anaerobic performance in this group. However, the anaerobic power and capacity were correlated with the body composition and blood lactate concentration. There was, in both populations, also an obvious change in anaerobic performance around 15 years old, as expected.

Our results suggest that the maturation degree (measured by Tanner methodology) did not influence anaerobic performance in group II. This parameter is probably correlated with an increase in body size. However, the groups I and III showed normal results and intra-groups correlations, as expected. The differences found between all groups of both populations seem to be dependent on several factors (genetic or social) that may control the development of the anaerobic pathway.

(1)–França N.M., Doré E., Bedu M., Van Praagh E., (2002). Am J Hum Biol. 14 (3): 364-371.

CONTINUOUS ASSESSMENT OF BLOOD PRESSURE USING THE EARLOBE PHOTOPLETHYSMOGRAM DURING EXERCISE

Kumahara, H., Kawano, H., Matsuda, T., Kiyonaga, A., Shindo, M., Tanaka, H.

Laboratory of Exercise Physiology, Japan

Introduction: Exercise stress test plays an important role in general evaluation of a cardiovascular and exercise tolerance, which can be valuable for ensuring a safety to participate in exercise training. Arterial blood pressure (BP) is an important parameter in the exercise stress. Recently a non-invasive continuous (beat-by-beat) blood pressure monitor based on a photoplethysmogram has been developed (Radia Press RBP-100, K&S Co., Japan). The new device consists a double wave-length spectrophotometry sensor, which is just clipped to the earlobe. It measures perfusion changes and then assesses BP. This may present some advantages such as less-restricted body movement and non-uncomfortable pressure. Beat-by-beat BP offers important and clinically relevant information on cardiovascular stress. The purpose of this study was to compare BP determined by the new device to that of the classical cuff-based Riva-Rocci (Korotkoff sound) method and of the previous validated Finometer (Finapres Medical Systems BV, Netherlands) during exercise.

Methods: Six young males (24±2yr of age and 21.8±0.8kg/m2 of BMI) performed a graded exercise test using a cycle ergometer. The work rate started at 15 watts and then increased by 15 watts every 2 minutes until the heart rate reached 85% of its maximum expected for the age. The systolic blood pressure (SBP) was measured by the earlobe photoplethysmogram method (SBPpl) and Finometer (SBPfi), simultaneously. The brachial arterial SBP measured by an automatic manometer (Tango, SunTech Medical Instruments Inc., USA) based on the Korotkoff sound technique was also employed (SBPko). The SBPpl and SBPfi values were averaged for 10 consecutive beat of just before each stage of exertion, and the SBPko was measured once each stage at the same time period. Double product (DP: SBPxHeart rate), as an index of cardiac oxygen demand, was also calculated. To compare the SBP determined by these devises, all the values during exercise were averaged.

Results: The average values of SBPpl, SBPko and SBPfi were 163.1±21.9, 138.4±24.3 and 147.7±28.8 mmHg, respectively. SBPpl was significantly($p<0.001$) higher than SBPko(25±18mmHg, 95%CI -10,60) and SBPfi(16±27mmHg, 95%CI -39,70). However, significant correlations were observed between SBPpl and SBPko($r=0.716$) or SBPfi($r=0.444$). When the relative change in the SBP from resting (calibration) to exercise period was calculated, these correlation coefficients increased. The DPpl significantly correlated with the DPko($r=0.947$) and DPfi($r=0.898$).

Discussion/Conclusion: The inter-individual variability of the relative error in SBP showed large deviation, however, the relative changes due to exercise loads could comparatively well assessed. These results indicated that careful individual calibration might be needed to provide more accurate assessment. The new device has a potential for the application of efficient exercise prescription.

References

Tanaka H et al. (1997) Med Sci Sports Exerc 29: 503-508

Schutte AE et al. (2004) J Hum Hypertens 18: 79-84.

TOTAL HAEMOGLOBIN MASS - A PROMISING PARAMETER TO DETECT BLOOD MANIPULATION

Prommer, N.

University of Bayreuth, Germany

To counteract against excessive blood manipulations haematological upper limits were introduced during the past years in most endurance sports disciplines. Once an athlete exceeds these limits he is suspended temporarily from competition and a doping analysis is

performed. This procedure, however, has the big disadvantage that changes in plasma volume can veil manipulations or lead to unwarranted sanctions towards the athlete. As the intention of every kind of blood manipulation is to increase total haemoglobin mass (tHb) it would be important and more reasonable to determine this key parameter directly. The aim of the project presented here was 1) to develop an easy manageable and fast method to determine tHb and 2) to evaluate whether tHb is a valid parameter to detect blood manipulation.

Objective 1: The commonly used and established CO-rebreathing method (Proccom) was optimised by changing the procedure of CO-administration and the breathing pattern, i.e. that instead of inhaling an O2-CO gas mixture for 10-15min a CO bolus was applied (Procnew) which reduced respiration time to 2min. Taking into account the modified kinetic of HbCO formation in Procnew capillary or venous blood sampling has to be performed in minute 7 after the onset of CO respiration to achieve identical tHb values as in Proccom (n=23). Reliability was evaluated in test-retests showing a typical error of 1.7%, i.e. that changes in tHb of more than 3.4% ($p<0.05$) are not due to methodical imprecision. Validity was determined by phlebotomy of 550ml (difference between calculated and measured values: 0.8 ±1.5%). HbCO halftime at rest averaged 132 ±77min and was lowered by more than 30% after exercise. Immediately after application of Procnew VO2max was reduced by 3.0 ±3.7%, i.e. that testing should not be performed straight before (6h) a competition.

Objective 2: tHb as a parameter to detect blood manipulation can only be beneficial if its physiological oscillation during a training year is lower than 12% which is characteristic for blood or EPO doping. We therefore examined 11 (6 triathletes, 5 cyclists) competitive athletes and 6 leisure sportsmen in regular intervals 5 times in the course of 12 months. The triathletes showed the highest oscillation with a mean maximum of 6.0 ±2.0%, followed by the leisure sportsmen (4.9 ±1.7%) and the cyclists (4.3 ±2.9%). The individual maximum deviation of the year's mean was 4.9%. Changes in [Hb] and Hct did not show any coherence to the changes in tHb.

It can be summarized that the optimized CO-rebreathing method is a valid tool to determine tHb exactly. As tHb does not show substantial physiological changes at lowlands and implicates individual predisposition it might outmatch the current haematological upper limits. It might therefore be a promising screening tool to pick out suspicious athletes and detect blood manipulation. However, influences of high altitude training, injuries and infections on tHb still have to be examined.

SKELETAL MUSCLE GLUCOSE UPTAKE HETEROGENEITY DECREASES WITH INCREASING EXERCISE INTENSITY

Nesterov, S.V., Kemppainen, J., Fujimoto, T., Nuutila, P., Knuuti, J., Kalliokoski, K.K.

University of Turku, Finland

The influence of exercise on muscle glucose uptake has been studied in plenty; however, changes in heterogeneity of this uptake during exercise still need attention. The purpose of the present study was to investigate the effects of increasing exercise intensity on skeletal muscle glucose uptake heterogeneity in healthy men.

Six practically healthy right-handed young men were studied during cycle ergometer exercise at relative intensities of 30% (LOW), 55% (MODERATE), and 75% (HIGH) of maximal oxygen consumption (VO2max) on three separate days. Glucose uptake in the quadriceps femoris muscle (QF) was directly measured using positron emission tomography (PET) and 18F-fluoro-deoxy-glucose ([18F]FDG). [18F]FDG was injected 10 min after the start of the exercise. Then the exercise was continued for another 25 min. PET scanning was conducted immediately after completion of the exercise. The measured glucose uptake values reflect the situation during exercise due to chemical characteristics of the [18F]FDG. Our particular interest was in measuring heterogeneity of glucose uptake (expressed as coefficient of variance – CV) and glucose uptake (GU) index in the QF of both legs.

As a result of the increasing exercise intensity GU index in QF increased from LOW (2.3±1.3 a.u.) to MODERATE (6.1±2.0 a.u., $p < 0.001$), but not further to HIGH (5.9±2.1 a.u., p = NS). No differences in GUI were found between the muscles of the left and the right legs. The muscles constituting QF differed in their levels of glucose uptake but the difference become smaller with increasing exercise intensity ($p < 0.01$) suggesting more uniform activation of different QF muscles. Glucose uptake became also less heterogeneous within the muscle regions with the increasing exercise intensity (CVs 41±22%, 33±15%, and 28±14% at LOW, MODERATE, and HIGH). Paired differences between LOW and MODERATE and LOW and HIGH were statistically significant but now between MIDDLE and HIGH. No differences in glucose uptake heterogeneity were found between the muscles of the left and the right legs. Heterogeneity values did not differ between the three vasti muscles (medial, lateral and intermedial) but were significantly ($p < 0.001$) higher in m. rectus femoris than in the other three muscles.

Having observed the tendency of exercising muscles to homogenize their glucose uptake, we are likely to conclude that the phenomenon of glucose uptake heterogeneity is an important property of the muscle tissue that diminishes under stressful conditions.

THE LACTATE ION INDUCES RECOVERY OF FORCE AND EXCITABILITY IN K+ DEPOLARIZED RAT SOLEUS MUSCLES

Jørgensen, R., de Paoli, F., Nielsen, O.B.

Institute of Physiology and Biophysics, Denmark

During contractions, muscle cells lose K+ to the extracellular space. This depolarizes the cell membrane and, if the K+ loss is large, it diminishes the cells ability to propagate action potentials, leading to a loss of membrane excitability that may contribute to fatigue. Adding lactic acid to isolated muscles under such conditions has been shown to induce recovery of force and excitability (Nielsen et al. 2001). This effect of lactic acid has been coupled to the accompanying acidosis (Nielsen et al. 2001). A series of pilot experiments indicated that addition of Na-lactate to K+-depolarized muscles led to a substantial recovery of force despite that Na-lactate had almost no effect on muscle pH. To evaluate these findings, we examined the effect of Na-lactate on force, excitability, intracellular pH (pHi) and Na,K-pump activity in muscles where excitability and force were reduced by exposure to elevated extracellular K+ ([K+]o).

Soleus muscles from Wistar rats were mounted on force transducers for isometric contractions in chambers containing Krebs-Ringer bicarbonate buffer equilibrated with 5% CO2 in O2. To mimic K+ conditions under intensive exercise, [K+]o was elevated to 11 mM, which reduces force to ~25% of control force in 4 mM K+. Muscles were stimulated to elicit a 2 s tetanus every 10 min with 0.2 ms pulses at 30 Hz. pHi was measured using fluorescence microscopy. The activity of the Na+,K+-pump was assessed from the ouabain-suppressible 86Rb+ uptake and excitability from measurements of compound action potentials (M-waves).

Addition of 20 mM Na-lactate to muscles at 11 mM K+ recovered force to 88 ± 3% of control force (n=7). At the same time M-wave area was increased from 17 ± 4% to 53 ± 11% of the control level (n=6), indicating a recovery of excitability. In contrast, Na-lactate had no effect on extracellular pH (pHo) and only decreased pHi from 7.19 ± 0.03 to 7.06 ± 0.03 (n=4). To evaluate the significance of this small lactate-induced acidification for the force recovery, the reduction in pHi was in another series of experiments mimicked by increasing CO2 from 5 to 7%. Although this led to a similar reduction in pHi from 7.22 ± 0.04 to 7.04 ± 0.03 (n=6) it only recovered force to 30 ± 4 % of control force (n=4), indicating that only a minor part of the effect of Na-lactate relies on reduced pHi. One could speculate that after addition of

Na-lactate, increased intracellular Na+ load associated with fibre pH regulation would increase Na,K-pump activity, which could contribute to force recovery by counteracting the K+-induced depolarization. This was, however, not the case because neither Na+ load nor Na,K-pump activity was increased after addition of Na-lactate.

In conclusion, this study shows that the lactate ion can improve muscle excitability via mechanisms that are independent of pH. This may protect muscle excitability during exercise involving high [K+]o.

Nielsen, OB; de Paoli, F and Overgaard, K. J Physiol. 536:161-166, 2001.

THE IMPROVEMENT OF EXCITABILITY AND FORCE INDUCED BY LACTIC ACID IN K+ DEPRESSED MUSCLES IS RELATED TO A DECREASE IN INTRACELLULAR PH

de Paoli, F.., Overgaard, K., Pedersen, T.H., Nielsen, O.B.

University of Aarhus, Denmark

During strenuous exercise, extracellular K+ ([K+]o) increases, which has been proposed to contribute to muscle fatigue by reducing muscle excitability. However, addition of lactic acid to isolated muscles counteracts the depressing effect of high [K+]o. This effect of lactic acid has been associated with the ensuing acidification (Nielsen et al. 2001), which down-regulates Cl- channel function (Pedersen et al. 2005). Since it is not possible from these experiments to determine whether the effect of lactic acid is specifically related to the decreased intracellular pH (pHi) or extracellular pH (pHo), we here examine the effects of specific reductions in pHi and pHo on force and excitability in K+-depressed muscles.

Soleus muscles from Wistar rats were mounted on force transducers for isometric contractions in chambers containing Krebs-Ringer bicarbonate buffer. Two sec tetani were elicited every 10 min with 1 ms pulses at 30 Hz. Excitability and Cl- channel function was assessed from measurements of compound action potential area (M-waves) and membrane conductance (Gm), respectively. Intracellular pH was measured using fluorescence microscopy.

In the isolated muscles, an increase in [K+]o to 11 mM reduced tetanic force and M-wave to around 25% of control values determined at a [K+]o of 4 mM. Subsequent addition of 20 mM lactic acid, which reduced pHo and pHi from 7.4 to 6.8 and from 7.44±0.02 to 6.80±0.02, respectively, led to an almost complete recovery of force and M-waves. To examine the roles of pHi and pHo, two experiments were made in which either pHi or pHo were as reduced:

Reduced pHi: In these experiments, pCO_2 and buffer HCO_3^- were simultaneously increased from 5 to 15 % and from 25 to 70 mM, respectively. This reduced pHi from 7.16±0.07 to 6.95±0.04 (P=0.04, n=4) but had no effect on pHo (7.44±0.01 vs 7.44±0.01, n=3). At the same time, tetanic force was increased from 43±9 % to 70±7 % of the of control values at 4 mM K+ (n=8).

Reduced pHo: In these experiments 20 mM HCl was added. This led to a large reduction in pHo (from 7.40±0.01 to 6.72±0.01, n=2) but did not reduce pHi (7.17±0.05 vs 7.09±0.05, P=0.29, n=6). At the same time only a small and transient recovery of force and M-wave was seen (from 16±3 to 37 ± 9 %, P=0.06, n=5 and from 17±5 to 31±11 %, P=0.29, n=5, respectively). In concord with this, Gm did not change significantly (2136 ± 150 vs 2365 ± 119 mS/cm2, n=10/23 and 6/15 (muscles/fibres), respectively), indicating that HCl did not reduce Cl-channel function. However, a transient increase in resting membrane potential (from -51.7 ± 0.4 to -53.2 ± 0.4 mV, P = 0.04, n=10/23 and 6/15) was seen, which may explain the transient increase in force.

In conclusion, the protective effect of lactic acid on muscle excitability is specifically related to a decrease in pHi.

Ref:

Nielsen OB, de Paoli F and Overgaard K. J Physiol 536: 161-166, 2001.

Pedersen TH, de Paoli F and Nielsen OB. J Gen Physiol 125(2):237-46. 2005.

HEREDITY-INDEPENDENT EFFECTS OF LONG-TERM VOLITIONALLY INCREASED PHYSICAL ACTIVITY AND AEROBIC FITNESS ON HEPATIC FFA UPTAKE AND BODY ADIPOSITY

Hannukainen, J.C., Borra, R., Nuutila, P., Janatuinen, T., Heinonen, O.J., Kaprio, J., Kujala, U.M., Rönnemaa, T., Viljanen, T., Haaparanta, M., Parkkola, R., Knuuti, J., Kalliokoski, K.K.

University of Turku, Finland

Regular physical exercise decreases body adiposity and improves whole body lipid and glucose utilization. Effects of increased physical activity on hepatic free fatty acid (FFA) uptake are largely unknown, although exercise has been shown to decrease hepatic triglyceride accumulation and further enhance insulin resistance (5). Exercise training increases gluconeogenesis at rest (2) and decreases liver FFA uptake during hyperinsulinemia (4). In the present study we investigated heredity-independent effects of moderately increased physical activity and aerobic fitness on hepatic FFA uptake.

Based on the mailed questionnaires and a phone interview, 12 pairs of young healthy adult male monozygotic twins were recruited from a FinnTwin16 study (3). Subjects performed a VO_2max test with cycle ergometer and nine pairs with intra-pair difference of at least 9% in VO_2max were selected for further studies. Abdominal subcutaneous and visceral fat mass was measured using MRI and hepatic FFA uptake at fasting state with positron emission tomography and [18F]FTHA. The co-twins with higher VO_2max constituting the more active group (MAG) were compared to the less active brothers (LAG) with lower VO_2max.

Mean VO_2max was 18% higher in MAG than LAG (50.1±5.1 vs. 43.4±6.7 ml/kg/min, $p<0.001$). Both groups had similar BMI and similar lean body mass, but MAG had 10% lower whole-body fat percent. MAG had also 19% lower abdominal subcutaneous and 20% lower visceral fat mass compared to LAG. Plasma glucose and serum FFA concentrations were similar between the groups. Hepatic FFA uptake was 33% lower in MAG than LAG (5.5±4.3 vs. 9.0±6.1 µmol/100ml/min, p=0.04) and it was associated to whole-body fat percent in the whole study group (p=0.05). When the whole-body fat percent was used as the covariate in ANCOVA the difference in hepatic FFA uptake between the groups was no longer statistically significant (p=0.08).

Without the confounding effects of genetic factors, moderately increased physical activity and aerobic fitness decreases body adiposity even in normal-weighted humans. The lower hepatic FFA uptake in more active and fit subjects agrees with the suggestion that with decreased body adiposity, especially in intra-abdominal area, the rate of adipose tissue lipolysis is lower, thus decreasing the FFA load to the liver (1). As energy flux is the major determinant of energy utilisation it is also possible that increased gluconeogenesis (2) would lead to metabolic shunting of glucose to tissues. In conclusion, as liver is metabolically the most versatile organ and covers most of its energy demand by oxidizing FFAs, it is reasonable to presume that even small changes in the availability of substrates may have large effects on hepatic energy utilisation.

1. Arner Diabetes Metab Res Rev 2002.

2. Bergman et al. Am J Physiol Endocrinol Metab 2000.
3. Hannukainen et al. J Appl Physiol 2005.
4. Iozzo et al. Diabetes Care 2004.
5. Tamura et al. J Clin Endocrinol Metab 2005.

ENHANCEMENT OF CAPILLARY TORTUOSITY AFTER RESISTANCE TRAINING

Egeland, W., Kvamme, N.H., Rønnestad, B.R., Kadi, F., Raastad, T.

Norwegian College of Sports Sciences, Norway

Strength training has great impact on maximal strength and muscle hypertrophy, but results on capillarization are contradictory. Different training protocols and different measures of capillarization are possible reasons for conflicting results. A common method is to calculate the capillaries around each fibre (CAF), and in addition relate this to area of fibre (CAFA). By measuring the length of capillaries relative to the perimeter of fibre on cross-sections (LC/PF), it is possible to calculate the tortuosity of the capillaries. Charifi et al (2004) demonstrated that endurance training resulted in greater increase in LC/PF than CAF, however, no studies have been performed on strength training programs. In addition, training volume, given as the number of sets per exercise, may influence the effect on capillaries. Therefore, we hypothesized that 3-set strength training would, in addition to give greater changes in maximal strength, also have greater effect on muscular endurance and capillarization than 1-set strength training.

Sixteen untrained men (age 18-40) were randomly selected into two groups; a 3-set group (n=9) and a 1-set group (n=7). Both groups trained 3 days per week for 11 weeks, and workouts consisted of leg press, leg curl and leg extension performed with one or three 7-10 RM sets. Strength tests (1RM), relative muscular endurance (numbers of repetitions at 60% of 1RM until failure) and biopsies were conducted before and after the training period. Biopsies were taken from m. vastus lateralis, and stained for type I and IIa fibres and capillaries (CD31).

Both groups increased their maximal strength. The 3-set group demonstrated a significantly greater increase in leg strength than the 1-set group (41±3% vs. 25±2%, respectively, $p<0.01$), but there were no significant differences between groups in changes in muscular endurance or capillarization. Measured as changes in LC/PF both groups significantly increased capillarization for type I fibres (16±6%), and near significant for type IIa fibres (18±7)($p=0,058$). We found a significant reduction in CAFA for type IIa fibres (-8±4%), and the difference in change between LC/PF and CAFA was significant for type I fibres. No correlation between capillarization and muscular endurance was found.

The method of measuring capillarization has great impact on the results. This is indicated by the significant difference between LC/PF and CAFA. Thus, CAFA might not be a sensitive measure when hypertrophy is expected. Also, the addition of capillaries after training is usually described by greater CAF. Our findings demonstrate a greater increase in LC/PF than CAF after 11 weeks of resistance training, and this can indicate that the adaptation of the capillarization may be due to an enhancement of the capillary tortousity by increasing the capillary length rather than increasing the number of capillaries.

Charifi N, et al. (2004): Enhancement of microvessel tortuosity in the vastus lateralis muscle of oldmen in response to endurance training. J Physiol 554; 559-569

DECREASED SERUM BDNF REVEL IN ATHLETES

Nofuji, Y., Suwa, M., Moriyama, S., Nshichi, R., Ichimiya, A., Radák, Z., Kumagai, S.

Kyushu University, Japan

Decreased serum BDNF level in athletes

Yu Nofuji1, Masataka Suwa2, Yoshihiko Moriyama1, Reiko nishichi3, Atsushi Ichimiya2, Zsolt Radak4, Shuzo Kumagai2,4

1: Graduate School of Human-Environment Studies, Kyushu University, Kasuga, Fukuoka, Japan

2: Institute of health Science, Kyushu University, Kasuga, Fukuoka, Japan

3: St.Mary's University, Kurume, Fukuoka, Japan

4: Faculty of Physical Education and sports Science, Semmelweis University, Budapest, Hungary

Brain-derived neurotrophic factor (BDNF) is a member of the neurotrophin family expressed in the nervous system and periphery. BDNF is known to play an important roles in the growth, development, maintenance and function of survival neuronal system. In rodents, it has been reported that voluntary exercise significantly increased the BDNF mRNA and protein levels in the hippocampus, lumbar spinal cord, cerebellum and cortex. The BDNF can cross the blood-brain barrier in both directions, suggesting that the serum BDNF level may reflect the brain BDNF level. Therefore, it is possible that exercise affect the serum BDNF level.

PURPOSE: The purpose of this study is to test the hypothesis that the serum BENF level associates with the exercise training.

SUBJECTS: Male 13 athletes (age: 21.62 ± 0.96 years) and 15 healthy volunteers with no sports activities (age: 22.33 ± 1.23 years) participated in this study. The athletes group includes distance runners (n = 8), a sprinter (n = 1), tennis players (n = 3), and a badminton player (n = 1). All athletes have participated in regular sports activities (over 16 hours per week for more than 3 years). Control subjects have not participated in any regular exercise (for more than 1 year).

METHODS: To evaluate physical activity, the participants attached the Lifecorder® (Suzuken, Nagoya, Japan), a small solid state recorder (62.5 × 46.5 × 26 mm, 40g), containing an acceleration sensor, for 1 week just before the day of blood collection. The self-ratable State-Trait Anxiety Inventory (STAI) and the 28 items version of the General Health Questionnaire (GHQ-28) were performed in all subjects. Serum BDNF levels were measured using the BFND Emax Immunoassay kit (Promega, Madison, WI, USA). The statistical analysis of the two groups was performed using Student's t test.

RESULTS: The serum BDNF level was significantly lower in athletes than in normal subjects (19.65 ± 4.35 vs. 23.80 ± 2.90 ng/ml, respectively; $p<0.01$). The mean daily calorie consumption and movement-related calorie consumption and stem numbers in the athletes group (2533 ± 270 kcal, 556 ± 174kcal, 15518 ± 4225 steps/day, respectively) were distinctly higher than in the control group (2200 ± 228 kcal, 262 ± 109 kcal, 9171 ± 2861 steps/day, respectively; $p<0.01$). On the other hand, there were no differences in age, sex, weight, body mass index, percentage of body fat between the two groups.

CONCLUSION: The serum BDNF level would associate with the physical activity.

RADIATION INDUCED THERMOREGULATORY FAILURE AND THE REDUCTION OF EXERCISE PERFORMANCE IN THE HOT

Suzuki, T., Kawabata, T., Fujimoto, S., Miyagawa, T.

Graduate School of Medicine, Osaka City University , Japan

It is well documented that exercise performance can be impaired in the hot environment. The solar radiation is especially important factor besides ambient temperature and relative humidity in the field. Infrared (IR) radiation increases skin temperature (1), and promotes sweating (2) and skin blood flow (3) for resting human. Therefore, we hypothesized that mechanisms of human physiological regulation at a high temperature environment with radiation were different from without one. In the present study, we investigated physiological changes by radiation during endurance exercise in the laboratory.

Nine healthy male subjects dressing shorts remained seated resting for at least more than 40 min, and then performed cycle ergometer at 60% peak oxygen uptake until exhaustion in the climatic chamber at 33°C ambient temperature (Ta), and 40% relative humidity (RH). The dorsal aspect of trunk was irradiated by IR heater with main emissivity intermediate-infrared (MIR; 1.5-5.8μm) regions (I-trial at 38°C globe temperature (Tg)) and compared without IR irradiation (C-trial at 33°C Tg). Esophageal temperature (Tes) and skin temperature (Tsk), sweat rate (SR), skin blood flow (SkBF), heat flax (HF), heart rate (HR), oxygen uptake (VO2), mean arterial blood pressure (MAP), and the ratings of perceived exertion (RPE) of dyspnea and leg were measured continually throughout the experiment. Body weight loss (BWL) was measured at the end of experiment immediately. And more we recorded the exercise performance time (EPT).

EPT was shorter in the I-trial (35.07±15.17 min) compared to the C-trial (43.81±14.04 min) and exhaustion during moderate exercise in a hot environment with or without IR irradiation occurred at the same Tes within an individual although both Ta were same in each trial. And significant differences in Tes, Tsk, SkBF, HR, and RPE by IR irradiation were observed. However, VO2, MAP were not affected.

Heat gain from the environment to skin must form part of the integrated responses which mediates the decreased central recruitment and power output in the heat, and a high skin temperature may inform the brain that the capacity for heat dissipation is reduced (4). Therefore, the increase in core and skin temperature with radiation influences on central thermoregulatory center and causes the reduction of exercise performance.

References

1. Hardy JD. Physiological effects of high intensity infrared heating. ASHRAE J 4: 36-42, 1962.

2. Ogawa T, Sugenoya J, Ohnishi N, Natsume K, Ochiai M, Nishida M, Shinoda N, Katoh K, Imamura R. Dynamic sweating response of man to infrared irradiation in various spectral regions. Int J Biometeorol. 35: 18-23, 1991.

3. Ise N, Katsuura T, Kikuchi Y, Miwa E. Effect of far-infrared radiation on forearm skin blood flow. Ann Physiol Anthropol. 6: 31-32, 1987.

4. Tucker R, Rauch L, Harley YX, Noakes TD. Impaired exercise performance in the heat is associated with an anticipatory reduction in skeletal muscle recruitment. Plugers Arch. 448: 422-430, 2004.

GENDER DIFFERENCES IN MUSCLE FATIGUE AND BRACHIAL ARTERIAL BLOOD FLOW DURING INTERMITTENT, MAXIMAL VOLITIONAL HANDGRIP

Saito, Y., Iemitsu, M., Otsuki, T., Maeda, S., Ajisaka, R.

University of Tsukuba, Japan

Introduction: Females have been reported to have greater resistance to skeletal muscle fatigue than males [1]. Russ et al. demonstrated that the gender difference disappeared during ischemic conditions[2]. It suggested the importance of muscle perfusion, which increases oxygen transport to the muscles and promotes removal of metabolic by-products, thereby may contribute to lessen muscle fatigue. Muscle blood flow may be greater in females than in males via some mechanisms such as vascular effects of estrogen [3], but gender differences in blood flow during exercise are unclear. We hypothesized greater blood flow contributes to smaller exercise-induced muscle fatigue in females. Purpose: The purpose of the present study is to investigate the relation between muscle force decline and increase in brachial arterial blood flow during intermittent, maximal volitional handgrip in young males and females. Methods: Healthy young (24.6± 0.5 years) males (n=8) and females (n=8) laid in a supine position and underwent a 4-min repeated (5 seconds contraction followed by 5 seconds rest) static maximal voluntary contraction(MVC)s handgrip. The MVC force during exercise was evaluated relative to their respective baseline values. Brachial arterial blood flow (BABF) was measured using Doppler ultrasonography. Results: A two-way ANOVA detected main effect of gender on MVC force decline during exercise ($p<0.05$). The MVC force decline was smaller in females than in males at the initial 1st min of exercise ($p<0.05$) and no significant differences were found at any other time points following the 1st min. A significant interaction between gender and time was detected in the BABF adjusted to forearm volume during exercise ($p<0.05$) and the BABF was greater in females than in males at the 1st min of exercise only ($p<0.05$). The area under the time-blood flow curve (AUC) analyses also supported this finding ($p<0.05$). There is a negative relationship between changes in the BABF and MVC from baseline to the 1st min of exercise only in females ($r=-0.69$, $p=0.058$). Conclusion: In conclusion, the gender differences in exercise-induced muscle force decline may be related to differences in the blood flow to their working muscles during the initial phase of exercise.

Reference:

1. Hicks, A.L., J. Kent-Braun, and D.S. Ditor. Sex differences in human skeletal muscle fatigue. Exerc Sport Sci Rev, 2001. 29: p. 109-12.

2. Russ, D.W. and J.A. Kent-Braun. Sex differences in human skeletal muscle fatigue are eliminated under ischemic conditions. J Appl Physiol, 2003. 94: p. 2414-22.

3. Ettinger, S.M., Muscle sympathetic nerve activity during exercise and the influences of gender, in Gender Differences in Metabolism, M. Tarnopolsky, Editor. 1998, CRC press: Boca Raton. p. 87-119.

IS PEAK OXYGEN UPTAKE ASSOCIATED WITH MICROVASCULAR FUNCTION IN 9-10 YEAR OLD CHILDREN?

Farr, C., Shore, A., Armstrong, N., Mawson, D., Middlebrooke, A.

University of Exeter, United Kingdom

Risk factors for adult cardiovascular disease are present at a young age and are associated with the development of atherosclerotic disease (1). Changes in vascular function occur early in the development of cardiovascular disease (2) and microvascular dysfunction has been demonstrated in normal children with a clustering of cardiovascular risk factors (3). Microvascular dysfunction has been associated with maximal oxygen uptake in adults (4) and therefore the purpose of this study was to investigate whether subtle changes in microvascular function in normal healthy children were associated with peak oxygen uptake.

One hundred children, (53 boys and 47 girls) (age 9.9±0.4years, body mass 33.6±7.2kg, body mass index 17.3±2.6kg.m2), were recruited from local state schools. Each subject performed a continuous incremental exercise test to exhaustion on a cycle ergometer to determine peak oxygen uptake. Respiratory gas analysis was performed continuously throughout the test using an online breath-by-breath gas analyser. Microvascular function was assessed by the maximum skin hyperaemic response to local heating (42°C) on the dorsal aspect of the foot. The resultant red blood cell flux was measured using a single point laser Doppler probe at eight non-centric points on the heated site. Resting arterial blood pressure (systolic and diastolic) was determined as the mean of two readings with the subject in the supine position. The study was approved by the local Medical Research Ethics Committee and written informed consent was obtained from both the child and their parent(s) / guardian(s).

Peak oxygen uptake was significantly higher in the boys compared to the girls (boys: 194.6±30.0 v girls: 165.9±28.0mL.kg-0.58.min-1, p=0.0001). However, there was no significant difference in the maximum microvascular hyperaemia (boys: 1.78±0.32 v girls: 1.79±0.43V, p=0.880) although minimum microvascular resistance approached significance (boys: 39.7±7.4 v girls: 43.6±11.9mmHg.V, p=0.052). There was also no significant difference in maximum microvascular hyperaemia between the highest and lowest quartiles of peak oxygen uptake (highest quartile: 1.79±0.32 v lowest quartile: 1.75±0.36V, p=0.620). Sex-specific correlation analysis revealed no significant correlations between peak oxygen uptake and the maximum microvascular hyperaemia or minimum microvascular resistance.

These data demonstrate that despite a significantly higher peak oxygen uptake in boys this was not reflected in measures of microvascular function and that there is no association between microvascular function and peak oxygen uptake in 9-10 year old children.

(1) Berenson et al. (1998). New England Journal of Medicine, 338: 1650-1656

(2) Ross (1993). Nature, 362: 801-809

(3) Khan et al. (2003). Journal of Physiology, 551: 705-711

(4) Middlebrooke et al. (2005). Diabetic Medicine, 22: 483-489.

AGE RELATED DIFFERENCES IN FIBER TYPE SPECIFIC SATELLITE CELL CONTENT

Verdijk, L.B., Koopman, R., Schaart, G., Meijer, K., Savelberg, H., van Loon, L.J.

Maastricht University, Netherlands

Introduction

Satellite cells (SC) play an important role in growth and repair of skeletal muscle fibers. The number of SC per muscle fiber has been reported to decline with aging (Kadi, 2004). However, this decline has not been reported consistently (Dreyer, 2006). A reduced number of SC could lead to impaired maintenance of muscle fiber structure and function. In healthy young adults, no differences seem to exist in the number of SC between type I and II skeletal muscle fibers (Kadi, 2005). Considering the specific loss and atrophy of type II muscle fibers with aging, we hypothesized that in elderly, SC content is specifically reduced in type II fibers.

Methods

Biopsies were taken from the vastus lateralis muscle of 8 elderly (E: 76±4 y) and 8 young (Y: 20±1 y) healthy male subjects. 5 µm thick serial cross sections were stained with ATPase for fiber typing, and with pax7 counterstained with DAPI to visualize SC and myonuclei. Differences between E and Y were evaluated by independent-samples T-tests; all values are expressed as means±SD. For SC counts, 291±83 and 287±74 fibers were analyzed in E and Y subjects, respectively.

Results

The proportion of type II fibers was smaller in E than in Y subjects (47.2±8.8 vs 56.8±8.5 %, respectively; P=0.043). For mean cross sectional area (csa) of type I fibers, no difference was observed between E and Y (5471±641vs 5589±794 µm², respectively). In contrast, mean csa of IIa and IIb fibers was smaller in E vs Y (4807±1328 vs 6260±1064, P=0.030; and 3970±959 vs 5890±1160 µm², P=0.003, respectively).

SC counts revealed no difference in the mean number of SC per muscle fiber (0.063±0.008 vs 0.076±0.017 in E and Y, respectively; P=0.067). However, fiber type specific analyses revealed a significantly lower number of SC per type II muscle fiber in E compared to Y subjects (0.044±0.010 vs 0.080±0.021, respectively; P=0.001). In addition, the number of SC per mm² of type II fiber was lower in E vs Y (9.7±2.8 vs 12.6±2.7, respectively; P=0.047). In type I fibers, no differences were observed between E and Y for either SC content (0.082±0.014 vs 0.071±0.016, respectively; P=0.151), nor for the number of SC per mm² (13.8±2.8 vs 12.7±3.1, respectively; P=0.468).

Discussion

This study is the first to show fiber type specific differences in SC content in skeletal muscle fibers between young and elderly men. The number of SC in type II muscle fibers is substantially reduced in elderly compared to young adults, even when correcting for fiber cross sectional area. As a consequence, the capacity to maintain structure and function of type II muscle fibers is likely to be impaired in elderly. This could represent an important factor in the development of sarcopenia and associated health problems.

References

Dreyer H et al (2006). Muscle Nerve, 242-253

Kadi F et al (2004). Muscle Nerve, 120-127.

Kadi F et al (2005). Histochem Cell Biol, 1-5.

KINETICS OF CARDIAC OUTPUT, SYSTEMIC O2 DELIVERY AND LUNG O2 UPTAKE IN NORMOXIA AND NORMOBARIC HYPOXIA IN MEN

Lador, F. 1, Azabji-Kenfack, M. 1, Moia, C. 1, Cautero, M. 2, Morel, D.R. 3, Capelli, C. 2, Ferretti, G. 1-4

1 Centre Mêdical Universitaire, Geneva, Switzerland, 2 Hôpital Cantonal Universitaire, Geneva, Switzerland, 3 Università di Udine, Italy 4 Università di Brescia, Italy, Switzerland

At the onset of light square wave exercise in normoxia, cardiac output (Q) and systemic O2 delivery (QaO2) is characterized by a first rapid phase (phase I) followed by a slower phase (phase II) up to steady state. The appearance of phase I was related, amongst others, to withdrawal of vagal tone upon exercise onset. Exposure to acute hypoxia implies reduced vagal activity and increased sympathetic activity. If this is so, the kinetics of Q and QaO2 ought to be slower in hypoxia than in normoxia, possibly for lack of phase I, this being a possible consequence of a lack of vagal activation in resting humans in hypoxia. In this study we tested the hypothesis that the kinetics of Q and QaO2 is slower in hypoxia than in normoxia, as would the associated kinetics of VO2. To test this hypothesis, simultaneous determinations of beat-by-beat (BBB) Q and QaO2, and breath-by-breath VO2 at the onset of constant load exercises at 50 and 100 W were obtained in normoxia and hypoxia on six men (age 24.3 + 3.1 years, maximal aerobic power 333 + 61 W in normoxia). VO2 was deter-

mined using Gronlund's algorithm. Q was computed from BBB stroke volume (Qst, from arterial pulse pressure profiles) and heart rate (fH, electrocardiograpy) and calibrated against a steady-state method. This, along with the time course of hemoglobin concentration and arterial O2 saturation (infrared oximetry) allowed computation of BBB QaO2. Lactataemia remained below the so-called lactate threshold during the experiments. The Q, QaO2 and VO2 kinetics were analysed with single and double exponential models. Q and VO2 increased upon exercise onset to reach a new steady state. The steady level of Q was significantly higher in hypoxia (Qrest 6.75 + 0.33 l/min, Q50W 12.18 + 0.25 l/min Q100W 17.81 + 0.64 l/min) than in normoxia (Qrest 6.58 + 0.22 l/min, Q50W 11.89 + 0.25 l/min Q100W 14.44+ 0.33 l/min) for each work load. The steady level of VO2 in hypoxia (VO2rest 0.57 + 0.08 l/min, VO250W 1.41 + 0.12 l/min, VO2100W 1.91 + 0.07 l/min) was not significantly different from that obtained in normoxia (VO2rest 0.61 + 0.08 l/min, VO250W 1.44 + 0.07 l/min, VO2100W 1.77 + 0.05 l/min) for each work load. The kinetics of Q and QaO2 at the whole body level was found slower in hypoxia than in normoxia (Time constants for phase I (T1) and II (T2): Qn50W T1 3.02 + 1.50 s, T2 2.10 + 1.04 s, QaO2n50W T1 2.69 + 1.31 s, T2 2.54 + 1.48 s; Qn100W T1 3.10 + 1.42 s, T2 8.53 + 3.28 s, QaO2n100W T1 2.47 + 1.64 s, T2 9.29 + 4.60 s; Qh50W T1 2.20 + 1.65 s, T2 20.59 + 8.63 s, QaO2h50W T1 2.38 + 1.08 s, T2 16.98 + 7.61 s; Qh100W T1 5.13 + 3.97 s, T2 37.23 + 7.41 s, QaO2h100W T1 5.54 + 5.59 s, T2 30.49 + 7.91 s). Moreover, the kinetics of QaO2 was not significantly different from that of VO2 (VO2h50W T1 1.36 + 0.73 s, T2 29.77 + 5.89 s, VO2h100W T1 2.67 + 0.63 s, T2 30.54 + 5.68 s). These results are compatible with the tested hypothesis, as well as with the notion of a lack of vagal activation in resting humans in hypoxia.

VARIABILITY OF MUSCLE ACTIVITY DURING PEAK POWER OUTPUT CYCLING

Albertus-Kajee, Y., Lambert, M.I., Noakes, T.D., St Clair Gibson, A.

University of Cape Town, MRC/UCT Research Unit for Exercise Science and Sports Medicine, South Africa

Variability is found in biological signals such as muscle activity patterns (EMG), however it is not known if this variability is due to biological control processes or testing artefacts. When analysing EMG, there is a need to reduce variability caused by testing artefact so as to highlight sensitive changes in muscle activity caused by the variability in biological control mechanisms. Thus normalisation methods play a significant role in reducing variability. The use of maximal voluntary contractions (MVC) as a normalisation method is standard, however using this method for dynamic exercise such as cycling; this method is questionable, because of the variability in maximal output in cycling. We have thus proposed two other methods for normalisation which may reduce variability, namely a 10 second maximal sprint and cycling at 70% of peak power output. This study aims to provide an appropriate method of EMG normalisation for cycling trials, while allowing assessment of minute stages of biological control mechanisms (muscle activity).

13 well trained cyclists performed the same experimental protocol on three separate occasions separated by 5-7 days of normal training. EMG activity was measured on 6 muscles on the right leg. Subjects firstly performed a maximum voluntary contraction (MVC) using the Biodex Dynamometer 3, followed by a 10 second maximal sprint on an electronically braked cycle ergometer starting at 200W. Following this, they performed the Peak Power Output (PPO) test until exhaustion, where work rates began at 3.33 W/kg body mass. After a resting period they performed a submaximal cycle at 70% of PPO for 5 minutes at 90rpm. The three EMG normalisation methods were the MVC, 10sec sprint and the 70% PPO for 5 min. The study showed that normalising EMG data to 70% PPO was more repeatable and thus less variable, where the intraclass correlation (ICC) of 0.87 (-0.48-1.00) was significantly higher than MVC ICC=0.66 (-0.55-1.00) (p=0.03) and 10s sprint ICC=0.65(-0.54-1.00) (p=0.04). Despite being more repeatable, greater changes in muscle activity were found in the muscle groups tested during PPO, where VMO, RF and BF muscle activity at exhaustion was significantly greater to activity at the start and middle of the trials. Whereas normalising to MVC, only RF and VL showed this significant difference. MG and LG were the only muscle showing no changes in muscle activity during PPO tests.

Normalizing EMG to 70% PPO appeared to reduce variability caused by testing artifact and elicit changes in muscle activity caused by variability of biological control mechanisms during PPO tests, which was not shown using the MVC or sprint method. The reason for the greater testing artefact variability in the MVC and 10 s sprint EMG (which are self-paced exercises) needs to be assessed in future research.

INDICES OF NEW FIBRE FORMATION AFTER STRENGTH TRAINING IN YOUNG, HEALTHY MEN

Kvamme, N.H., Egeland, W., Rønnestad, B.R., Hanssen, K.E., Kadi, F., Raastad, T.

Norwegian School of Sport Sciences, Norway

Kadi & Thornell (1999) observed fibres expressing embryonic and neonatal myosin heavy chain (MyHC) in the trapezius muscle of healthy women after ten weeks strength-training. Six out of nine subjects had small-sized muscle fibres expressing embryonic and neonatal MyHC, while the small-sized fibres were not detected in any of the biopsies taken before the strength training. The embryonic and neonatal MyHCs are considered as markers for the early stages of fibre development and positive fibres might therefore indicate formation of new muscle fibres in response to strength training. The purpose of this study was to further investigate the expression of developmental MyHC in vastus lateralis and trapezius in young men undergoing 11 weeks of heavy strength training.

Nineteen untrained men (18-40 years) took part in the study. The subjects performed 3 workouts per week for 11 weeks. Each workout consisted of eight exercises and subjects performed 1-3 sets of 7-10 repetitions (7-10 RM load) in each exercise. Biopsies were taken from trapezius and vastus lateralis before and after 11 weeks of training. Whole muscle cross sectional area (CSA) of thigh muscles and upper part of trapezius was measured by magnetic resonance imaging (MRI). Values are given as mean±SEM.

There was a significant increase in the number of fibres expressing embryonic MyHC (from 0.44±0.13 to 2.05±0.68%, $p<0.05$) and vimentin (from 0.12±0.05 to 1.92±0.60%, $p<0.01$) after training for vastus lateralis, while there was a significant increase in the number of fibres expressing neonatal MyHC (from 0.2±0.1 to 3.1±1.1%, $p<0.05$) for trapezius. We found a significant increase in the fibre area for type IIa in both vastus lateralis (19±5%, $p<0.01$) and trapezius (16±6%, $p<0.05$). We also found a significant negative correlation between the fibre area of type IIa at the start of the training and the relative change in fibre area during the training period for both vastus lateralis ($p<0.01$) and trapezius ($p<0.05$). In particular, subjects with fibre areas ≥8000 microns experienced no fibre hypertrophy but had the same increase in whole muscle CSA as the subjects with an increase in fibre area.

The increase in fibres expressing markers for formation of new fibres and the negative correlation between fibre area at the start of the training period and the change in fibre area during the training period may indicate a possible hyperplasia. It might be hypothesised that muscle fibres have a maximal size and when reaching this limit the fibres either split or there is a formation of new fibres An alternative hypothesis is that strength training induces local disruptions in myofibres and that the developmental MyHC indicates regenerating areas.

Kadi F & Thornell L-E (1999) Training affects myosin heavy chain phenotype in the trapezius muscle of women. Histochem Cell Biol 113, 99-103.

AN INVESTIGATION OF EXERCISE AND INSULIN-INDUCED OPENING OF MUSCLE CAPILLARIES USING NIRS

Shaw, C.S., Zijlstra, E.D., Wagenmakers, A.J.

University of Birmingham, United Kingdom

Muscle contraction and increases in plasma insulin following ingestion of a meal or drink can stimulate the recruitment of skeletal muscle capillaries and glucose uptake into the muscle cells. A growing amount of evidence suggests that the recruitment of muscle capillaries is vital in allowing access of glucose and insulin to the muscle bed and thus maintaining glucose homeostasis (Rattigan et al, 2005). We aimed to investigate whether the increase in muscle capillary volume could be detected using near infrared spectroscopy (NIRS) in the period of hyperaemia following isometric skeletal muscle contractions and in the 2 h period after consumption of a glucose+protein beverage, which is known to lead to a large increase in plasma insulin concentration (van Loon et al, 2000).

Our assumption is that total haemoglobin (HbT) and oxygen saturation (StO2) in muscle capillaries is measured using NIRS. HbT will increase when more red blood cells enter the muscle capillaries and the observed increase should be proportional to the increase in capillary volume; oxygen saturation is expected to decrease when blood supply does not meet oxygen demand and to increase when the increase in blood flow during hyperaemia exceeds the oxygen requirement of the muscle.

10 healthy lean subjects (aged 26.7±8.6 years, BMI 22.3±2.3) took part in one or both of the study protocols. 6 subjects completed 3 one-minute isometric contractions of the biceps brachii interspersed with 5 minute recovery periods. 6 subjects were measured for 2 hours after the consumption of a glucose+protein (75g+30g) beverage. The NIRS probe was attached to the centre of the biceps brachii and measures of StO2 and HbT content (relative to baseline) were recorded on a 4 wavelength continuous wave near-infrared spectrometer (InSpectraTM Tissue Spectrometer Model 325, Hutchinson Technology, Hutchinson, MN).

During the 1 min isometric contractions HbT decreased from 54.4±1.8 to 45.5±1.8 potentially due to the expulsion of blood from the muscle bed with the increased intramuscular pressure during contraction, while StO2 fell from the resting level of 78.4±2.0 % to 1.6±0.4 % ($P<0.05$). In the 5 minute period post-contraction, relative HbT content and StO2 increased on average 17.2±4.1% and 21.2±5.6% respectively ($P<0.05$) above resting values. During the 2 h period after consumption of the glucose+protein beverage, HbT remained unchanged throughout the 2 hour post-prandial period ($P>0.05$). StO2 fell from a baseline of 87.1±2.7% to 74.8±3.6 % during the 60-80 minute period ($P<0.05$).

We conclude that NIRS is suited to measure the increases in HbT levels indicating increases in capillary volume following a static contraction but is unable to identify the more subtle changes in capillary volume upon insulin-stimulation.

Rattigan S et al (2005). Exerc Sport Sci Rev 33: 43-48.

Van Loon LJ et al (2000). Am J Clin Nutr 72: 96-105.

SPINAL AND CORTICOSPINAL CONTRIBUTION TO NEUROMUSCULAR CONTROL IN STRETCH-SHORTENING CYCLE

Taube, W., Leukel, C., Schubert, M., Rantalainen, T.J., Gollhofer, A.

University of Freiburg, Germany

Introduction

Muscular activation during drop-jump (DJ) is assumed to rely on spinal reflexes as well as on supraspinal participation (1). However, the relative importance of either activation sources could not be verified, so far. To identify spinal and corticospinal contributions to the muscular activation we applied peripheral nerve stimulation (H-reflex=HR) and transcranial magnetic stimulation (TMS) during different phases of DJ. The comparison of spinal and corticospinal effects was used to reveal modulations in cortical excitability.

Methods

In each subject 5 stimulation times were determined after averaging the background EMG of 10 DJs from 31cm. The first stimulus was applied in the pre-innervation phase (PRE), the second at the time of the short-latency response (SLR). Stimuli 3, 4 and 5 were timed to coincide with reflex peaks at approximately 70ms (medium-latency response=MLR), 90ms (long-latency response=LLR) and 120ms (later component of the LLR =LLR2). Subthreshold TMS and HR were triggered so that both, the motor evoked potential (MEP) and the H-reflex arrived in the soleus at the same time as the PRE, SLR, MLR, LLR or LLR2. HRs were recorded in two different ways to ensure constant stimulus intensity (methods are in accordance with (2) and will be described in the presentation). The underlying background EMG activity was subtracted from the HRs and MEPs evoked at PRE, SLR, MLR, LLR and LLR2. MEPs and HRs were expressed as a percentage of their maximal excitability during drop jump to compare the time course of spinal and corticospinal excitability.

Results

MEP- as well as HR-sizes were strongly dependent on the background EMG activity. However, differential excitability courses were obtained for electrical and magnetic stimulation when subtracting background EMGs from HRs and MEPs. MEPs were highest in PRE (100%) and of similar sizes at SLR (51%), MLR (46%), LLR (50%) and LLR2 (60%). HRs were also high at the beginning (PRE=82%); SLR=100%) but then progressively decreased with ongoing time from ground contact (MLR=46%; LLR=24%; LLR2=26%).

Discussion/Conclusion

Comparison of corticospinal and spinal excitability during stretch-shortening cycle indicates that cortical excitability is high during PRE, interestingly low at SLR and raised again approximately 90ms after touch down. In contrast, spinal excitability is most prominent at SLR followed by a progressive decline. Our results indicate that DJ is a centrally initiated activity with gating of spinal reflex pathways shortly after touch down. We assume the reflex gating to be caused by supraspinally induced reduction in presynaptic inhibition.

References

1. Gollhofer, A. & Kyröläinen, H. (1991). Neuromuscular control of the human leg extensor muscles in jump exercises under various stretch-load conditions. Int.J.Sports Med. 12, 34-40.

2. Simonsen EB & Dyhre-Poulsen P (1999). Amplitude of the human soleus H reflex during walking and running. J Physiol 515 (3), 929-939.

MATHEMATICAL MODELLING OF TRANSCAPILLARY INSULIN TRANSPORT

Zijlstra, E.D. 1, Sjöstrand, M. 2, Groenendaal, W. 3, van Riel, N. 3, Lönnroth, P. 2, Wagenmakers, A.J. 1

1 The University of Birmingham, United Kingdom, 2 University Hospital, Göteborg, Sweden, 3 Eindhoven University of Technology, The Netherlands, United Kingdom

BACKGROUND

Obesity and insulin resistance (IR) due to low physical activity levels and poor nutritional habits have developed into world-wide epidemics. Insight in the biological mechanisms leading to IR will define the targets for future interventions and can be enhanced by the use of mathematical models. It is well-known that insulin, when it binds to its receptor, promotes glucose uptake in skeletal muscle cells by means of GLUT-4 translocation. However, in recent years it has become evident that failure of insulin to recruit muscle fibre capillaries and limitations in transcapillary insulin transport may prevent the access of insulin to the interstitial fluid (ISF) surrounding the muscle cells especially in insulin resistant states.

AIM

The aim of this study was to investigate and quantify possible impairments in transcapillary insulin transport in obese, insulin resistant subjects after ingestion of a glucose drink (oral glucose tolerance test). This study helps to understand the role of insulin transport mechanisms in the development of IR. It will also provide a tool to assess the effect of exercise interventions on IR in future studies.

METHODS

A previously proposed mathematical model of insulin transcapillary transport (1) was used to quantify insulin transport rates in both a group of obese, insulin resistant subjects and a group of healthy lean volunteers. Parameter estimation was executed using Maximum Likelihood Estimation. Measured arterial plasma insulin concentrations serve as input signal and measured interstitial insulin concentrations as output signal for this model.

Experimental work was carried out in the Lundberg Laboratory for Diabetes Research. Subjects reported to the lab at 8:00 A.M. after an overnight fast and were instructed to drink a 250 ml solution containing 75g of glucose. Plasma and interstitial insulin concentration were sampled every 15 minutes for 105 minutes using respectively venous forearm cannulation and forearm muscle microdialysis.

RESULTS

The estimates from the measurements for the insulin transcapillary transport rate were 0.0172 ± 0.0066 vs. 0.0123 ± 0.0053 min-1(lean vs. obese); p = 0.03.

CONCLUSION

The transport of insulin from plasma to the ISF surrounding muscle cells is reduced during an oral glucose tolerance test in obese, insulin resistant subjects. This reduction, is either caused by defective insulin-induced capillary recruitment mechanisms and/or an obstructed transendothelial insulin transport, and is likely to contribute to the observed IR.

REFERENCES

1) Steil GM, Ader M, Moore DM, Rebrin K, Bergman RN, Transendothelial transport is not saturable in vivo, no evidence for a receptor mediated process, J Clin Invest 97(6): 1497-1503, 1996.

CARDIORESPIRATORY RESPONSES AT THE ONSET OF THE DOMINANT AND NON DOMINANT LIMBS EXERCISE

Hotta, N., Yamamoto, K., Katayama, K., Akima, H., Ishida, K.

Nagoya University, Japan

Our laboratory has found that cardiorespiratory responses at the onset of exercise in endurance runners and sprinters were lower than that of sedentary subjects. As cardiorespiratory responses at the initial phase after the start of exercise are mainly controlled by central command and mechanoreflex via thin-fiber muscle afferents, we have hypothesized that repeated exposure to muscle contraction or metabolic substances desensitizes thin-fiber muscle afferents. Generally, people give preference to their dominant arm or dominant leg in their day to day activities. Thus it can be assumed that dominant limbs are more often exposed to mechanical stimuli than non dominant limbs. Therefore, we compared the initial ventilatory and circulatory responses to light exercise of subjects using their dominant and non dominant limbs. Regarding the upper limbs, fifteen subjects performed a single-elbow flexion-extension exercise with a load of 5% MVC for 20 s during voluntary or passive exercise, attached to the wrist. In addition, passive exercise was performed on the subjects in the same way as the above-mentioned voluntary exercise to eliminate the effect of central command. We defined the difference between the resting value and mean value for 20 s as delta. It was found that delta ventilation during passive exercise of the dominant arm was significantly lower than that of the non dominant arm, whereas delta HR was unchanged between the dominant and non dominant arms. As for the lower limbs, all seventeen subjects performed a single-knee extension-flexion exercise and passive exercise in the same way as the experiment for the upper limbs. Delta ventilation during both voluntary and passive exercise by the dominant leg was lower than that of the non dominant one. Similar to the response of the upper limbs, delta HR showed no change between the dominant and non dominant legs. These results suggest that the sensitivity of thin-fiber muscle afferents to muscle contraction is dulled and that this can be attributed to the frequent exposure to mechanical stimuli such as muscle contraction.

THE EFFECTS OF HYPOXIA AND SHORT-TERM VIBRATION STIMULI DURING CYCLING ON ANGIOGENIC AND ANTI-ANGIOGENIC FACTORS

Suhr, F., de Marées, M., Achtzehn, S., Mester, J.

German Sport University Cologne, Germany

Introduction

Various stimuli are known to induce angiogenesis, e.g. mechanical forces, such as hydrodynamic induced shear forces, hypoxia and metabolites1. It is well-established that these factors induce the expression of matrix metalloproteinases (MMPs), the formation of endostatin, and an increased expression of VEGF. Hypoxia and mechanical forces normally are present in the vasculature by an increased cardiac output, lowered oxygen supply and deformations of muscle tissue during exercise. Therefore these factors are essential in the organ-specific expression of new capillaries. The aim of this study was to investigate the biological response in this area following highly intensified stimuli (vibration and artificial normobaric hypoxia).

Methods

Twelve cyclists participated in this study. Each subject completed four training sessions (90 minutes cycling for each) at weekly intervals in a randomised order. The four training sessions were: normoxia without vibration, normoxia with vibration, hypoxia without vibration and hypoxia with vibration. For each subject five blood samples were taken at each training session at the following terms: pre training, 0h, 0.5h, 1h and 4h post training. Hypoxia was induced by a normobaric hypoxic-chamber with an average altitude of 2500 m. The artificial mechanical forces (cycling with or without vibration) were induced by a cycling ergometer (a specially designed bicycle fixed on a vibration platform with a peak-to-peak amplitude of 4 mm and a frequency 30 Hz, where the vibration could be switched on or off). The parameters VEGF, endostatin and MMPs have been measured by ELISA kits (R&D Systems GmbH, Germany).

Results

VEGF showed a significant increase after the training sessions with artificially induced vibrations compared to the non-vibration sessions. Endostatin was significant increased after all training sessions.

Conclusions

These results show that the treatment with vibration can be an important stimulus for the increase in the expression of VEGF. The results induce the hypothesis that vibration can be a more efficient stimulus for the VEGF-release than hypoxia because an increase in VEGF after the sessions in hypoxia without vibration could not be proved. Endostatin has been discussed to inhibit as well as to facilitate the growth of new capillaries2 and was increased after all training sessions. This leads to the conclusion that the treatment with hypoxia as well as with vibration can be understood as an effective stimulus for the expression of endostatin. These findings may contribute to a broader understanding of angiogenesis and thus energy supply in the skeletal muscles.

References

1. Brown, M. D., Hudlicka, O.: Modulation of physiological angiogenesis in skeletal muscle by mechanical forces: Involvement of VEGF and metalloproteinases. Angiogenesis, 2003; 6 (1): 1-14

2. Schmidt, A., Addicks, K., Bloch, W.: Opposite effect of Endostatin on different endothelial cells. Cancer Biol Ther, 2004; 3 (11): 1162-8.

TRAINING STRENGTH WITH HEART RATE: BENCH PRESS APPLICATION

Martín Caro, C., Benito, P.J., Díaz, V., Peinado, A.B., Calderón, F.J., Sillero, M.

Physical Education Faculty , Spain

Introduction: The relationship between heart rate (HR) and oxygen up-take remains lineal in strength exercises, there is a stronger slope toward HR, which indicates that, comparing strength exercises with resistance exercises, the HR increases more than oxygen uptake (1, 2). This work arises from the necessity of knowing if HR can be used as an intensity indicator for strenght exercises. Method: The sample was composed by 7 males in good physical fitness, skilled on strength training, aged 27 ± 4,7 years, weighted 72,1 ± 5 kg, and 169,8 ± 4,1 cm in height. They carried out 5 Bench Press trials, while HR was recorded by a Polar S710 HR monitor. In four of the them, the load was increased progressively along the sets from 20 to 90% of a single maximum repetition (1RM), performing 20 (2 times), 10 and 6 repetitions, and a previous maximum test to determine the 100% of 1RM. The 20 repetitions trials were performed at two different execution rates. It was carried out a lineal regression analysis with the variables and a Pearson's correlation. These variables were obtained from an ANOVA for each proposed model, and a Wilcoxon test for compared samples, the significance level was set at $p<0,01$.

Results: We found the highest correlations between percentage of 1RM and percentage of the corrected HR reserve: $r = 0,737$; $p <0,01$ (for 6 rep), $r = 0,738$; $p <0,01$ (for 10 rep), $r = 0,818$; $p <0,01$ (for 20 slow rep) and $r = 0,816$; $p <0,01$) (for 20 fast rep). We also found significant differences ($Z=-4,415$; $p<0,01$) between the maximum HR obtained in the fast and slow 20-repetitions sets. Four prediction formulas were obtained to estimate the % 1RM from the HR with a correlation of r=0,729 (6 rep) , r=0,796 (10 rep), r=0,830 (20 rep) and r=0,760 (general equation,, which is showed below).

%1RM= 34,148 – (1,771 • number of repetitions) + (0,704 • % reserve HRcorr)

Discusion: Supporting with Westcott's data (HR rest + 53 beats at 70%1RM versus HR rest + 50 beats at 85% 1RM) and with our data, we can assert that HR increase more with high repetitions sets (3). This is the only work that analyze the lineal relationship between HR and %1RM.

Conclusions: HR can be used as an easy method to control the execution intensity in bench press, assuming that the closer is the intensity to 1RM, the bigger is the error of the estimation.

References:

1. Collins MA, Cureton KJ, Hill DW, Ray CA. Relationship of heart rate to oxygen uptake during weight lifting exercise. Med Sci Sports Exerc. 1991 May;23(5):636-40.

2. Crawford WW, Loy SF, Nelson AG, Conlee RK, Fisher AG, Allsen PE. Effects of prior strength exercise on the heart rate oxygen uptake relationship during submaximal exercise. J Sports Med Phys Fitness. 1991 Dec;31(4):505-9.

3. Westcott WL, O'-Grady S. Strength training and cardiac postrehab: using heart rate to monitor cardiovascular effort could help your design an appropriate strength training program. Idea Personal Trainer. 1998;Feb:41-6.

PLASMA GHRELIN RESPONSES TO ACUTE EXERCISE IN BOYS AT DIFFERENT STAGES OF SEXUAL MATURATION

Pomerants, T., Tillmann, V., Karelson, K., Jürimäe, J., Jürimäe, T.

University of Tartu, Estonia

Ghrelin has recently been involved in the regulation of a large array of endocrine and non-endocrine functions, including the influence on growth hormone (GH) secretion, food intake and energy balance (Korbonits et al. 2004). The aim of the present study was to investigate changes in plasma ghrelin concentrations and pertinent components of the GH-insulin-like growth factor (IGF) axis during the 30 min cycle ergometer test in prepubertal (n=20), pubertal (n=20) and postpubertal (n=20) boys based on Tanner classification – group I was prepubertal, group II included stages 2 and 3, and group III stages 4 and 5. Subjects were also analyzed as a total group (n=60). Maximal oxygen consumption (VO2max) and individual ventilatory threshold (IVT) were measured directly using stepwise increasing loads on cycle ergometer. Second test consisted of a 30 min constant exercise on the same ergometer at the level of ~ 95% of their IVT. Venous blood samples were obtained before, immediately after and after 30 min of recovery for the measurement of ghrelin, leptin, insulin, testosterone, GH, IGF-I, IGFBP-3 and glucose. At baseline, prepubertal children had significantly different values for ghrelin, testosterone, GH, IGF-1 and IGFBP-3 levels compared to other groups. Testosterone and ghrelin were in significantly different between pubertal and postpubertal boys. Acute exercise altered GH significantly in all studied groups. The level of GH remained significantly higher after 30 minutes of recovery, with an exception of prepubertal group where the difference between GH pretest and recovery values was not

significant. Changes were also significant in levels of insulin in group II, III and total group and glucose in total group. Individual analysis indicated that ghrelin concentration increased more than 10% in 13 and decreased in 25 boys postexercise. Higher VO2max values were more related with increased ghrelin after exercise ($p<0.01$). VO2max correlated significantly with baseline ghrelin ($r=-0.61$), GH ($r=-0.50$), IGF-1 ($r=0.60$), IGFBP-3 ($r=0.46$), testosterone ($r=0.90$) and insulin ($r=0.52$) concentrations before cycle ergometer test in total group. The relationship of the same metabolic characteristics with VO2max/kg was significant, but lower ($r=-0.43$, $r=-0.30$, $r=0.49$, $r=0.31$, $r=0.60$ and $r=0.34$, with ghrelin, GH, IGF-1, IGFBP-3, testosterone and insulin, respectively). It was concluded that moderate intensity aerobic exercise did not change ghrelin concentration in blood, while the changes on GH levels were significant in all pubertal stages and insulin decreased in pubertal and postpubertal groups.

References:

Korbonits M, Goldstone AP, Gueorguiev M, Grossman AB. Ghrelin - a hormone with multiple functions. Frontiers in Neuroendocrinology 2004; 25: 27-68.

THE INFLUENCE OF CARBOHYDRATE INGESTION AND ENVIRONMENTAL TEMPERATURE ON PACING STRATEGY DURING A 16.1 KM TIME TRIAL IN WELL TRAINED CYCLISTS

Abbiss, C., Peiffer, J., Peake, J., Nosaka, K., Suzuki, K., Laursen, P.

Edith Cowan University, Australia

Introduction: Carbohydrate ingestion has been shown to reduce the overall time required to complete a given amount of work, especially in exercise durations greater than 1 h. Few studies however have examined the influence of environmental temperature and carbohydrate ingestion on the distribution of power during an exercise task. The purpose of this study therefore was to determine the effects of carbohydrate ingestion and heat stress on the pacing strategy employed during a 16.1 km time trial.

Methods: In a counterbalanced randomized crossover design, ten trained male cyclists (age = 27 ± 7 y; mass = 77.9 ± 6.1 kg; VO2max = 61.7 ± 5.0 ml/kg/min) performed a total of four 90 min constant pace experimental cycling trials at 80% of second ventilatory threshold (220 ± 12 W). Trials were conducted in either cool (18.1 ± 0.4 °C) or hot (32.2 ± 0.7 °C) conditions during which subjects ingested either carbohydrate (CHO; 0.96 g/kg/h) or placebo (PLA) gels; all trials were immediately followed by a 16.1 km time trial. Power output (Velotron, Racermate; WA), and rectal and skin temperatures (SquirrelView, Grant 2020; UK) were recorded every second and averaged over each 2 km of the trials. Venous blood was sampled through an antecubital vein for the determination of blood glucose concentration before exercise, following the 90 min trial and immediately post time trial.

Results: Time taken to complete the 16.1 km time trial was significantly greater in the PLA compared with the CHO condition during exercise in the heat (27.5 ± 1.9 vs. 26.6 ± 1.4 min, respectively; $P<0.05$) but not in the cool (25.4 ± 1.6 vs. 25.4 ± 1.7 min, respectively). In the cool, power output did not change significantly in the PLA condition, but significantly ($P<0.05$) increased for the final 2 km in the CHO condition. Compared with the initial 2 km in the heat, power output was significantly lower at and beyond 4 km, until the final 2 and 4 km under PLA and CHO conditions, respectively ($P<0.05$). Compared with trial means, power output tended to be greater during the first 2 km of the hot PLA trial (13.2 ± 16.4%; $P<0.07$) and in the final 2 km of both hot and cool CHO trials. The initial rate of heat storage (kJ/km) was significantly greater in the heat until the third km ($P<0.05$). Compared to the PLA trials blood glucose concentration following the 90 min constant pace cycling was significantly greater in both the hot (110 ± 10 vs. 91 ± 13 mg/dL) and cool CHO trials (100 ± 10 vs. 91 ± 7 mg/dL; $P<0.05$).

Conclusion: Compared to the mean power output subjects tended to commence the hot trials and finish the CHO trials at relatively high power outputs. These data suggest that the rate of heat storage and carbohydrate supply may independently influence not only the average absolute power output, but also the distribution of work during self-paced exercise.

RECOVERY-TIME CONSTANT AND AMPLITUDE CHARACTERISTICS TO REPEATED SHORT-TERM BREATH-HOLDING DURING DYNAMIC LEG-EXERCISE

Németh, H., Saito, H., Kimura, M., Maki, A., Ito, S., Takenaka, T.

Semmelweis University, Budapest, Hungary

Short-term breath-holding occurs in various water and outland sport activities. The purpose of the present study was to investigate breath by breath respiratory responses in the recovery after repeated short-term breath holding during dynamic leg-exercise in moderate-exercise intensity domain (2-102W). During the 45 minutes bicycle ergometer test the subjects performed 20-second breath-holding sessions starting at 20, 25, 30, 35 minutes of exercise. The short periods following the four sessions were analyzed. The end-tidal carbon dioxide concentration (ETCO2), the end-tidal oxygen concentration (ETO2), the expiratory tidal volume (TVe) and the respiratory rate were observed. Single exponential curves were fitted to ETCO2, ETO2 and TVe. Heart rate and arterial oxygen saturation have also been monitored. In case of ETCO2 and ETO2 bigger time constants and smaller amplitudes were found at lower intensity, and smaller time constants and bigger amplitudes at higher intensity. Amplitude-ETO2 was found to be bigger than amplitude-ETCO2. The respiratory rate seems to have bigger time constant. As for the cardiovascular response to breath-holding, a slightly delayed decrease of the heart rate was observed. The amount of this delay seems to increase proportionally with increase of exercise load intensity. A considerable decrease in arterial oxygen saturation was only observable at higher intensities.

We conclude that time constants and amplitudes of ETCO2 and ETO2 have intensity dependency, and that ETCO2 and ETO2 showed a somewhat different time course of recovery.

FOREARM VASCULAR RESPONSES TO COMBINED MUSCLE METABORECEPTOR ACTIVATION IN THE UPPER AND LOWER LIMBS

Tokizawa, K., Mizuno, M., Muraoka, I.

Waseda University, Japan

INTRODUCTION: Seals (1989) suggested that cardiovascular responses elicited during exercise of separate limbs exhibit an 'inhibitory interaction'. Our previous studies showed that venous occlusion or passive stretch of the lower limb, assuming a mechanical stimulus, attenuates the vasoconstriction in the nonexercised forearm during post-exercise muscle ischemia (PEMI) of the arm (Tokizawa et al. 2004a,b). In this study, we investigated whether a metabolic stimulus to the lower limb induces a similar response.

METHODS: Eight subjects performed a 2 min static handgrip exercise at 30% maximal voluntary contraction (MVC) followed by 3 min PEMI of the arm, concomitant with or without 2 min static ankle dorsiflexion at 30% MVC followed by 2 min PEMI of the calf. Mean arterial pressure, heart rate, forearm blood flow (FBF), and forearm vascular conductance (FVC) in the nonexercised arm were measured.

RESULTS: During PEMI of the arm alone, FBF and FVC decreased significantly, whereas during combined PEMI of the arm and calf, the forearm vasoconstriction produced by PEMI of the arm was attenuated. FBF and FVC were significantly greater during combined PEMI of the arm and calf than during PEMI of the arm alone. When PEMI of the calf was released after combined PEMI of the arm and calf (only PEMI of the arm was maintained continuously), the attenuated vasoconstriction observed during combined PEMI of the arm and calf was not observed.

CONCLUSION: These results indicate that a metabolic stimulus to the lower limb attenuates the vasoconstriction in the nonexercised forearm mediated by muscle metaboreceptor activation in the upper limb. It is suggested that the inhibitory integration of muscle afferent inputs from multiple limbs contribute to the attenuated vasoconstriction, irrespective of the mode of muscle afferent.

REFERENCES:

Seals DR. Influence of muscle mass on sympathetic neural activation during isometric exercise. J Appl Physiol 67: 1801–1806, 1989.

Tokizawa K, Mizuno M, Nakamura Y, and Muraoka I. Venous occlusion to the lower limb attenuates vasoconstriction in the nonexercised limb during posthandgrip muscle ischemia. J Appl Physiol 96: 981–984, 2004a.

Tokizawa K, Mizuno M, Nakamura Y, and Muraoka I. Passive triceps surae stretch inhibits vasoconstriction in the nonexercised limb during posthandgrip muscle ischemia. J Appl Physiol 97: 1681–1685, 2004b.

VARIATION IN LUNG VOLUMES WITH PSOITION

Álvarez, M., Díaz, V., Peinado, A.B., Benito, P.J., Martín, C., Calderón, F.J.

Politecnical University of Madrid, Spain

INTRODUCTION

In other studies there have been differences observed in the pulmonary volumes and capacities in relation to the position of the subject (1). The aim of this study was to observe the differences in the spirometric values in the three most common positions in sports and its possible application to the assessment of athletes. The observed variables were the habitual ones and the abbreviations of European Respiratoy Society were used (ERS).

MATERIALS AND METHODS

The study population consisted of 25 men and 7 women students of Physical Education that were healthy, nonsmokers. Each subject carried out a minimum of three manoeuvres of inspiration and forced espiration and three valid manoeuvres of maximal voluntary ventilation in 12 seconds in standing (S), sitting (ST) and supine position (SU) in a random order. The best attempt was chosen following the criteria of the ERS.

Spirometry was carried out using spirometer Jaeger Oxycon Pro ® (Erich Jaeger, Germany). The volume transducer is digital bidirectional (Triple V ®) of low dead space and resistance, fulfilling normative ATS (American Thoracic Society) (6) and ERS.

For the analysis of the data, a one-way ANOVA was used. If significant differences were found an analysis post-hoc of Scheffé was used. The signification level was set at $p<0.05$.

RESULTS

The analysis of the variance showed significant differences in the ERV in both genders, between the SU and S and between ST and SU, but no differences were found between the sitting and standing position. For both genders the ERV value in SU was lower than in the other two positions.

In the following variables no significant differences were found for men, but significant differences were found for women in FEV1, MVV, VCEX and FVC. The lowest value was in the SU.

DISCUSSION

In SU there is a reduced in ERV, decreasing FRC but remainding VC constant. This could be due to the elevation of the diaphragm about 40mm (2) that takes place in the SU (3). Therefore, in SU the IRV is larger. The greater number of differences found in women against men can be due to the size and heterogeneity of the sample.

The results suggest the evaluation of pulmonary volumes in the same position as the sport is practiced, for example in swimmers in supine position, since there is a redistribution of the pulmonary volumes varying the respiratory mechanics (4).

REFERENCES

1. Lalloo UG, Becklake MR, Goldsmith CM. Effect of standing versus sitting position on spirometric indices in healthy subjects. Respiration. 1991;58(3-4):122-5.

2. Houston JG, Angus RM, Cowan MD, McMillan NC, Thomson NC. Ultrasound assessment of normal hemidiaphragmatic movement: relation to inspiratory volume. Thorax. 1994 May;49(5):500-3.

3. Wade OL, Gilson JC. The effect of posture on diaphragmatic movement and vital capacity in normal subjects with a note on spirometry as an aid in determining radiological chest volumes. Thorax. 1951 Jun;6(2):103-26.

4. Drummond GB. Effect of apparatus on functional residual capacity. Br J Anaesth. 1996 Apr;76(4):560-2.

THE EFFECTS OF EXERCISE-INDUCED MUSCLE DAMAGE ON UNILATERAL BALANCE PERFORMANCE

Twist, C., Eston, R., Gleeson, N.P.

University of Chester, United Kingdom

Efficient movement execution requires an adequate postural stability, which is partly dependent upon afferent information directed from proprioceptors located within the contractile and non-contractile elements of the muscle-joint system. Exercise-induced muscle damage (EIMD) has been shown to impair proprioceptive function (Brockett et al., 1997). However, it is not known whether this phenomenon adversely affects balance performance. Therefore, the purpose of this study was to investigate the effects of EIMD on unilateral balance performance.

Six healthy adult participants (age 24.0 +/- 3.3 yr, stature 1.72 +/- 0.1 m, body mass 73.6 +/- 11.9 kg) who had not performed any systematic resistance training in the previous 6 months, participated in the study. Muscle damaging exercise consisted of 10 sets x 20 repetitions of double leg vertical jumps, interspersed with 1 minute recovery between each set. On landing, participants were instructed to

ensure minimal flexion at the knee, thus increasing the mechanical stress upon the triceps-surae muscle group. Stability was recorded as the variance between the tilted and reference position over a 20 s period (sampling rate 20 Hz) using an instrumented balance system (Biodex Balance System, Biodex Medical Systems, Shirley, NY) and expressed as a Stability Index (SI). Peak torque of the ankle extensors was measured at 30 and 180 deg/s to evaluate the effects of EIMD on muscle force generating capability (Biodex 3, Biodex Medical Systems, Shirley, NY). In addition, perceived muscle soreness was recorded on a 0–10 visual analogue scale. Measurements were taken before, immediately after and at 24, 48 and 72 hours following the muscle damaging exercise.

Perceived muscle soreness increased significantly following the plyometric exercise protocol, with values of 1.0 (0.5), 3.2 (0.5), 5.7 (0.9), 4.9 (0.9), 3.3 (0.9) at baseline, 30 min, 24, 48 and 72 h ($F_{2, 18} = 10.86$, $P<0.01$), respectively. Peak torque was significantly reduced from baseline after the plyometric exercise protocol ($F_{4, 20} = 3.40$, $P<0.05$), with similar decrements for slow (76.4 (4.6)%, 79.8 (8.8)%, 87.5 (5.7)%, 90.2 (8.4)%) and fast speeds (87.2 (7.2)%, 89.4 (7.5)%, 80.8 (12.0)%, 90.6 (11.6)%) at 30 min, 24, 48 and 72 h, respectively. The SI was significantly increased ($F_{1.5, 0.6} = 3.14$, $P<0.05$) with values increasing from baseline (2.05) to 2.60, 3.43 and 2.48 immediately after plyometric exercise, and at 30 min, 24 h and 48 h respectively.

These results indicate that neuromuscular control is reduced following a bout of muscle-damaging exercise. This has implications for both the use of skill-based activities and for increased injury risk following high intensity plyometric training.

References

Brockett, C, et al. (1997) Brain Res: 771: 251-258.

FACTORS AFFECTING THE PREDICTION OF ENERGY EXPENDITURE FROM ACCELEROMETER DATA

Stone, M., Esliger, D., Tremblay, M.

University of Saskatchewan, Canada

Introduction: Some accelerometers employ frequency-dependent filters which may exacerbate reliability and validity problems when utilizing these devices for physical activity assessment. Differences in leg length (LL), stride length and stride frequency in a population could contribute to variations in activity data output and therefore prediction of EE. This study assessed whether age, weight and LL assist in the prediction of EE from three motion sensors (Actical, Actigraph, RT3) across various movement intensities during treadmill locomotion. Methods: Eighty six participants aged 8-40 yrs performed three 10-minute bouts of treadmill activity (speeds: walk, walk/jog, run) ranging in speed from 4-12 km/hr. Accelerometer-derived EE (predicted EE) was compared to measured EE from respiratory gas analysis across speed categories. Height quintiles were created in order to determine whether the capability of manufacturer-based, model-specific equations (MSE) to predict energy expenditure was affected by LL and whether the inclusion of LL as a predictor variable into our own research-derived regression equations (RDE) offered an improvement in the estimation of EE. Reliability coefficients (R2) from MSE and RDE for each model across each speed category were generated and compared. Results: All speeds considered, each model provided the most valid estimate of EE for height quintiles 3 and 4 (R2 = 0.54 to 0.86). For the tallest individuals, validity coefficients from all models were very weak during treadmill running (R2 = 0.14 to 0.39). The inclusion of weight, LL and age, in addition to accelerometer counts into regression equations explained 85-94% of the variance in EE. For all models, the inclusion of age and LL as predictor variables into RDE's helped to explain a larger amount of the variance in EE across all speeds. Age was a significant predictor of EE during treadmill walking, however it became non-significant during treadmill jogging and running for all models (except Actical for treadmill jogging). Conclusion: The validity of accelerometer-derived EE may be affected by changes in treadmill walking/running speed and individual differences in height. Accounting for age and LL may increase the accuracy and validity of EE data from accelerometers, however the predictive power of these variables (and others) may vary at different treadmill speeds.

This work was funded in part by Statistics Canada and the University of Saskatchewan.

EFFECT OF HYPERCAPNIA ON LACTATE AND AMMONIA ACCUMULATION DURING EXERCISE

Kato, T., Matsumoto, T., Tsukanaka, A., Nakano, M., Ito, R., Kosaka, M., Matsui, N.

Chukyo University, Japan

<Introduction> The application of hypercapnic gas inhalation may bring a novel impact on sports and/or health sciences. We have investigated physiological responses during exercise under hypercapnia (Kato et al, 2005). The purpose of this study was to determine the effects of hypercapnia on lactate and ammonia accumulation during exercise.

<Materials and methods> Six healthy males volunteered to participate in the present study. Each subject performed incremental exercise until exhaustion on three occasions; 1) breathing ambient air (MAX); 2) breathing hypercapnic (21% O2, 6% CO2, N2=balance) gas (6%CO2); 3) breathing mild hypercapnic (21% O2, 3% CO2, N2=balance) gas (3%CO2). Subjects breathed ambient air or hypercapnic gas from 10 min before the start of exercise until the end of exercise. Exercise tests were conducted using an electrically-braked cycle ergometer. The initial workload was 30 Watt (W), and thereafter the workload was increased by 30 W every 2 min until exhaustion. Arterialized blood was drawn from a superficial vein.

<Results> Before exercise, VE, respiratory rate (RR), and blood PCO2 were significantly higher in 6%CO2 than those in MAX and in 3%CO2 ($P < 0.05$). Blood pH was significantly lower in 6%CO2 than those in MAX and in 3%CO2 ($P < 0.05$). HR was significantly higher in 6%CO2 than that in MAX ($P < 0.05$). In comparison between MAX and 3%CO2, VE and RR were significantly higher in 3%CO2 than those in MAX ($P < 0.05$). At the exhaustion, plasma lactate concentration was significantly lower in 6%CO2 than that in MAX ($P < 0.05$). Plasma ammonia concentration was not significantly different among the three conditions (6%CO2 vs. MAX, $P = 0.095$). VE, RR, and HR were not significantly different among the three conditions. Blood pH was significantly lower in 6%CO2 than that in MAX ($P < 0.05$), blood PCO2 was significantly higher in 6%CO2 than those in MAX and in 3%CO2 ($P < 0.05$). Performance time and VO2max were not significantly different among the three conditions, but performance time tended to be lower in 6%CO2 than that in MAX ($P = 0.07$).

<Discussion> Our results showed that the higher hypercapnic gas inhaled, the lower plasma lactate and ammonia concentrations observed at the exhaustion. Lactate and ammonia are metabolites of anaerobic metabolism. Therefore, it is suggested that as hypercapnic level rises, anaerobic metabolism is limited. In comparison between 6%CO2 and 3%CO2, the responses in respiratory and circulatory system, and blood gas responses were more remarkable in 6%CO2 than that in 3%CO2. From these results, we recommend less than 3% of CO2 concentration, when hypercapnic gas inhalation is applied in sports and/or health sciences.

<Conclusion> The higher hypercapnic gas inhaled, the lower plasma lactate and ammonia accumulation occurred during exercise.

<References>

Kato et al. (2005) Effect of hypercapnia on changes in blood pH, plasma lactate and ammonia due to exercise. Eur J Appl Physiol 95: 400-408.

CARDIAC NERVE ACTIVITY DURING RECOVERY FROM EXERCISE CHANGES WITH AEROBIC TRAINING AND DETRAINING

Arduini, A. 1, López, Y.A. 2, Sala, S.P. 3, Guillen, S. 3, Romagnoli, M. 1+2

1 Dept.Physiolog,Univ.of Valencia, 2 Dept. of Sport Science, 3 ITACA University Polytechnics of Valencia , Spain

Introduction

Cardiodecelaration, during recovery from exercise, is governed by a rapid parasympathetic reactivation and by withdrawal of sympathetic stimuli (1). Cohort and training studies demonstrated that trained people have faster parasympathetic reactivation (2). HR-recovery kinetics allows a larger "window" of data to be analysed and avoid the technical inconvenient of non-linear sets of R-R intervals. So, the observation of the HR-kinetics could favour the understanding of the complex interaction between sympathetic and parasympathetic cooperation in the recovery process.

Aim of the study

1) To assess the sensitivity of HR-recovery kinetics for evaluation of cardiac nerve activity changes during a period of increased and decreased physical fitness; 2) To identify the significance of the parameters of the recovery kinetics.

Material and methods

Fourteen sedentary non-smokers subjects (30.16.1 yrs, 24.33.21 kg/m^2; underwent an exercise programme of 3d/wk for 8 wks on a static bike, followed by 8 wks of detraining. Intensity of training increased from 65 to 80% VO2max. VO2 was measured breath-by-breath and data were mediated during 30s of each 3-min step of the incremental exercise. HR kinetics was assessed in a 3-minute recovery by two exercises of 6 minute each, one at 65%HRmax and the other at 80%HRmax. Recovery data were fitted by an exponential function (y =A0+Amax(e-(x/τ))). Tau[30s], an index of parasympathetic reactivation was also calculated (3).

We applied a repeated measures design and significance ($p<0.05$) was evaluated by post-hoc Bonferroni comparisons.

Results

VO2max increased with training from 36.95.9 to 42.85.4 mLO2∙kg-1∙min-1 (week 8 vs. pre-training, $p<0.05$,). Amax increased during training from 46.08.7 to 53.79.6 and 58.59.0 bpm ($p<0.001$ after 8 wk vs. control) and decreased with detraining (48.112.2 bpm). A0 changed with training and detraining from 104.210.2, 96.911.8, 91.99.3 and 102.913.3 bpm ($p<0.001$ at 8 wk vs. control). Tau-3min showed only a trend toward a decrease (68.837.0, 67.534.2 and 55.321.3 s at 0, 4 and 8 wk, respectively, $p>0.05$), almost restored during de-training (61.624.6 s).

The variation of Amax and A0 with training was moderately associated with that of tau-30s ($r = 0.60$-$.63$). Tau-3min varied independently from any other parameter.

Conclusions

Vagal reactivation evidenced a time adaptation to increased physical activity. Amax and A0 also changed with training, so they can be used as valid markers to evaluate cardiac adaptations to changes in physical fitness. The 30% variation of A0 and Amax with tau-30s suggests that the former are reflecting mainly a non-parasympathetic component, possibly a sympathetic one. HR-recovery kinetics can effectively assess cardiac nerves adaptations to training and detraining.

References

1-Nishime EO et al., JAM.

EFFECT OF MANY DAYS LONG-LASTING HIGH ALTITUDE WORK UPON AEROBIC CAPACITY, STRENGTH AND SIZE OF MUSCLE

Popov, D.

Institute for Biomedical Problems Russian Academy of Since, Russia

Endurance training under normoxic conditions causes an increase of oxidative capacity of the organism. On the other hand many days long-lasting (6-8 hrs) moderate aerobic work under normal conditions (ski expeditions) do not lead to an increase of aerobic indices [1,2]. Moreover a decrease of oxidative capacity of working muscles and of muscle size is recorded after climbing 8000 m peaks in mountain-climbers [3].

The aim of the study was to evaluate the aerobic and force-velocity characteristics of human beings after long-lasting low-intensity exercise during high altitude expedition without aid of other men. The expedition took place at a height of 3000-6800 m above sea level (Pamir, Tadjikistan). The expedition route was 262 km long, included overcoming the mountain passes at high altitude (above 5000 m) and climb of the peak "Rossia" (6830 m).

4 male and 2 female athletes (age 25±1 yrs, weight 71±4 kg, height 1.77±0.03 m, VO2max 50±3 ml/min/kg) gave their written consent to participate in the experiment. The high altitude expedition lasted 33 days including 4 resting days, the mean height was 4243 m, total positive climb was 13800 m. Mean working time a day was 6-7 hours, starting rugsack weight – 30-35 kg. Before and 5-8 days after expedition testing took place at the sea level. Cross-sectional area (CSA) of m. quadriceps femoris was calculated using MRI section areas of the thigh. Force-velocity characteristics of knee extensor muscles were recorded in an isokinetic regime at angular velocities 300, 180 and 30 ˚/s. The aerobic and anaerobic thresholds (AeT and AnT), VO2max , maximal power (Wmax) and maximal blood lactate concentration were recorded on the cycle ergometer during incremental exercise till exhaustion.

After 33 days high altitude expedition decreases of body weight (8±2%), knee extensors force (10-11%), CSA of m. quadriceps femoris ((5±1%), VO2max (4±2%) and Wmax (4±2%) were demonstrated for all subjects. On the other hand the values of AeT and AnT did not change. When related to body weight force, CSA, VO2max and Wmax did not change and AeT and AnT had a tendency for an increase. The strong positive correlation between decreases of Wmax and of body weight was revealed ($r=0.89$; $p<0.05$).

Thus relative indices of working capacity tightly related to the work against gravity did not change after long-lasting high altitude expedition. The decrease of maximal aerobic capacity recorded under these conditions most probably was associated with a decrease of muscle mass, but not with a decrease of AeT and AnT.

1. Schantz P et al. Adaptation of human skeletal muscle to endurance training of long duration. Clin Physiol. 1983; 3 (2).

2. Helge JW et al. Skiing across the Greenland icecap: divergent effects on limb muscle adaptations and substrate oxidation. J Exp Biol. 2003; 206 (Pt 6).

3. Hoppeler H et al. Muscle tissue adaptations to hypoxia. J Exp Biol. 2001; 204(Pt 18).

A SINGLE LACTATE ASSESSMENT DOES NOT PREDICT ANAEROBIC THRESHOLD IN RUNNING

Romagnoli, M. 1+2, Yeste, A. 1, García Herreros, S. 1, Gómez-Cabrera, M.C. 3, Beorlegui, A.B. 1, Arduini, A. 2

1 Univers Polytechnics, 2 University of Valencia Dept Physiology, 3 Catholic University of Valencia, Spain

Introduction

Lactate anaerobic threshold (AT-lac) is a valuable parameter to determine the working load for a training programme and useful for the assessment of changes (either increases or decreases) in aerobic fitness. It is usually referred to as an intensity at which the human metabolism is able to keep equilibrium between lactate production and its removal. Sirtori et al. (1) proposed a method by a single lactate measurement (Mognoni-test) that predicts the AT-lac at 4mM (OBLA), with a r^2 of 91%. Later literature affirmed the uneven physiological response and time to exhaustion in different subjects at the intensity corresponding to OBLA.

Aim

To evaluate the relation between a single lactate determination and the AT-lac calculated (on an individual base) as the exponential increase of blood lactate relative to workload increase.

Material and methods

24 healthy subjects (30.4±7.2 yrs, 71.3±8.6 kg; BMI: 23.1±2.5 kg∙m^-2) underwent a running incremental exercise with a 3 min-step duration and at least one constant-load exercise of 6 min at a fixed velocity of 13.5 km∙h-1. Arterialized blood lactate concentration was used to calculate AT-lac with the method of Hagberg JM (2) with minor modifications (3). Test-retest was done with the Pearson's r and evaluating parameters of the equation. The same statistic was applied to evaluate the prediction of AT-lac by a single lactate determination and a $p<0.05$ was accepted as significant.

Results

The concentration of blood lactate at the AT-lac after the incremental exercise test was 3.0 ± 0.5 mM, and the corresponding velocity was 13.8 ± 0.8 km∙h-1. The lactate concentration after the 6 min constant pace exercise was 3.0 ± 1.4 mM. In the subgroup of 12 subjects who underwent the re/test procedure the lactate in the first trial was 3.4±1.7 and 3.3±1.8 mM in the second trial. The coefficient of correlation between the lactate measured in the two trials was r = 0.986 ($p<0.001$). The slope and the intercept of the regression were 1.06 and 0.32, respectively, both parameters non-statistically different from 1 and 0, respectively. Regression of lactate concentration at the end of the 6-min test to the velocity (km∙h-1) at AT-lac revealed association between the two parameters (r = 0.75), with a mean SE of 0.67 km∙h-1.

Discussion

A single assessment of lactate concentration after a constant load test is not enough to precisely determine the velocity corresponding to the AT-lac. By the way, lactate concentration was highly reproducible after a 6-min constant load running, independently of the relative intensity at the set velocity. So, conversely to heart rate measurement, the reliability of lactate concentration after a trial of such duration could benefit the design of new methods of AT-lac determination.

References

Sirtori MD et al. (1993): Med Sport 46:281-286.

Hagberg JM, Coyle EF (1986): Med Sci Sports Exerc, 15(4):287-289.

Londeree BR, Ames SA (1976): Med Sci Sports, 8(2):123-5.

ECCENTRIC MUSCLE CONTRACTIONS INCREASE NEURONAL NITRIC OXIDE SYNTHASE MRNA EXPRESSION IN SKELETAL MUSCLE

Kon, M., Tanabe, K., Lee, H., Kimura, F., Akimoto, T., Kono, I.

University of Tsukuba, Japan

BACKGROUND: Nitric oxide (NO) is produced from L-arginine by the action of NO synthase (NOS) in skeletal muscle and plays an important role in activating of satellite cells. However, the effect of resistance exercise on the expression of NOS isoform gene in skeletal muscle remains unknown. Moreover, it is unclear that how contraction type muscle affects the expression of NOS isoform gene. The purpose of this study was to examine whether NOS isoform (nNOS and eNOS) mRNA expression in skeletal muscle changes after resistance exercise, and whether those expression is different depending on type of muscle contraction, such as eccentric and concentric muscle contraction.

METHODS: Eight-week male ICR mice (n=63) were divided into three groups: eccentric muscle contraction group (ECC, n=33), concentric muscle contraction group (CON, n=24), and control group (PRE, n=6). The muscle contraction was applied involuntary model, contraction of the tibialis anterior (TA) muscle was induced by electrical stimulation (frequency 100 Hz, duration 5 ms at 3V) of the peroneal nerve. Animals performed total 150 contractions grouped into 5 sets of 30 contractions. The TA muscle was isolated PRE and at 1, 6, 12, 24, 72, and 168 hours after muscle contractions. NOS isoform (nNOS and eNOS) and MyoD (index of satellite cell activation) mRNA expression were measured. Semiquantitative RT-PCR analysis was performed to measure each mRNA expression. The amounts of mRNA in each sample were normalized to that of GAPDH mRNA.

RESULTS: There was a significant difference between ECC and CON in the change of nNOS mRNA ($P<0.05$). In ECC, nNOS mRNA significantly increased at 12 h ($p<0.05$), returned to PRE levels at 24 h after exercise. On the other hand, nNOS mRNA did not change in CON. There was no significant difference between ECC and CON in the change of eNOS mRNA. Moreover, eNOS mRNA did not change after muscle contraction compared to PRE. There was a significant difference between ECC and CON in the change of MyoD mRNA ($p<0.05$). MyoD mRNA significantly increased at 12 h in ECC ($p<0.05$), returned to PRE levels at 24 h after exercise. In contrast, there were no significant changes in MyoD mRNA in CON.

CONCLUSIONS: These data suggest that eccentric muscle contractions increase the expression of nNOS mRNA and MyoD mRNA in skeletal muscle, concentric muscle contractions does not increase in the expression of those mRNA. However, the eNOS mRNA expression did not significantly change after both muscle contractions. From the above-mentioned, eccentric muscle contractions may increase nNOS expression. Therefore, there is also a possibility that nNOS-derived NO is associated with activation of satellite cell after eccentric muscle contraction.

CHANGES IN LUNG FUNCTION VALUES AFTER SHORT-TERM POWER OUTPUT IN ELITE JUDO PLAYERS

Radovanovic, D. 1, Bratic, M. 1, Vukovic, J. 2

1 Faculty of Physical Education Nis, 2 Public Health Center Sabac, Serbia and Montenegro

Judo is characterized as an explosive power sport, requiring tremendous reserves of anaerobic power and capacity operating within well developed aerobic system. The objective of this study was to examine the relations between the power expressed during short-term power output and the changes in lung function values (forced vital capacity-FVC, forced expiratory volume in 1 second- FEV1.0, and peak expiratory flow-PEF) in elite judo players (National, Balkan and Mediterranean Championship medalists). Eleven subjects (age 21.0yrs±2.41, height 176.63cm±7.43, weight 75.55kg±8.91, fat mass percentage 8.25±4.38, peak O2 uptake 54.99ml.kg-1.min-1±4.11), without history and clinically diagnosed exercise-induces bronchoconstriction, were subjected to the 30-s all-out test on a cycle ergometer for the recording of peak power (PP 11.95W.kg-1±0.79) and mean power (MP 8.18W.kg-1±0.48). Subjects were required to perform FVC maneuvers on computerized spirometer according to American Thoracic Standardization on Spirometry. The first measurement was done before the warm up procedure for the 30-s all-out test (FVC 6.52L±0.74, FEV1.0 5.1L±0.52, PEF 10.4L.s-1±0.96). The second measurement was done after the test, immediately after the heart rate frequency decreased bellow 120 beats.min-1 (FVC 4.85L±0.69, FEV1.0 4.02L±0.61, PEF 8.55L.s-1±1.01), the third measurement was done 1 min after the completion of the second, (FVC 5.54L±0.69, FEV1.0 4.48L±0.5, PEF 9.44L.s-1±0.87), and the fourth 2 min after completing the second measurement (FVC 6.09L±0.71, FEV1.0 4.84L±0.51, PEF 10.02L.s-1±0.9). The data were assessed for normality using the Shapiro-Wilk's test, and Levene's test was used to test the homogeneity of variance. A one-way ANOVA and Post Hoc (Tukey HSD) were used to analyze the data. Mean values of the lung function parameters were rapidly lowered right after the test, and afterwards their values gradually increased. There is a statistically significant difference in the mean values of FVC, FEV1 and PEF determined in different time periods in relation to the test (ANOVA – $p<0.001$). The correlation between FVC, FEV1 and PEF determined before the subjects underwent the all-out, and the same lung function parameters determined after the test was checked over using Pearson's coefficient of linear correlation and showed the following: a. the correlation is positive (the subjects with higher values of parameters before the test, exhibited higher values after the test as well) and statistically significant, b. the correlation strength between FVC and FEV1 (determined by the coefficient) was observed to be the lowest right after the test to increase over time during which there came to the recovery of lung function, c. the strongest correlation was observed between PEF before and after the test (r=0.935).

DELTA DESATURASE BLOCKADE AFTER CAFFEINE INGESTION

Olcina, G., Maynar, M., Caballero, M.J., Muñoz, D., Timón, R., Maynar, J.I.

Sport Science Faculty. University of Extremadura, Spain

Introduction: caffeine is a trimethylxantine with a great influence on fat metabolism. Many researches show that this alkaloid can enhance free fatty acid (FFA) mobilization from body fat tissues to mitochondria during physical activity. Does caffeine act equal over all FFA? or some FFA could be more affected by caffeine ingestion?.

Objectives: the aim of this study is to analyze the effect of caffeine ingestion on several FFA during exercise.

Material and Methods: A double blind randomized design with 5 mg/bw of caffeine (CAF) or placebo (PLA) was performed. Twenty non trained males were cycling until exhaustion on a cycle ergometer. Load started with 100 w and it was increased for 50 w every 2 minutes. Ergospirometric response was measured with a Medical Graphics gas analyzer. Before and after exercise vein blood was collected with the purpose of studying changes in plasma FFA composition (saturated C12:0, C14:0, C16:0, C18:0, C20:0; monounsaturated: C16:1, C18:1, C24:1; polyunsaturated: C18:2.6, C18:3.6, C18:3.3, C20:3, C20:4, C20:5.3, C20:5.4, C22:6) and desaturases enzymes activity (Delta 9.1: C 16:1 / C 16:0; Delta 9.2:C18:1 / C18:0 and Delta 5:C20:4 / C20:3) using gas chromatography. Statistical analysis was carried out using a statistical package for social sciences (SPSS 11.0 for windows). ANOVA for repeated measures was used to determine the significance of the differences, considering $P<0.05$ statistically significant.

Results: caffeine ingestion increase total time of exercise (PLA: 11'35" ± 1'45 vs. CAF: 12'08" ± 1'59) $p<0.05$, VO2 max in ml kg/ min (PLA: 38.47 ± 4.99 vs. CAF: 41.59 ± 6.50) $p<0.05$ and decrease maximum RER values (PLA: 1.46 ± 0.14 vs. CAF: 1.40 ± 0.13) $p<0.05$. In caffeine trials, percent of saturated fatty acids were increased after exercise (from 29.35 ± 5.79 to 33.83 ± 8.27) $p<0.05$, while monounsaturated fatty acids were decreased (from 25.62 ±5.70 to 23.69 ± 4.69). Polyunsaturated fatty acids didn't change significantly in caffeine trials as well as FFA in placebo test. Desaturases enzymes activity only changed in delta 9.2 after caffeine trials (from 2.75 ± 0.94 to 1.84 ± 0.36) $p<0.05$

Discussion: caffeine ingestion may enhance performance in ergometric incremental test until exhaustion in non trained men. A possible involved mechanism in addition to other should be FFA mobilization, concretely by blocking delta 9.2 activity, in this way stearic acid (C18:0) won't be converted into oleic acid (C18:1) and it could be use such as source of energy for exercise.

References:

1. Graham, T. E. (2001). Caffeine and exercise: metabolism, endurance and performance. Sports Med 31, 785-807.

2. Chesley, A., Howlett, R. A., Heigenhauser, G. J., Hultman, E. & Spriet, L. L. (1998). Regulation of muscle glycogenolytic flux during intense aerobic exercise after caffeine ingestion. Am J Physiol 275, R596-603

3. Mandel, H. G. (2002). Update on caffeine consumption, disposition and action. Food Chem Toxicol 40, 1231-1234.

OXYGEN UPTAKE DURING SOCCER: A CASE STUDY

Gatterer, H.

University of Innsbruck, Austria

INTRODUCTION: So far no study has provided accurate and valid data of measured oxygen uptake (VO2) during soccer. The physiological demands have been determined mainly by monitoring heart rate (HR). Establishing the relationship between HR and VO2 in the laboratory subsequently allows calculating VO2 in a game. However, the validity of the HR-VO2 relationship in intermittent exercise may be questionable. Water loss, psychological stress etc. may influence HR by unaffected VO2.

According to Stolen et al., new gas analysers (~500g) should allow accurate measurement of VO2, but at present no such study has been performed (4). Therefore the aim of this study was to measure VO2 with a portable gas analyser during real match play.

METHOD: Two healthy amateur soccer players (24 and 25 years, 179 and 178 cm, 77 and 69 kg) participated in this study. During a friendly soccer match, VO2 of each of the two subjects was measured with a portable gas analyser (Cosmed K4, 800g) for one half. HR

(Polar) was continuously monitored over the whole time. VO2max was determined by an exhausting 600m-run performed directly after the halves.

RESULTS: Subjects obtained a VO2max of 65.8 and 56.2 ml/(min*kg). The average VO2's during match play were 37.4±6.8 and 34.3±6.4 ml/(min*kg), corresponding to 56.8 and 61.0% of VO2max. Average HR's were 167±9 and 176±11 b/min in the first half and 164±10 and 179±11 b/min in the second. Over the whole time average HR's were 166±9 and 177±11 b/min, corresponding to 87.4% and 87.7% of HRmax.

DISCUSSION: Monitoring HR showed that the gas analyser did not interfere or inhibit performance, because the HR values of each subject did not differ in the first and second halves. Data also show that the intensity of the play, given by % HRmax, was the same as reported by other studies (ca.87%Hfmax vs. 81.7-85.6%Hfmax)(3). Considering this the measured data of VO2 [37.4±6.8 and 34.3±6.4 ml/(min*kg)] should correctly reflect the true VO2 during match play.

It should be pointed out that the average relative intensity, given by % VO2max, with values of 56.8 and 61.0% is not high and differs from data reported in the literature (70-75% VO2max)(1). However data from literature were only estimates of VO2 from the HR. Thus it seems that HR is not a good predictor of VO2 in intermittent exercise such as soccer, as also other authors supposed (2).

It should be kept in mind that in this study data were only available for two players and that further work has to be carried out.

1. Bangsbo J (1994). Energy demands in competitive soccer. Journal of Sports Science 12:5-12

2. Crisafulli et al. (2006). Poor reliability of heart rate monitoring to assess oxygen uptake during field training. Int J Sports Med 27:55-59

3. Helgerud et al. (2001). Aerobic endurance training improves soccer performance. Med Sci Sports Exerc 33(11):1925-1931

4. Stolen et al. (2005). Physiology of soccer: an update. Sports Med 35(6):501-536.

RELATIONSHIP BETWEEN MUSCLE OXYGENATION OF AN EXERCISING FOREARM AND INACTIVE LEG DURING AND AFTER STATIC HANDGRIP CONTRACTION

Ogata, H., Nakazawa, K., Akai, M.

Research Institute of National Rehabilitation Center for Persons with Disabilities, Japan

The purpose of this study was to determine whether a decrease in oxygen supply to inactive leg muscle is caused by an oxygen inadequacy in exercising forearm muscle during and after static handgrip exercise.

Eight healthy male subjects with a mean age of 26 ± 3 years, a mean weight of 68 ± 10 kg, and a mean height of 1.77 ± 0.06 m participated in this study. The subjects performed 2-min static handgrip exercise at intensities of 5, 25 and 45% of maximal voluntary contraction (SHG5, SHG25 and SHG45, respectively). Oxygen saturation (SmO2), determined by near-infrared spatially resolved spectroscopy (NIRO 300, Hamamatsu Photonics, Hamamatsu, Japan), was used to estimate the occurrence of oxygen inadequacy in exercising forearm muscle. SmO2 reflects a dynamic balance between oxygen supply and consumption. Thus, SmO2 was also used as an index of oxygen supply to inactive muscle, because oxygen consumption in an inactive leg muscle is almost constant. We measured SmO2 in the flexor digitorum superficialis muscle as a representative exercising forearm muscle and in the tibialis anterior muscle as a representative inactive muscle of the lower limb. SmO2 was measured continuously during rest, exercise and recovery periods.

In regard to change during exercise, SmO2 in the inactive leg (SmO2inact) decreased significantly from the pre-exercise value only during SHG45. The decrease in SmO2inact began about 60 sec after the onset of exercise. Thereafter, SmO2inact decreased gradually until the end of exercise. SmO2 in the exercising muscle (SmO2exerc), on the other hand, decreased significantly from the pre-exercise value during exercises at all intensities. The magnitude of decrease in SmO2exerc at the end of exercise tended to be larger with an increase in contraction force. The patterns of decrease in SmO2exerc during exercise were similar in the three trials. Briefly, SmO2exerc was close to the pre-exercise value for the initial 30 sec of exercise and then began to decrease. Thereafter, SmO2exerc decreased steeply until about 60 sec of exercise, and then the decrease became slower. In regard to change during recovery, SmO2inact after the end of SHG45 continued to decrease for about 30 sec. Thereafter, SmO2inact began to increase toward the pre-exercise level, but the value of SmO2inact was still significantly lower than the pre-exercise value at least until the 2nd min of recovery. SmO2exerc, on the other hand, began to increase rapidly after the end of exercise and then returned to the pre-exercise level within the 1st min of recovery in all of the three exercises.

We demonstrated that the decrease in SmO2inact after the end of SHG45 was not necessarily accompanied by the decrease in SmO2exerc. Thus, we concluded that the decrease in oxygen supply to the inactive leg muscle is dissociated from the oxygen inadequacy in the exercising forearm muscle during and after static arm exercise.

THE IMPACT OF HEART RATE UPON THE E/A QUOTIENT IN ATHLETIC AND NON ATHLETIC MALES

Kneffel, Z., Kispéter, Z., Horváth, P., Németh, H., Sidó, Z., Pavlik, G.

Department of Health Sciences and Sports Medicine, Faculty of Physical Education and Sports Science, Hungary

Purpose: To clarify whether an enhanced E/A of male athletes was independent of athletic bradycardia and thus an alteration in intrinsic relaxation properties of the left ventricle.

Methods: Echocardiograms were performed in 1238 males (940 athletic). Peak early (E) and atrial (late) blood flow velocities (A) were assessed by Doppler echocardiography at rest. Linear regression analysis determined the relationships between E/A and resting heart rate (HR), regression equations of athletes and non-athletes of different ages were compared.

Results: The E/A decreased with aging, decrease was less marked in the athletic subjects. Except the children, it was significantly higher in the athletes than in the non-athletes. Children (age<14 yr.): athletes 2.05 ± 0.45, non-athletes 2.03 ± 0.51, adolescent-young subjects (14-20): 2.13 ± 0.51 vs. 1.87 ± 0.46, young adults (21-30): 1.97 ± 0.44 vs. 1.80 ± 0.51, adults (31-44): 1.73 ± 0.42 vs. 1.38 ± 0.38, older males (age>44 yr.) 1.39 ± 0.42 vs. 1.11 ± 0.34. In the children, adolescent-young and young adult subjects E/A against HR equations of the athletic and non-athletic groups were similar, differences between the means were only due to the differences in the HR. In the 31-44 yr. old males, the athletes' regression curve showed a parallel upward shift. The oldest (>44 yr.) active subjects showed a significant regression while sedentary males did not.

Conclusions: Results indicate that a HR-independent beneficial effect of regular physical training on the diastolic function manifests itself only at an older age. The impact of resting HR should always be taken into consideration when assessing intergroup differences in the E/A ratio, especially when studying the effect of exercise training upon cardiac function.

METHODOLOGICAL APPROACH OF ARTERY DOPPLER BLOOD FLOW MEASUREMENT DURING DYNAMIC EXERCISE

Walther, G., Nottin, S., Perez-Martin, A., Dauzat, M., Obert, P.

Physiology Laboratory of Cardiovascular Adaptation to Exercise, UFR Sciences, University of Avignon, France

Purpose: Doppler ultrasound is a suitable method for non-invasive and continuous estimation of muscle blood flow during exercise. An appropriate methodology using this technology implies measuring simultaneously blood velocity and vessel diameter. Most of the literature studies have to date investigated lower limb vasculature (principally femoral artery) and used different methodological approaches. Few data are available on blood flow involving upper limb testing. Te present study addressed special methodological considerations by applying Doppler ultrasound to lower and upper limb vasculature. Accordingly, our aims were to assess the influence of exercise intensity on femoral and axillary artery diameter dilatation, 2) to determine whether volume blood flow (BF) measured during early recovery reflects accurately exercise BF, and 3) to evaluate the effect of artery calibre and/or site as well as exercise intensity on BF measurement reproducibility. Methods: Thirteen healthy subjects (25.9 ± 7.7 yr) performed a discontinuous (exercise : 150s, recovery : 30 s) incremental leg-extension (LE) and elbow-flexion (EF) exercise in supine position. At each step and maximal effort, arterial diameter and blood flow velocity were recorded simultaneously during the last 30 s of exercise and the first 30 s of recovery. Results: A significant increase in femoral and axillary artery diameter was noticed from workload #2 to peak (3.5% and 6.5%, respectively) exercise. Blood flow velocity during the recovery period was significantly different from end-exercise values, depending on time and workload. The coefficient of variation of BF measurement during exercise was 7.1 to 12.1% and 6.4 to 9.5% in LE and EF, respectively. Conclusion. The present study shows that BF measurement with Doppler ultrasound during exercise is reproducible but requires measuring arterial diameter at each workload. Measurements performed immediately after exercise cannot be used as a surrogate for exercise blood flow velocity.

PHYSIOLOGICAL EQUIVALENCE OF HORIZONTAL VS. UPHILL RUNNING: FINDINGS FROM JUNIOR AND ADULT WORLD CLASS ORIENTEERS

Zürcher, S., Tschopp, M., Clénin, C., Marti, B.

Swiss Federal Institute of Sport, Magglingen, Switzerland

When sport activities are taken outdoors, natural obstacles such as hill climbing becomes an issue. Yet, the question persists, to what extent does a horizontal detour to avoid climb still present the same effort in terms of physiological exertion or perceived fatigue? The additional horizontal distance required to achieve equivalent uphill work can be calculated by multiplying incline, uphill speed and an equivalence factor (EF). The literature has published a range of EF from 1.8, which from practical experience is too little, to the frequently used standard of 10, which in our opinion is inflated (1). Research question: To which additional horizontal distance does uphill running correspond to in endurance athletes with balanced abilities in both horizontal and uphill running? METHODS: Elite orienteers (18 Men, 14 Women, 21.8yrs+/-4.1) from the Swiss National team took part in this study. Two treadmill stage tests, with 3-4 hours rest between, were completed. The first a horizontal lactate threshold test and the second an uphill running test at a 22% incline. In pilot testing, a "physiological equivalence" of horizontal to uphill running was approximated using a EF 6.5; this thereafter determined the speed for each stage in the uphill running test. The initial speed in the horizontal test and uphill test were typically 9.0km/h and 10.8km/h, with a 1.8km/h increase and 3.6km/h and 4.3km/h with a 0.7km/h increase per 3 minute stage for women and men, respectively. Both tests were run to voluntary exhaustion. In data analysis, uphill speed was compared to horizontal speed at test termination (maximal speed, (MS)), at 90% of maximal heart rate (subHR), at 90% of maximal lactate (subLa), and at a rating of perceived exertion of 17 (RPE17). Different EF's based on MS, subHR, subLa, or RPE17, and an EFAll (mean of the four criteria) were calculated. RESULTS: The different EF's based only on one single criterion varied slightly. EFMS was 6.2+/-0.54, (range 5.4-7.6); EFsubHR 7.0+/-0.88 (5.8-8.6); EFsubLa 6.3+/-0.76 (5.4-8.0); EFRPE17 6.7+/-0.76 (5.6-8.8). The aggregate EFAll was 6.5+/-0.62, with a 95% confidence interval of 6.32-6.76. CONCLUSION: Within this sample of well trained male and female elite orienteers, we found a surprisingly consistent EF of about 6.5 at an incline of 22%, regardless of whether it was calculated from maximal speed or additional sub-maximal parameters. Individual variation in EF was broader, with values between 5.5 and 8.5, the former suggesting above average ability and the latter below average ability in uphill running for orienteers. This information provided individual feedback for the coach and athletes. The validity of the presently found EF of 6.5 should be checked with additional runners, specifically trained for horizontal or uphill running under conditions without preliminary maximal running test in the same day.

(1)Zürcher S, Clénin G, Marti, B. Upill running capacity in Swiss elite orienteers. SciJO; 17 (1), 2005.

PHARMOKINETICS OF CAFFEINE FOLLOWING INGESTION IN CAPSULAR OR LIQUID FORMAT IN HEALTHY MALES

Beades, M., Donne, B., Warmington, S., Mahony, N.

Trinity College Dublin, Ireland

Sport drinks containing caffeine are increasingly used by athletes. However, scientific evidence regarding the ergogenic potential of caffeine, and particularly its role in influencing fat metabolism is highly variable (Graham and Spriet 1995, Armstrong 2002). Some of these differences in performance may be explained by differences in the absorption and/or metabolism of caffeine when ingested in either liquid or capsule format.Therefore, the aim of this study was to compare the effects of caffeine ingestion in capsule and liquid format on the serum concentration of non-esterified fatty acids (NEFA's) and the pharmokinetics of caffeine, at rest.

Following ethics approval, 9 healthy male non-habitual caffeine users underwent a medical examination and ECG screening prior to participation in the study (age 23±4yr, mass 84±12kg and height 1.80±6.4m). Each subject completed three different, randomised ingestion trials consuming either a placebo (PL: 300mg lactose capsule), caffeine (CAFF: water plus caffeine capsule), or Red Bull (isoRB: diluted 60:40 with water). Fluid volume ingested determined by body mass was the same in all trials. The caffeine dose was 3mg.kg-1 for isoRB and CAFF. Ingestion was completed over a 20 min period, and venous blood samples were collected both pre- and post-ingestion, and every 30 min for 2 hr following ingestion. A two-way repeated measures ANOVA with post-hoc Bonferroni tests were used to infer differences across treatments. $P<0.05$ was considered statistically significant.

No changes in serum glucose (mmol.L-1) were observed across time during PL and CAFF trials. IsoRB data were significantly lower at 90 (3.81±0.18) and 120 min (4.01±0.16) when compared to data immediately post-ingestion (5.36±0.37). In CAFF serum NEFA's increased steadily following ingestion, and were significantly higher at 90 and 120 min when compared to both pre-and post-ingestion. In contrast, in isoRB, NEFA's decreased compared to pre- ingestion, absolute changes relative to pre-ingestion were significantly different from CAFF ($P<0.01$) at 30, 60 and 90 min. A significant time effect was observed for serum caffeine concentration following ingestion ($P<0.05$). However, there was no significant treatment effect observed in serum caffeine concentration comparing isoRB and CAFF at any time point.

The decrease in serum NEFA's relative to pre-ingestion in isoRB possibly resulted from the carbohydrate contained in Red Bull inducing an increase in insulin and subsequent inhibition of lipolysis. However, the main findings of this study show that the serum pharmokinetics of caffeine are similar in response to caffeine ingestion from either a liquid or a capsule.

References

Graham T, Spriet L (1995) J Appl Physiol. 78: 867-74

Armstrong L (2002) Int J Sports Nutr Ex Met. 12 189-206

CYCLING POWER, PERFORMANCE AND PACING STRATEGIES AT SIMULATED 200, 1200, 2200, AND 3200 M

Clark, S., Bourdon, P., Aughey, R., Singh, B., Schmidt, W., Woolford, S., Onus, K., Cable, G., Gore, C.

Australian Institute of Sport, Australia

It is well established that altitude results in a decrease in VO2max (1) but the acute effect of altitude on performance in well-trained athletes has not been well documented. Wehrlin et al. (2) reported a decrease in run time to exhaustion of 14.5% per 1,000 m of altitude between 300 and 2,800 m. However, in most competitions athletes do not perform at a fixed workload until exhaustion. Instead, they usually produce the greatest power possible for a given distance or time, and this can be influenced by the athlete's pacing strategy. Therefore the aim of this study was to determine the performance decrement in an all-out 5 min cycling time trial (5TT) at 1200, 2200, and 3200 m simulated altitude compared with 200m. In addition, the pacing strategies adopted during the four trials for each individual were investigated. Ten well-trained male cyclists/triathletes (Mean±SD Age= 28.4±4.6 yr; Body mass= 73.0±8.6 kg; VO2max = 71.6 ±5.2 ml.kg-1.min-1) were recruited. Testing was performed in a hypobaric chamber at the Royal Australian Air Force (RAAF). Subjects completed a trial under each altitude condition in a random counterbalanced order. All trials were double blinded with only the RAAF personnel operating the chamber aware of the altitude. All subjects performed two habituation 5TT in the weeks prior to the study; the typical error for the mean power during these two trials was 3.5% (90% CI = 2.6-5.8%). All trials were conducted on one dynamically-calibrated, wind-braked cycle ergometer. After a standardised 25 min warm-up subjects performed an all-out 5TT, and during this time power, VO2, and HR were measured. Average power (W) during the 5TT was 367±42, 346±41, 329± 38, and 294± 37 and average VO2 (L.min-1) was 5.23± 0.64, 4.80± 0.58, 4.49± 0.45, and 4.03± 0.39 at 200, 1200, 2200, and 3200 m simulated altitude, respectively and the values at each altitude were significantly lower than at 200m. There was no difference in maximum HR during the 5TT at each of the simulated altitudes. Despite the mean power being lower at simulated altitude there was no difference in the pacing strategies adopted during each of the four trials. Interestingly, the decrease in mean power was apparent during the first 30 seconds of the 5TT at 3,200m without a reduction in VO2 at this time, which suggests a role of teleo-anticipation (3). However, the peripheral feedback from the warm-up in hypoxia may also have been a factor. In conclusion, acute exposure to low-moderate simulated altitude substantially reduced maximal cycling power, but despite the novelty of the altitude exposure, the pacing strategies were relatively consistent. How athletes determine the appropriate power to produce during the first 10% of a maximal 5-min effort at altitude requires further research.

1. Fulco CS et al. Eu. J Appl Physiol 57, 761-6, 1988.

2. Wehrlin JP et al. Eur J. Appl Physiol , 96, 404-12, 2006.

3. Noakes TD et al. J Exp Biol 204, 3225-34, 2001.

MOTOR CORTICAL ACTIVITY DURING BILATERAL AND UNILATERAL REACTION TIME AND FORCE TASKS

Taniguchi, Y.

International Budo University, Japan

Introduction

When simultaneous bilateral movements are introduced in reaction time (RT) task or in strength exertion task, performances are reduced compared to that during single movement conditions. These phenomena, known as "bilateral deficit", have been studied separately in RT or force task. In many sports, however, quickness and strength are required simultaneously. In RT task, Taniguchi et al. (2001) reported that electroencephalograph (EEG) correlate of the bilateral deficit was not found during the preparatory period but during the execution period. Motor cortical activity in the simultaneous RT and strength task has not yet been clarified. This study determined, whether there was a bilateral deficit in RT and/or force, and whether there was a related bilateral deficit in EEG during the simultaneous RT and strength task.

Methods

Seven right-handed subjects, aged 18-34 years, performed simple RT tasks with isometric abduction of the index finger under three conditions; with the right hand, left hand, and both hands. Each response condition consisted of 2 blocks of 20 trials. The order of the blocks was randomized. EEG activity was recorded on 21 locations using the 10 - 20 system. During the preparatory period, EEG was averaged, time-locked to the preparatory signal, under the three task conditions. Electromyographs (EMGs) were recorded with surface electrodes on the right and left first dorsal interosseous muscles. EMG-RTs were measured from the response signal to the onset of EMG. Isometric abduction forces were recorded by force transducers.

Results and Discussion

A two-factor analysis of variance, with two tasks (unilateral and bilateral) x two sides (right and left) demonstrated that significant bilateral deficits in EMG-RTs were found in four of seven subjects. Regarding force, a significant bilateral deficit was observed in one subject, but significant bilateral facilitations were found on two other subjects. Amang the remaining four subjects, a significant bilateral deficit was observed on three right hands and significant bilateral facilitations were found on three left hands. During the simultaneous RT and strength task, it was concluded that bilateral deficit in RT was observed as shown in previous studies, but there was not consistent force. The amplitude of contingent negative variation (CNV) on motor cortical area (C3 and C4) just before the response signal, as an index of motor preparation, tended to show bilateral deficit but did not reach significance. More studies are needed to clarify whether motor cortical activity during the preparatory period causes the bilateral deficit in EMG-RT.

References

Taniguchi et al. (2001). Deficit in motor cortical activity for simultaneous bimanual responses. Exp Brain Res 137: 259-268.

This research was supported by the Grant-in-Aid for Scientific Research (C) from the Japan Society for the Promotion of Science (JSPS).

PHYSIOLOGICAL REACTIONS IN LISTENING TO THE MUSIC THROUGH THE RESPONSE OF THE AUTONOMIC NERVOUS SYSTEM

Naotaka, I.

Nagoya University of Arts, Japan

It is reported that the musical influence on the living body is admitted in the physiology under not only the psychological influence but also a certain situation. There is the possibility that listening to the music before or in the course of playing sports has an effect on the improvement of the game performance. However, the effect has not been clarified yet. This study is an examination about the response of autonomic nervous system as the clue of the influence of the music on the living body.

Using four kinds of music tones, awakening, sedative, bright and dark, the study examined a physiological change of the body when switching was instantaneously done.

Heart rate variability was used for the index of the change of the autonomic nervous system.

After measuring the R-R interval on an electrocardiogram and specifically performing FFT, two components, LF component and HF component, were extracted.

The precedent studies about that these components were reflecting activities of the sympathetic nervous system or the parasympathetic nervous system.

I examined the change in the activity of the autonomic nervous system by examining this transition of the above two components.

From the experiment, I find the tendency as follows； when listening to the awakening and bright music tone, the value of the HF component, the index of which showed the relaxation fell from 0.9 to 0.6, measured as relative value with rest. When listening to the bright and sedative music tone, the value of the HF component rise from 0.75 to 1.1, measured as relative value with rest. As a result, it was suggested that the activity of the sympathetic nervous system is controlled when listening to the awakening and bright music tone, and conversely, the activity of the sympathetic nervous system is activated when listening to the bright and sedative music tone, which suggests that the situation of the sympathetic nervous system become dominant.

HOW TO ESTIMATE THE RECOVERY FROM AN INCREMENTAL EXERCISE TEST BY CHECKING STEADY-STATE CONDITION FROM BEAT-TO-BEAT TIME SERIES

Merati, G., Veicsteinas, A., DiRienzo, M., Castiglioni, P.

University of Milan and Don C. Gnocchi Foundation, Milan, Italy, Italy

Heart rate (HR) and systolic blood pressure (SBP) recovery after an exercise test are currently accepted as predictors of mortality [Cole et al.] and considered of high prognostic value in patients at cardiovascular risk [Nishime et al.]. HR recovery is usually measured as the HR level reached after 1-1,5 minutes after exercise stop. In such conditions, HR is often a transient value, thus being scarcely informative about the process underlying cardiovascular recovery. Aim of this work was to assess whether recovery can be measured as the time needed by the cardiovascular variables to reach a steady state after the end of exercise, and whether this measure depends on the level of fitness, by applying a procedure for checking cardiovascular steady-state from blood pressure (BP) and HR values [Castiglioni et al]. Finger BP and ECG were continuously recorded in 5 healthy subjects (1 female, 4 males, 44 [14] (mean [SD]) yrs; 71 [13] kg) on a cycloergometer: 1) at rest (15 min); 2) cycling at progressive loads (25W/min) from 0 W to the maximal volitional load; and 3) during recovery. Beat-to-beat values of SBP, diastolic blood pressure (DBP) and R-R intervals (RRI) were derived from each recording to calculate a "steadiness profile". The algorithm was based on the "run-test", applied to SBP, DBP and RRI series to get a global index of steadiness, the total number of runs. Briefly, we split each series into consecutive non-overlapping windows of length T=20 s, and computed the mean in each window. A running segment of N=14 means was then considered. In the running segment, we computed the median of the N means; we associated the symbol "+" when the mean was greater than the local median and the symbol "-" otherwise. Finally, we calculated the number of runs as the number of sequences of consecutive "+" or "-" symbols in the running string of N symbols, separately for SBP, DBP and RRI. The global index of steadiness was obtained by summing the number of runs for SBP, DBP and RRI. The steady-state hypothesis was rejected when this global index was lower than a given threshold, derived from reference steady-state data. During exercise the level of steadiness decreased progressively with the workload, remaining however higher in the best trained subjects. Steady state was lost at the maximum workload (WLmax) in all subjects. Recovery time, measured as the period to reach a new steady state after exercise, was inversely related to WLmax, ranging from 254s in the subject with the best level of fitness (WLmax = 275W) to 350s in the subject with the worse level of fitness (WLmax = 175W)($r=-0.65$, $p<0.05$).

Assessment of this index of steadiness during and after incremental exercise tests may therefore provide an objective measure of the recovery time and give information on the cardiovascular fitness of the subjects.

Cole CR, Blackstone EH, et al.. N Engl J Med 1999

Nishime EO, Cole CR, et al. JAMA 2000

Castiglioni P, Di Rienzo M. Physiol Meas 2004

THERAPEUTIC AND PREVENTIVE EXERCISE REDUCES BLOOD PRESSURE IN LDLR -/- MICE

Cardinot, T., Moretti, A., Koike, M., Souza, H.

State University of São Paulo, Brazil

Objective: To evaluate the effect of therapeutic and preventive exercise on resting blood pressure (BP) and weight (W) in LDL receptor deficiency mice (LDLr -/-) submitted to fat and cholesterol diet.

Methods: We studied 96 LDLr-/- male mice with 16 weeks of life they were randomly separated in 8 groups of 12 mice to start fat and cholesterol diet and/or exercise (see table below). Diet was added to 10% fat and 1.25% cholesterol. The exercised groups were submitted to 60 minutes of moderate intensity aerobic exercise (50% of VO2) in a treadmill, five days a week, for 14 weeks. The therapeutic groups started exercise protocol after 14 weeks of diet intake and preventive groups started diet and exercise simultaneously. Therapeutic groups were studied for 28 weeks and preventive groups for 14 weeks. At the end of the study therapeutic groups have 44 weeks of life and preventive groups 30 weeks of life. Weight was registered weekly and BP was verified at the beginning and at the end of the study.

TF: Therapeutic exercise and Fat and cholesterol diet group

TFC: TF's Sedentary Control group

TN:Therapeutic exercise and Normal diet group
TNC: TN's sedentary Control group
PF: Preventive exercise and Fat and cholesterol diet group
PFC: PF's sedentary Control group
PN: Preventive exercise and Normal diet group
PNC: PN's sedentary Control group
Results: Initial BP and W were not different among the groups. Final BP was significant different in TF, TN, PF and PN when compared with their respective sedentary control groups: TFC, TNC, PFC and PNC. Final W was significant different in PF and PN when compared with their respective sedentary control groups: PFC and PNC.

GROUP	WEIGHT	BP
TF	38,2 ± 4	90 ± 6
TFC	38,5 ± 3	102 ± 8
TN	28,5 ± 2	89 ± 4
TNC	29,0 ± 2	101 ± 8
PF	30,9 ± 5	95 ± 3
PFC	38,8 ± 7	112 ± 6
PN	28,4 ± 1	94 ± 8
PNC	30,2 ± 2	99 ± 6

Conclusion: Moderate intensity exercise reduced resting blood pressure independently of its therapeutic or preventive character and of the fat and cholesterol diet intake. However, only preventive exercise was able to reduce mice's weight.

EFFECTS OF CREATINE SUPPLEMENTATION ON PROLONGED INTERMITTENT EXERCISE IN THE HEAT

Ishizaki, S., Naito, H., Katamoto, S., Yasumatsu, M., Inagaki, M., Yoshimura, M., Aoki, J.,

Oyama National College of Technology, Japan

Creatine (Cr) supplementation has been demonstrated to increase concentration of Cr and phosphocreatine (PCr) in skeletal muscle (1), and to improve performance during high-intensity exercise (2). In addition, Cr supplementation has been consistently shown to increase total body water (TBW). Thus, it is expected that Cr supplementation could have beneficial effects on prolonged high-intensity exercise in a heat environment. We tested a hypothesis that Cr supplementation would enhance prolonged intermittent exercise performance in a hot environment.

Twelve male collegiate soccer players (age; 19.6 ± 0.9yr, height; 177.5 ± 6.0cm, body mass; 71.1 ± 7.3kg, VO2max; 62.9ml/kg/min.) volunteered to participate in this study. Subjects were randomly assigned to either a Cr supplementation group (CR; n=6) or a placebo supplementation group (PLA; n=6) using a double-blind design. The CR ingested four 5-g doses of Cr monohydrate (Kenko, Japan) per day for 5 days, whereas the PLA ingested the same dosage of lactose (Kenko, Japan). Before (pre-) and after (post-) the supplementation period, subjects underwent a prolonged intermittent exercise in a heat environment room (32.0 ± 0.2degrees, 58.5 ± 1.4%) for 45 minutes. This exercise consisted of forty-five 5-sec maximal pedaling (exercise load; 7.5% body weight kp) interspersed by 55-sec recovery (25-sec active recovery + 30-sec rest). Before the exercise, indices of body composition (%body fat, TBW, intracellular water; ICW, extracellular water; ECW) were estimated by a bioelectrical impedance analysis (InBody 3.2, Biospace, Japan). Mean power output, rectal temperature, heart rate, blood lactate concentration, rating of perceived exertion (RPE), and thirsty level were measured during exercise.

Body weight, %body fat, TBW, ICW, and ECW were not affected by Cr supplementation. And there were no differences in heart rate, blood lactate concentration, and RPE during exercise between pre- and post- supplementation periods. However, rectal temperature during the exercise in the CR group was significantly lowered (from 0.16 to 0.20degrees) at the set of 5, 10, 15, 20, 25, and thirsty level was lowered at the set of 25 in the post- supplementation. There was a significant increase of mean power output only in the CR group (pre; 741.5 ± 77.2watt VS post; 763.6 ± 78.8watt, $P<0.01$).

It was concluded that Cr supplementation could prevent the elevation of body temperature and improve mean power output during the prolonged intermittent exercise in the heat environment.

References

(1) Harris, R. C., et al., Elevation of creatine in resting and exercised muscle of normal subjects by creatine supplementation. Clin. Sci. 83, 367-374, 1992

(2) Casey, A., et al., Creatine ingestion favorably affects performance and muscle metabolism during maximal exercise in humans. Am. J. Physiol., 271, E31-E37, 1996

THE FREQUENCY CHARACTERISTICS OF RESPIRATORY RESPONSE DURING CONSTANT LOAD EXERCISE

Saito, H., Németh, H., Kimura, M., Watanabe, T., Kuboyama, I.

Kokushikan University, Japan

INTRODUCTION

Breathing has irregularities that produce breath-to-breath fluctuation in pulmonary gas exchange, but the mechanism of the fluctuation is not still clear now.

The purpose of present study was to analyze respiratory response during exercise through frequency analysis of respiratory response parameters.

METHODS

Two healthy female subjects used a bicycle ergometer, being instructed to keep cadence of the pedal around 60 rpm during exercise. The exercise protocol was seven-minute 2W pedaling and trapezoidal load which consisted of three-minute ascending ramp, 20-minute constant load and three-minute descending ramp. Intensities of the constant load were set at 2W, 22W, 42W, 62W, 82W, 102W, 122W, 142W and 0W (just sitting on the bicycle ergometer). Each load intensity exercise was repeated three times in different days. Sampled data of 15 minutes in constant load were adopted for subsequent analysis.

Expired gas was measured using respiratory gas analyzer (AE300S, Japan) with breath by breath method. Four analyzed respiratory response parameters were end tidal oxygen concentration (ETO2), end tidal carbon dioxide concentration (ETCO2), expiratory tidal volume (TVe), and respiratory rate (RR). Data sampling time was five seconds.

Power spectrum was obtained in each load through Kyplot 4.0 analysis software (Japan) using Continuous Wavelet Transformation with Gabor's Function.

RESULTS

Curves of power spectrum were much smoother and their power gradually declined as the frequency increased.

Power of RR in more than 62W load increased 10 times higher than one at rest in all frequency bands, and that of TVe was not changed from 0W to 42W load, but abruptly increased in more than 62W load in all frequency bands. Power of ETCO2 dropped in 22W and 42W, and recovered to 0W level in more than 62W load in all frequency bands, however, that of ETO2 increased in more than 82W load especially in middle frequency bands.

DISCUSSION and CONCLUSION

The frequency analysis showed that ETCO2 changed during mild exercise and ETO2 changed during hard exercise, which suggested exercise-induced respiratory response might contain frequency characteristics. Further study, however, would be required to clarify respiratory response during exercise in another method.

PROTECTOR EFFECT OF EXERCISE WEEKLY FREQUENCY ON BLOOD PRESSURE IN SPONTANEOUSLY HYPERTENSIVE RATS

Cardinot, T., Moniz-de-Aragão, A., Farintatti, P.

State University of Rio de Janeiro (UERJ), Brazil

Objective: To evaluate the effect of different exercise training weekly frequencies on resting blood pressure (BP) in spontaneously hypertensive rats (SHR).

Methods: Fifteen male rats had been studied in three groups of five rats: sedentary control (SG), trained with frequency of 3 days/week (G3) and 5 days/week (G5). The trained groups had been submitted to 60 minutes of low intensity aerobic exercise in a treadmill for 16 weeks. The trained groups started the adaptation exercise in the 5th week of life (WL). The following week they started the first week of exercise training (WT). BP and weight were verified weekly.

Results: The initial BP was not different among the groups: 117±3 mmHg (G5); 119±4 mmHg (G3); and 120±6 mmHg (SG) ($p>0.05$). G5 and G3 remained normotensive during all the studied period, but G5 BP was significant smaller since 13th WT. At the end of the study the difference between G5 and G3 was around 11 mmHg: 122±4 mmHg (G5) and 133±3 mmHg (G3) ($p<0.05$). The SG showed gradual increase of BP during all the studied period and its final BP was 184±10 mmHg. The BP difference between SG and trained groups was significant since 5th WT ($p<0.05$). No weight difference was observed among the groups during the studied period ($p>0.05$).

Conclusion: Low intensity exercise prevents hypertension in SHR with observed effects since 5th week of training independent of exercise weekly frequency, but the protector effect seems to be bigger in the 5 days/week training group.

EFFECTS OF BED REST AND POSTURE ON THE KINETICS OF O2 UPTAKE AND CARDIAC OUTPUT

Azabji-Kenfack, M. 1, Fagoni, N. 2, Tam, E. 1+3, Cautero, M. 3, Lador, F. 1, Moia, C. 1, Capelli, C. 3, Linnarsson, D. 4, Ferretti, G. 1+2

1 CMU, Genève, CH, 2 Uni Brescia, IT, 3 Uni Udine, IT, 4 Karolinska Institute, Stockholm, SE, Switzerland

The aim of this study was to evaluate the effects of prolonged bed rest on the kinetics of O2 uptake and cardiac output at the onset of square-wave exercise in upright and supine posture. To this aim, O2 uptake (V'O2) was determined breath-by-breath by Gronlund's algorithm and cardiac output (Q') was determined beat-by-beat by the Modelflow method on 18 male subjects (33.1 years ± 0.9; 71.1 kg ± 1.1; 1.75 m ± 0.01) at rest and during the rest-to-work transient of 50 W exercise in upright and supine posture, before (BB) and after (AB) 90 days of head-down tilt bed rest. In BB, the amplitude of the V'O2 change was lower supine (0.65+0.08 L/min) than upright (0.74+0.09 L/min) ($p<0.05$). In AB, the amplitude was the same supine (0,86±0,43 L/min) as upright (0,76±0,18 L/min). No effects of bed rest were observed. The time constant of the V'O2 increase was longer supine than upright, both in BB (52,49±10,77 s vs 28,42±6,19 s) and in AB (56,78±10,36 s vs 36,26±10,08 s). A significant effect of bed rest was found only in the upright posture. In BB, the amplitude of the Q' change supine (2,36±0,86 L/min) was not significantly different from upright (2,91±0,54 L/min). The same was the case in AB (3,72±1,55 L/min supine vs 2,92±0,59 L/min upright). A significant effect of bed rest was found supine. The time constant of the Q' increase was longer supine than upright, both in BB (24,95±15,10 s vs 4,12±2,32 s) and in AB (34,28±18,57 s vs 7,02±4,13 s). No significant effects of bed rest were found. The time constants of the Q' response were always faster than those of the V'O2 response. We conclude that the rapid Q' kinetics upright with respect to supine may be a consequence of reduced central blood volume in the former as compared to the latter posture. These results thus suggest a role for cardiopulmonary baroreceptors in determining the Q' response to exercise. The similar time constants before as after bed rest imply the regulation of circulation at exercise onset operates according to the same principles before as after bed rest, despite the development of cardiovascular deconditioning with bed rest.

RATE OF FORCE DEVELOPMENT: DIFFERENCE BETWEEN UPPER AND LOWER LIMBS IN HEALTHY OLDER WOMEN

Ditroilo, M., Fernández Peña, E., Benelli, P., Centonze, F., De Lillo, F., Giacomini, F., Grassi, E., Trisolino, G., Stocchi, V.

Istituto di Ricerca sull'Attività Motoria, Italy

In older people, the ability to exert a rapid increase in muscle force has important consequences with the successful performance of daily tasks like rising from a chair or climbing stairs, and may even reduce the incidence of falls related to the impaired control of postural balance with increasing age. The individual's ability to quickly generate muscle force is also known as the rate of force development (RFD). It was demonstrated that the lower limbs (LL) are more affected by strength loss than upper limbs (UL). Accordingly, the purpose of this study was to investigate whether the muscles of upper and lower extremities would show a difference in RFD. It was hypothesized that LL would have shown a reduced RFD compared to UL.

Twenty-five healthy women (age 68.4 ± 5.1 years; height 157.9 ± 7.4 cm; weight 63.5 ± 7.6 kg) volunteered and gave their written informed consent for participating in the study. Knee extension (keMVC) and hand grip (hgMVC) isometric maximal voluntary contraction were measured on both the right and the left limb with, respectively, a leg-extension machine (Panattasport, Apiro, Italy) and a hand

dynamometer (Lafayette Instrument Co., Lafayette, IN, USA) equipped with a strain gauge, sampling at 100 Hz and linked to a data collection unit (Muscle Lab Bosco System, Ergotest Technology a.s., Langesund, Norway). Subjects were instructed to push and squeeze as quickly and strongly as possible, trying to maintain the maximal force for about 3-4 seconds, while a vigorous verbal encouragement was given. A minimum of two maximal actions was recorded for each leg and hand, with at least 1 minute rest in between.

The keMVC and hgMVC were calculated by averaging the values of force registered during 600 ms which included the maximal peak force point. The slope of the first 0.25 s of the force time curve were considered for each subject to calculate the corresponding RFD.

The keMVC of the dominant side was significantly greater than hgMVC (302.8 ± 78.0 vs 260.0 ± 65.7 N). However no significant difference was found in RFD of LL and UL (slope 950.6 ± 323.9 and 939.6 ± 293.9 respectively). The force time curve showed that the subjects reached about the 50% of their MVC after 0.15 s, and about the 75% after 0.25 s, both in LL and in UL.

Opposing the hypothesis, it was found that the RFD is not significantly different in leg extensor and hand grip muscles of older women. However it should be stressed that i) the women participating in the study were physically active and involved in walks and housework; ii) the RFD data collected showed a large variance. Furthermore LL and UL RFD variables showed just a slight positive relationship unlike what would be expected.

Macaluso A, De Vito G (2004). Eur J Appl Physiol 91:450-72

Candow DG, Chilibeck PD (2005). J Gerontol A Biol Sci Med Sci. 60:148-56.

COMPARISON OF THE VASTUS LATERALIS NEUROMUSCULAR ACTIVITY IN CYCLISTS AND LONG-DISTANCE RUNNERS

Oliveira Marques, F., Tavares, P., Rosado, M.F., Ribeiro, G., Anjos, I., Fontes Ribeiro, C.A.

Faculty of Sport Sciences and Physical Education, University of Coimbra, Portugal

There is agreement between exercise physiologists that the aerobic performance evaluation of a long-distance runner must be due in a treadmill whereas for cyclists that evaluation must be due on a cycloergometer due to biomechanic and physiological considerations. However, the leg muscle responsible for running and cycling is the same, namely the Vastus lateralis muscle. Thus, the aim of this study was to assess in both athlete type the Vastus lateralis neuroactivity in a cycloergometer aerobic maximal test.

Three groups of male volunteers participated in this study: cyclist athletes (CA), endurance athletes (EA) and seven sex-matched sedentary controls (SC), all matched in age (SA:22.0±1.5; EA:23.8±2.3; SC:24.1±0.5 years old). All the subjects performed an aerobic maximal graded exercise test in a cycloergometer (Monark 824E) in order to determine the specific VO2max. This test consists in a constant pedal frequency (60 rpm) starting with 50 W workload and increasing 25 W every two minutes until fatigue. Oxygen and carbon dioxide measurements were made with a Metamax Ergospirometry System. Before the exercise test, basal values of heart rate were determined as well as during and 30 minutes after the tests, by using a heart rate monitor (Polar®). During the exercise test the surface electromyographic parameters (RMS-EMG and MPF-mean power frequency) were evaluated in the Vastus lateralis muscle of each subject. The EMG recording was made with a MegaWin® ME3000 device. In order to compare individual results, the RMS-EMG values were normalized by dividing the obtained values for the crural perimeters of each subject. Results were analysed according to power and time.

Oxygen maximal consumption was higher in cyclists when compared with the other group. The maximal heart rate achieved was similar in both athlete groups. Concerning the EMG analysis, we verified that in both groups the MPF remained constant during the test and, therefore, is power - independent. The RMS-EMG values were positively correlated with power but show no significant differences between cyclists and long distance runners. Thus, both endurance athlete groups showed the same neuronal activation of the Vastus lateralis muscle during this aerobic maximal test in a cycloergometer.

This work was supported by grants of PAFID programme (from the Portuguese Sport Institute
Partial) and FCT (Fundação para a Ciência e Tecnologia), Portugal.

CHANGES IN CORTICOMOTOR EXCITABILITY OF ANTAGONIST MUSCLES DURING A SUBMAXIMAL FATIGUING CONTRACTION

Lévénez, M., Carpentier, A., Duchateau, J.

Université Libre de Bruxelles, Belgium

Introduction

The concurrent activation of agonist and antagonist muscles, which is commonly referred as coactivation (Nielsen & Kagamihara, 1993), must be continuously adjusted by the nervous system during a fatiguing contraction so that the performance of the agonist muscles is not impeded. The purpose of the present study was to improve our knowledge on the control mechanisms of coactivation by recording the changes in the corticomotor excitability of antagonist muscles during a submaximal fatiguing contraction.

Methods

Eleven subjects (24-40 yrs) participated in a fatigue study that consisted to sustain a submaximal isometric contraction with the dorsiflexor muscles at 50% of their maximal voluntary contraction until task failure. Surface EMG activities of the tibialis anterior (TA) and of two antagonist muscles, the soleus (Sol) and the lateral gastrocnemius (LG), were continuously recorded. Concurrently, motor evoked potential (MEP) induced by transcranial magnetic stimulation and compound action potential (M-wave) elicited by maximal electrical stimulation were recorded in these muscles, before, during (at 20s interval) and after the fatigue task. To exclude fatigue-related changes of the muscle fibre membrane in the interpretation of the data, the MEP area of the TA was normalized to its M-wave area.

Results

The average endurance time for all subjects was 340.2 ± 118.2s (mean ± SD). After the fatigue test, the maximal torque produced by the ankle dorsiflexors and the aEMG of the TA dropped by 35.8 ± 13.7% ($P<0.01$) and 30.3 ± 27.0% ($P<0.01$) of the pre-fatigue values, respectively. In the antagonist muscles, the aEMG increased by 119.9 ± 92.7% ($P<0.01$) and 65.5 ± 65.7% ($P<0.01$) in the Sol and LG, respectively. Compared with the pre-fatigue values, the normalized MEP area at task failure increased progressively to 156.6 ± 64.8% ($P<0.01$) in the TA and, to 139.0 ± 58.0% ($p<0.05$) and 146.5 ± 39.1% ($P<0.01$) in the Sol and LG, respectively.

Conclusion

The main finding of the current study was that the biphasic modulation of the spinal reflex excitability in the antagonist muscles during a sustained contraction at 50% MVC force (Lévénez et al., 2005) is accompanied by a progressive increase in the excitability of the corticospinal pathway. The latter observation indicate that the reduced spinal reflex excitability observed at task failure is not due to reduction in the excitability of the motoneurones pool but to an increased presynaptic inhibition. Collectively, these results indicate that the level of coactivation during fatigue is controlled by supraspinal rather than spinal mechanisms.

References
Lévénez M, Kotzamanidis C, Carpentier A and Duchateau J (2005): Spinal reflexes and coactivation of ankle muscles during a submaximal fatiguing contraction. J Appl Physiol 99: 1182-1188.
Nielsen J and Kagamihara Y (1993): The regulation of presynaptic inhibition during co-contraction of antagonistic muscles in man. J Physiol 464: 575-593.

EFFECT OF POSTACTIVATION POTENTIATION ON THE LOADVELOCITY RELATION OF A HUMAN MUSCLE

Baudry, S., Duchateau, J.
Université Libre de Bruxelles, Belgium

Introduction
The torque and the rate of torque development of a muscle twitch is transiently increased after a maximal voluntary contraction (MVC; i.e. postactivation potentiation or PAP)1,3,4. However, it is not clear whether the maximal velocity of muscle shortening against different loads is also increased by a conditioning contraction. Hence, the purpose of this study was to compare the effect of PAP on the load-velocity relation and to investigate Sale's suggestion that intrinsic human muscle performance could be improved through this procedure 4.
Methods
The experiments were performed on ten subjects (24-40 years). The angular displacement of the thumb and its first derivative were recorded during contractions of the adductor pollicis muscle performed against various loads (10, 20, 30, 40 and 50% of MVC), before and after a conditioning isometric MVC of 6s. In a first series of experiments, the effect of PAP was tested by movements induced by tetanic contractions (15 pulses at 250 Hz) whereas, in a second series they were produced by voluntary contractions. The load-velocity relation was fitted by Hill's equation and the maximal shortening velocity at zero load (Vmax) was extrapolated from the relation. The maximal muscle power was also calculated.
Results
The load-velocity relations, tested by electrically-induced and voluntary contractions, were similarly modified after the conditioning MVC and showed an upward displacement. Vmax was significantly (P<0.01) increased by 14.9  5.4 % and 11.5  4.5% and maximal power was enhanced (P<0.01) by 16.8  4.1% and 12.3  3.1% during electrically-induced and voluntary contractions, respectively. Potentiation was maximal 1 min after the conditioning MVC and declined progressively over time to disappear completely after 5 min.
Conclusion
The main finding of the current work is that the velocity of muscle shortening against different loads is increased after a conditioning contraction. Furthermore, the similar effect of PAP on the load-velocity relation, maximal velocity of shortening and power when tested by a tetanic and voluntary contractions indicates that the mechanisms responsible for PAP are exclusively located in the muscle. This conclusion is in line with a previous work in mouse muscle showing that the increase in maximal shortening velocity after a conditioning contraction is induced by enhanced phosphorylation of myosin regulatory light chains2. In conclusion, our results indicate that PAP is acting during human voluntary movements and this mechanisms may be used to transiently increase speed and power in explosive sports.
References
1. Baudry S. and Duchateau J. Muscle Nerve 30: 328-336, 2004
2. Grange R.W. et al. Am J Physiol 269: C713-C724, 1995
3. Hamada T. et al. J Appl Physiol 88: 2131-2137, 2000
4. Sale D. Exerc Sport Sci Rev 30: 138-143, 2002

ACUTE PASSIVE STRETCHING ALTERS THE MECHANICAL BUT NOT THE ELECTRICAL PROPERTIES OF CALF MUSCLES IN HUMANS

Esposito, F., Cè, E., Alfieri, P., Pizzini, G., Veicsteinas, A.
University of Milan, Italy

An acute bout of passive muscle stretching has been shown to diminish maximal force and power output. Two mechanisms have been suggested to explain these findings: a mechanical alterations in the stretched muscle and an impaired neural activation. Thus, the aim of this study was to evaluate i) the stretching-induced changes in the electrical and mechanical properties of the muscle fibres during maximal electrically elicited contractions of the calf muscles; and ii) the time to recovery of these changes within two hours after stretching procedures. Thirteen subjects (age 23±2 years, mean±s.e.m.; body mass 70±4 kg; stature 178±3 cm) underwent 3 tetanic electrical stimulation at maximal intensity, before and after (every 15 min for 2 hours) a bout of passive stretching. During contractions, the force, surface EMG and mechanomyogram (MMG) were simultaneously recorded from the medial gastrocnemius muscle. From the analysis of the 3 signals, after stretching it resulted that: i) the force peak, time to peak and the peak rate of force production significantly decreased by 34±6%, 5±2% and 34±6%, respectively; ii) the MMG amplitude (peak-to-peak) also decreased (-14±5%; p<0.05); iii) no differences were found in EMG parameters; and iv) maximum force production remained significantly lower even after 2 hours of recovery from the stretching procedures. In conclusion, acute passive stretching affected the mechanical but not the electrical properties of the maximally contracting muscles, suggesting a stretching-induced alteration of the musculotendinous stiffness, but not a depression of muscle activation. Moreover, force depression persisted steadfastly after 2 hours from passive stretching, indicating a maximum force recovery time longer than two hours.

MULTI-CHANNEL ANALYSIS OF HUMAN INTRA-MUSCULAR MYOELECTRIC SIGNALS

Mizumura, S., Ohtsuki, T., Maezawa, K.
Meiji University, Japan

Many researchers have reported on motor unit firing behaviors during human voluntary isometric muscular contractions. In most of their studies, the single channel intra-muscular myoelectric signals were analyzed into its constituent motor unit action potential trains at force production of the low or intermediate levels. In the present study, in order to verify whether multi-channel analysis is needed to precisely identify the motor unit action potentials during voluntary isometric muscular contractions, we compare the motor unit firing behaviors by the single channel analysis with those by the multi-channel analysis in the same trials of the same subject.

Subjects sat on an experimental chair with their right knee flexed at 90 degrees. Isometric knee extension forces were recorded using a force transducer positioned at the distal end of the right leg. We asked the subjects to produce isometric trapezoidal ramp and hold knee extension force as follows: to increase the isometric knee extension force up to 25 % maximal voluntary contraction in 2.5 seconds (10%MVC/sec), then to maintain the force level for 10 seconds, and to decrease the force to 0 % MVC in 2.5 seconds (-10%MVC/sec). Two differential intra-muscular myoelectric signals were simultaneously recorded from right vastus medialis muscle using a specially designed quadrifilar fine wire electrode (Mizumura, 1999). The two signals were decomposed into its constituent motor unit action potential trains by one channel analysis respectively, and the same signals were decomposed by two channel analysis.
As a result, the motor unit action potentials were more precisely decomposed by the two channel analysis than by the single channel analysis. We believe that multi-channel analysis is needed to precisely identify the motor unit action potentials during human voluntary isometric muscular contraction even when the human subject produce low level of isometric force.

THE ADDITION OF CAFFEINE TO A SPORTS DRINK INCREASES MAXIMAL CYCLING POWER BUT DOES NOT AFFECT FLUID BALANCE OR THERMOREGULATION

Mora-Rodriguez, R., Del Coso, J., Estevez, E., Baquero, R.

Universidad de Castilla La Mancha, Spain

Introduction

Fluid replacement prevents cardiovascular drift and hyperthermia during prolonged exercise in the heat (1). Carbohydrates improve endurance performance (2) and sprinting ability (3) during prolonged cycling in warm conditions. Caffeine ingestion enhances repeated high intensity bouts of team-sport performance (4). The purpose of this study was to investigate if the performance effects of fluid replacement, carbohydrates and caffeine are additive when they are co-ingested during exercise in the heat.

Methods

Seven heat-acclimated trained subjects pedaled for 120 min at 63% VO2max in a hot-dry environment (36ºC; 29% rh) in six different occasions; 1) no fluid ingested (DEH); 2) caffeine supplementation (CAFF; 6mg/kg BW); 3) rehydrating 90% sweat loss with water (WAT); 4) rehydrating with water+caffeine (WAT+CAFF) 5) rehydrating with a 6% carbohydrate-electrolyte solution (CES) and 6) rehydrating with CES+caffeine (CES+CAFF). After 30, 60, 90 and 120 min of continuous pedalling, maximal cycling power (Pmax) was measured during 3 all-out sprints of 4 s duration. Rectal and skin temperatures were collected during whole the trial. Sweat rate was estimated from changes in body weight. VO2, VCO2, cardiac output and blood volume changes were measured at 15, 60 and 120 min. Data from trials were pooled for caffeine (CAF, WAT+CAF and CES+CAF) vs no caffeine treatments (DEH, WAT, and CES). Significance level was set at $P<0.05$.

Results

In comparison to DEH, fluid replacement (WAT) lowered final rectal temperature ~0.7ºC, increased sweat rate (from 1.3 to 1.4 L/h) and maintained blood volume (5%) and cardiac output (1.3 L/min) during exercise in the heat. However, it did not enhance cycling power. The addition of CHO and caffeine to plain water (CES and WAT+CAF) had no further cardiovascular and thermoregulatory benefits. When pooling data in the caffeine trials Pmax was higher than in the no caffeine trials at 30, 60, 90 and 120 min of exercise.

Discussion

Our data suggests than when interested on preserving short-term sprint performance during prolonged exercise in the heat the choice of a rehydration drink that contains water carbohydrates and caffeine (6mg/kg body weight) is advisable. Water alone or a CES are not enough to improve short-sprint performance in our trained subjects. Caffeine co-ingestion during prolonged exercise in the heat does not impair the thermoregulatory benefits of fluid replacement.

References

1. Hamilton MT, et al (1991) J. Appl. Physiol. 71: 871-877
2. Below, et al (1995) MSSE. 27: 200-210
3. Fritzsche RG, et al (2000) J. Appl. Physiol. 88: 730-737
4. Stuart GR, et al (2005) MSSE 37: 1998-2005

ENERGY COST CHARACTERIZING FACTORS BY TERRAIN TYPES

Leonardi, A., Schena, F.

Ce.Bi.SM. - Center of Bioengineering and Motor Sciences, Italy

Winter and summery sports on mountain paths like snowshoeing, trekking and mountain biking are popular type of physical activities widely diffused and they can be consider useful resources to promote health and well-being.
These forms of exercise requires amount of energy highly variable, in relationship to different factors as slope and speed of locomotion as previously determined in laboratory controlled conditions by energy cost (CE) calculation. Modern technologies allow to conduct accurate measures of path characteristics and metabolic requirements even on the terrain, giving us the possibility to verify the existence of characterizing parameters also in natural environment
Topographical surveys were executed on mountain area in three different CE studies to detect recurrent types of terrain. Each units at different medium slopes and meaningful different length was clustered by macro categories: untouched snow US and packed snow by catsnow PS about snowshoeing study, layer of rock particles mixed with very little humus also called gravel GW and rock-wood steps SW about trekking study, smooth solid layer also called compact CM, gravel-disjointed DM and narrow highly disjointed path NM about mountain biking. Each units was digitalised by using cartographic imaging 3D with positioning satellite receiver GPS with barometric altitude correction.
Subjects were equipped with a portable gas analyzer (K4, Cosmed, Italy) and GPS integrated module and moved on slopes between ±30 [%] for snowshoeing trekking and between ±15 [%] by bike.
The speeds were self selected on the basis of personal physical capacity in order to have habitual sense of effort. Energy cost of walking was calculated for each test from the steady state V'O2 using heart rate and ventilation data to check the sub-threshold level of effort. In this condition CE ([J•kg-1•m-1]) in was set equal to the average value of oxygen net consumption per body mass ratio to average chronometric speed on covered path. Each activity is described by polynomial functions always different for CE value related terrain conditions. In comparison to GW, walking on SW causes a CE increase with range 0.5-1.9 [J•kg-1•m-1] in particular at medium slope between -15[%] to +5[%]. In snowshoeing the comparison between the two snow conditions shown a higher value of CE on US with

ranging 0.6-1.4 [J/(Kg*m)] around slope from -25 to 20[%]. In mountain biking DM function remain for all gradients 0.6 [J/(Kg*m)] higher than CM with a very similar behaviour however NM path confronted to DM requires an additional energy with rapid increase ranged from 0.4 to 2.2 [J•kg-1•m-1] around slope from -10 to 6[%]. Our data shown common CE characterizing factors depending from contact point on the surface which compactness grade, adhesion (gripping-sliding) and easy rolling progression continuity and support this possible method to estimate accurately the energy expenditure of these outdoor activity.

RELIABILITY OF MUSCLE VS NERVE ELECTRICAL STIMULATION TO DETERMINE MUSCLE FATIGUE

Del Coso, J., Estevez, E., Mora-Rodriguez, R.

Universidad de Castilla La Mancha, Spain

Introduction

Muscle contraction evoked by electrical stimulation (EL) has been used to determine the origin of fatigue during exercise. The ratio between the force in a maximal voluntary contraction (MVC) and that with superimposed electrical stimulation (to maximize recruitment) is regarded as central activation ratio (CAR; index of central nervous system drive). In addition, to evaluate if the origin of fatigue resides within the muscle, maximal contraction evoked by tetanic electrical stimulation (EL) is commonly used. These procedures to determine the origin of fatigue can be used stimulating percutaneously over the muscle belly (MS) or over nerve trunk (NS). The purpose of this study was to compare the reliability of these procedures when using MS in comparison to NS.

Methods

Five subjects familiarized with the procedures performed the reliability tests. After warm up, MVC of the right leg with superimposed EL to obtain CAR was performed in duplicate. Following electrical stimulation (EL 20 and EL 80 Hz) was used to assess muscle contraction function. In one occasion EL was applied percutaneously over the quadriceps (MS) and in another occasion over the femoral nerve (NS). Trials were performed randomly and separated by fifteen minutes of recovery. Subjects performed this protocol in three different days, twice a day separated 2 hours between them to study intra-and between-day reliability. To ensure that MS is a sensible method to detect fatigue 7 young cyclist pedalled (60% VO2max) during 120 min in a hot-dry environment inducing to hyperthermia (39.0ºC) and fatigue. Before and after the exercise the origin of fatigue was studied using MS electro stimulation.

Results

MVC was in average ~553±9 with high within and between-day reliability (R1=0.97 and 0.92). CAR was very similar using NS and MS (95±0.5% and 94±0.6%, respectively) and the intra-between day reliability was also similar. The ratio of force produced during the 20 Hz/80 Hz stimulation was similar using NS or MS (0.87 vs 0.85). However, response time at 20 Hz and at 80 Hz was slower for NS in comparison to MS (246±12 vs 213±4 ms and 260±9 vs 194±2 ms, respectively; $P<0.05$). 120 min of exercise-induced hyperthermia reduced MVC by 11% (from 759±65 to 683±73 N; $P<0.05$) and CAR by 5% while maximal contraction evoked by tetanic electrical stimulation was unchanged by exercise.

Discussion

Muscle stimulation (MS) results in similar values for the assessment of the origin of fatigue (MVC, CAR, EL 20 Hz / EL 80Hz) than when using NS. The faster time response (from stimulus to onset of force production) during NS in comparison to MS could be due to the proximity of the axon to the electrodes while the stimulus during NS needs to travel from the inguinal fold to the muscle. In conclusion, EL (directly positioning the electrodes on the muscle) seems to be a location as reliable as the typically used femoral nerve stimulation to assess the origin of fatigue.

BRAIN AND MUSCLE OXYGENATION AND NEUROMUSCULAR PROPERTIES RESPONSES TO AN INCREMENTAL MAXIMAL EXHAUSTIVE CYCLING EXERCISE

Rupp, T., Perrey, S.

Faculty of Sport Sciences, UFR STAPS, 700 avenue du Pic Saint Loup, 34090 Montpellier, France

Introduction: The physiological causes of fatigue have been classified as either peripheral (skeletal muscle contractility) or central (neural drive to muscle) in origin. To date, theory identifying central nervous system as the central governor of altered motor performance have received less attention (Noakes et al., 2004). This study integrates this last theory and attempt to explore the role of cerebral functional activation in the muscle fatigue etiology in humans during severe exercise. The purpose of this preliminary study was to examine the effects of fatigue resulting from progressive maximal exhaustive cycling exercise on brain cortical oxygenation, muscle oxygenation and neuromuscular properties. Methods : Twelve trained healthy subjects (age: 24.2 ± 5.1 years, training per week: 7.1 ± 2.3 hours) performed an incremental exercise to forced exhaustion on a cycling ergometer. Left frontal cortical oxygenation and muscle oxygenation (over the vastus lateralis) were measured simultaneously by near-infrared spectroscopy (NIRS) to give evidence of cerebral functional activation and oxygen delivery and uptake by the muscle. Maximal voluntary knee extension torque and neuromuscular properties (M-wave amplitude and duration, voluntary activation ratio) were measured on vastus lateralis just before and 6 minutes after exercise to examine the neural adaptation mechanisms induced by exhaustive fatigue. The electromyographic (EMG) activity of the vastus lateralis was recorded and analyzed to reflect modifications of the neuromuscular system throughout the incremental cycling test. Preliminary results and discussion: Up today a part of data is still in processing and supplementary subjects are planned. The mean maximal power output value of the exhaustive test was 384.5 ± 29.4 W and subjects' maximal oxygen consumption (VO2max) reached 74.3 ± 7.0 mL.min-1.kg-1. There was no significant difference between pre- and post-exhaustive exercise for both the voluntary activation ratio and the M-wave patterns. These findings suggest that 6 minutes are sufficient to restore neuromuscular function after a short progressive fatiguing exercise. EMG activity increased non-linearly from start to end of exercise. Further analysis are under-way to confirm correlation between ventilatrory thresholds, the global surface EMG energy and the marked reductions in muscle oxygenation measured by NIRS. Finally, brain cortical oxygenation increased during the first minutes of exercise but decreased markedly at severe exhaustion. This last finding is in full accordance with prior studies (Shibuya et al., 2006) and suggests that a short progressive fatiguing exercise induces a decrease of brain activity that leads to transient changes in muscular function at the end of exercise.

References:

Noakes, T. D., A. St Clair Gibson, et al. (2004).

EFFECTS OF YOGA ON BONE MINERAL DENSITY AND BONE BIOCHEMICAL MARKERS IN ELDERLY

Bezerra, L.M., Oliveira, R.J., Abdhala, Lídia

Catholic University of Brasília, Brazil

ABSTRACT: The benefits of dynamic training for the bone mineral density (BMD) have been largely studied; however, the effects of static stimulus in bone physiology are not well-known. Thus, the practice of yoga may be a possible provider of static bone stimulus. Therefore, the aim of this study was to verify the effects of yoga in the bone mineral density and the bone biochemical markers (BBMs) of formation (osteocalcin) and reabsorption (CTx), as well as, the estradiol hormone. A total of fifty post-menopausal women (63,88 ± 5,66, years old) was randomly screened and divided in Yoga Group (YG, n = 25) and Control Group (GC, n =25). The BMD, the BBMs and the estradiol hormone were analyzed pre and post-test. Furthermore, the BMD of the femural neck, the trocanter, the Ward's area, the all hip region, the lumbar spinal (L2-L4), the total body region and the ultradistal forearm was performed by a Dual Energy X-ray Absorptiometry (DXA). The eletrochemioluminescence technique was performed to identify the BBMs and the estradiol hormone. The yoga intervention lasted six months (three time/week and one hour/session). The results were statistically analyzed by the SPLIT PLOT ANOVA and the significance level was p £ 0,05. The results showed a significant decrease between pre and post-test on BMD of spinal lumbar in both groups (0,984 ± 0,190 g/cm2 to 0,959 ± 0,175 g/cm2 and 1,021 ± 0,227 g/cm2 to 0,989 ± 0,230 g/cm2, to Yoga Group and Control Group, respectively). Besides, there was a significant decrease between pre and post-test in BMD of total hip region in control group (0,970 ± 0,161 g/cm2to 0,954 ± 0,164 g/cm2). The osteocalcin showed a significant increase between pre and post-test in Yoga Group (15,44 ± 6,16 to 20,89 ± 9,44 ng/ml). The CTx showed a significant decrease between pre and post-test in control group (0,453 ± 0,130 to 0,243 ± 0,206 nanog/ml). The values presented an increase of bone deposition in post menopausal women caused by the increase of osteocalcin. Therefore, the bone static stimulus, as result of the practice of yoga, can alter the bone metabolism.

VENTILATORY CONTROL AND PLASMA LEVELS OF ERYTHROPOIETIN AND OXIDIZED LDL IN ELITE APNEA DIVERS

Hildebrandt, W., Dröge, W., Bärtsch, P.

German Cancer Research Center , Germany

Elite apnea divers achieve extreme breath-hold (BH) times of >5 min that are indicative of a unique ventilatory control allowing to tolerate extreme hypoxia and/or hypercapnia. To what extent the BH training of today's competitive elite apnea divers affects their ventilatory control is largely unknown. Moreover, as BH training may impose a severe hypoxia-reoxygenation stress, it is of interest whether erythropoietin (EPO) and hemoglobin concentrations increase and whether apnea diver expose themselves to oxidative stress.

The present study therefore determined the isocapnic hypoxic as well as the hypercapnic ventilatory response (HVR and HCVR, respectively) in 8 elite apnea divers as compared to 25 age-matched non-diving controls. Moreover, apnea divers performed several maximal BH maneuvers for determination of their end-apnea levels of (minimal) peripheral O2-saturation and end-tidal gases as well as for arterial blood gas analysis around the BH breaking point. Pulmonary function parameter were also obtained in apnea divers. Furthermore, venous blood levels of hemoglobin, EPO, and oxidized LDL (oxLDL) were compared between 6 apnea divers and controls.

Maximal BH times of apnea divers ranged between 5:10 and 7:30 min and correlated best with vital capacity (VC) (r=0.93, p<0.001) which was 120+-17% of predicted values (mean+-SD). End-apnea O2-saturations were between 42% and 75% and expectedly related to maximal BH time. Isocapnic HVR was significantly lower in apnea divers compared to controls (0.36+-0.23 vs 0.69+-0.35 l min-1%-1, p<0.01) while HCVR was similar. End-apnea end-tidal and arterial PO2 were related to isocapnic HVR. There was a large interindividual variability in the pre-apnea hyperventilation maneuver leading to end-tidal PCO2 levels between 17.4 and 51.6 mmHg at last pre-apnea expiration and between 39.0 and 76.7 mmHg at end-apnea expiration. These normo- to extremely hypercapnic end-apnea levels of end-tidal PCO2 were inversely related to the apnea divers' HCVR (r=-0.79, p<0.05) indicating a very experienced use of hyperventilation. While no differences in hemoglobin were detected, plasma levels of EPO (14.2+-2.3 vs 8.5+-0.8 U/L) and of oxLDL (97.3+-8.6 vs 58.8+-4.6 U/L) were significantly increased.

These findings suggest that a high VC and a low HVR together with a HCVR-adjusted hyperventilation allow for extreme BH times and hypoxemia of apnea divers. BH training appears to impose a hypoxia-reoxygenation stress that is comparable to that occuring with sleeping apnea.

HEAT EXPOSURE ELEVATES MUSCULAR HEAT SHOCK PROTEIN 70 AND SUPPRESSES EXERCISE-INDUCED SKELETAL MUSCLE DAMAGE IN MICE

Mikami, T. 1, Yamauchi, H. 2, Ohota, S. 1

1 Nippon Medical School, 2 Jikei University School of Medicine, Japan

Heat shock proteins 70 (HSP70) is a super family of highly conserved protein, most of which are induced in response to a wide array of physiological and environmental stresses, including heat, cold, ischemia, hypoxia, and energy depletion. In cells, heat exposure induces cellular HSP70 and enhances a state of resistance to subsequent stress. In animal, exposing animals to hyperthermia also protects organs against stress-induced damage. Therefore, this study was designed to investigate whether heat exposure prior to exercise could elevate HSP70 in skeletal muscle and contribute to protect the muscle against exercise-induced muscle damage.

Male ICR mice were randomly divided into two groups, control and heat mice. The heat mice was anesthetized with pentobarbital sodium and placed in an environmental chamber at an ambient temperature of 42? for 30 min. Twenty-four hours after heat exposure, some of control mice and heat mice were killed to collect soleus, extensor digitorum longus (EDL) and plasma. The rest of mice were performed 60 min of downhill running on treadmill (decline 20 degrees, treadmill speed 25 m/min) because the downhill running are used as eccentric exercise model and the eccentric exercise induces more muscle damage than the concentric exercise. After downhill running, the exercised mice were killed at 12, 24 and 48 h after the end of downhill running. The amount of HSP70 in both muscles was determined using SDS-PAGE and western blot. Activities of plasma creatine kinase and muscle beta-glucuronidase were measured as the quantitative indicators of muscle damage. In addition, immunohistochemical analysis was performed to examine the change in HSP70 and dystrophin, a structural protein of the submembrane, in muscular cells.

Heat exposure significantly increased the amount of HSP70 in both soleus and EDL muscle compared with control mice. In non-heat/exercise mice, creatine kinase activity in plasma dramatically increased 12 h and 24h after downhill running, while beta-glucuronidase activity in soleus and EDL increased 48 h after downhill running; however, heat/exercise mice showed a lower level of both enzyme activities compared with non-heat/exercise mice. Histochemical analysis using Harris's hematoxylin-eosin staining showed that the degree of occurrence of muscle damage was less in heat/exercise mice than in non-heat/exercise mice. In double-

immunofluorescence staining using both anti-dystrophin and anti-HSP70 antibody, the soleus muscle of non-heat/exercise mice showed significant disappearance of dystrophin, while no disappearance of dystrophin was showed in the soleus muscle of heat/exercise mice.

These findings suggest that heat exposure prior to exercise may enhance skeletal muscle HSP70 and lead to a protective effect against skeletal muscle damage induced by exercise.

THE EFFECTS OF HIGH FAT FEEDING AND VOLUNTARY EXERCISE ON MITOCHONDRIAL RESPIRA-TION RATE IN SKELE-TAL MUSCLE OF MICE

Silvennoinen, M., Rinnankoski, R., Kivelä, R., Lehti, M., Vihko, V., Kainulainen, H.

University of Jyväskylä, Finland

Introduction

The prevalence of type 2 diabetes is increasing fast in the western countries. Increased resistance to insulin and impaired secretion of insulin characterizes this complex disorder. The main risk factors of type 2 diabetes are seden-tary lifestyle, overeating and obesity. It has been reported that type 2 patients have low oxidative capacity in their skeletal muscle. This may either be an important promoter of the disease or simply be the complication of disease. Regular exercise is recommended to diabetic patients because it increases the oxida-tive capacity and the insulin sensitivity of skeletal muscle. Our long-term aim is to study the significance of oxidative capacity in the aetiol-ogy of type 2 diabetes. In this pilot study, we tested the use of high fat fed mice as model for insulin resistance development.

Methods

Male C57BL/6J mice were fed with either normal low fat diet (LFD) or high fat diet (HFD). Mice were housed in indi-vidual cages. After 17 weeks, mice were divided to four groups: LFD sedentary (n=4), LFD running (n=4), HFD sed-entary (n=10) and HFD running (n=11). Running mice had running wheels in their gages. Glucose tolerance, fasting plasma glucose and insulin were measured three times during the experiment (after 9,16 and 30 weeks). When mice had been 34 weeks on the diet, they were killed and their mqf muscles were removed. Mitochondria were extracted from the muscle samples and the respiratory rates of mitochondria were measured with O2 electrode. Glutamate (5mM) + malate (2.5mM) and pyruvate (5mM) + malate (2.5mM) combinations were used as substrates. Maximal respiration rates of mitochondria were measured after ADP (0.125mM) addition.

Results

HFD mice had higher levels of glucose intolerance and fasting plasma insulin than LFD mice. Running didn't have effect on glucose intol-erance and fasting plasma insulin levels in either of the diet groups. There were no significant differences in maximal respiration rates between HFD and LFD sedentary groups with either of the substrate combi-nations. HFD running group had higher (15.8%, $p<0.05$) maximal respiration rate than corresponding sedentary group when glutamate and malate were used as substrate. With pyruvate and malate the difference (10.4%) was not statistically significant ($p=0.086$).

Discussion/Conclusion

High fat feeding induced glucose intolerance and insulin resistance as planned but didn't have an effect on oxidative capacity of mito-chondria. However, we can't exclude the possibility that the oxidative capacity has decreased by decreased number of mitochondria. The physical activity increased the oxidative capacity of mitochondria, but it didn't have significant effect on glucose tolerance or insulin resis-tance. Based on these result, the voluntary wheel exercise should be started earlier in the actual experiment in order to find more signifi-cant effects of physical activity.

SLEEP PATTERNS OF ADVENTURE RACERS ATHLETES

De Mello, M.T., Antunes, H.K., Andersen, M.L., Bittencourt, L.R., Silva, R.S., Tufik, S.

Federal University of Sao Paulo, UNIFESP, Brazil

The Ecomotion-PRO is a "non-stop" adventure race competition, where the athletes has to complete several km distributed in different sporty modalities, faced natural obstacles, weariness and sleep deprivation (SD). In October of 2004, Bahia (BA, Brazil) hosted Ecomotion-Pro, the most important "non-stop" and challenging adventure race on the Brazilian calendar that consisted in 6 nights and 7 days. The purpose of this study was to investigate the sleep patterns after an adventure race. Sixteen athletes of both genders were volunteers, standard polysomnographic recordings (Rechatscaffen & Kale, 1968), were carried out using an Embla Digital A10 Recording/ amplifier with Somnologica software (Flaga h.f., Reykjavík, Iceland), one week before the race and the first sleep after the race. in October of 2004, The results demonstrated an important decreased in sleep onset latency (min) (6.04 ± 4,79 to 1.08 ± 2.10), stage 2 of sleep (%) (62.08 ± 7.12 to 54.60 ± 5.01) and number of arousals (h) (8.77 ± 3.25 to 6.44 ± 2.96), increased was observed in total sleep time (min) (418.68 ± 50.59 to 573.04± 164.54), stage 4 of sleep (%) (13.21 ± 4.39 to 16.58 ± 5.01) and REM (%) (19.66 ± 5.29 to 23.77 ± 4.98). When the genders were observed separate, the females showed an increased in sleep efficiency and a decreased in stage 1 of sleep. The male's presented decreased in sleep onset latency, stage 2 and augmented in total sleep time, stage 4 and delta sleep (stage 3 +4). Sleep deprivation plus extenuated physical exercise promote modifications in sleep patterns of the adventures racers athletes. Ours results showed that after Ecomotion-Pro, these athletes increased REM sleep and delta sleep, possible because a necessity to promote physical recuperation. This is very interesting, once those innumerous researches presented that the relationship between REM sleep and delta sleep is inversely correlated. In this way, we can conclude that adventures racers need a time to restart cognitive and physical functions.

Reference:

Rechastchaffen A, Kales A. A manual of standardized terminology, techniques, and scoring system for sleep stages of human subjects. Washington: U.S. Government Printing office, 1968.

Financial Support: AFIP, FAPESP (CEPID #98/14303-3 TO S.T.) and CAPES.

Acknowledgements: CEPE and Instituto do Sono.

EFFECTS OF SINGLE AND MULTIPLE SET STRENGHT TRAINING ON THE NUMBER OF SATELLITE CELLS AND MYONUCLEI IN M. VASTUS LATERALIS AND M. TRAPEZIUS IN UNTRAINED MEN

Hanssen, K.E., Kvamme, N.H., Rønnestad, B.R. Egeland, W., Kadi, F., Raastad, T.

Ostfold Univeristy College, Norway

We have earlier observed that upper body muscles respond different from leg muscles on single vs. three set strength training (3). Leg muscles increased cross sectional area more with three sets than with one set strength training, while no differences between 1 and 3

sets was seen in upper body muscles. Satellite cells play an essential role in muscle mass enlargements by providing new nuclei to hypertrophying fibres (1). Therefore, the purpose of this study was to examine the effect of single and three set strength training on the number of satellite cells and myonuclei in a leg muscle (vastus lateralis) and an upper body muscle (trapezius). We hypothesised that 3 set strength training would lead to a greater number of satellite cells and myonuclei per fibre in leg muscles than 1 set training, but no differences in upper body muscles.

Twenty-five untrained men were randomly assigned into two groups. One group performed 3 sets in legs exercises and 1 set in upper body exercises (3L-1UB), while the other group performed 1 set in leg exercise and 3 sets in upper body exercise (1L-3UB). The subjects performed 3 workouts per week during 11 weeks. 1RM testing was done in all strength exercises pre- and post-intervention. Biopsis were obtained before and after training and cross sections from vastus lateralis (VL) and upper part of trapezius (T) were analysed by immunohistochemistry for satellite cells, myonuclei and fiber types.

3 L-1UB increased strength (1 RM) in leg exercise significantly more than 1L-3UB (41±3% vs. 25±2%, respectively, $p<0.01$), and correspondingly had a greater increase in thigh muscle CSA than the 1L-3UB group. In upper body there were no significant differences between groups neither in strength nor in muscle CSA. In VL fibre area in type IIA fibres increased in both groups (21±6% and 17±6% in 1L-3UB and 3L-1UB, respectively), while no significant changes in fibre area was observed in type I fibres. In T 1L-3UB got a significant higher increase in type IIA fibre area compared to 3L-1UB (35±7% vs. 7±6%, $p<0,05$). A significant higher number of satellite cells per fibre was observed in T compared to VL before training (0.15 vs. 0.13, respectively, $p<0.05$). The number of satellite cells in both VL (37%) and T (38%) was significantly increased after the intervention in both groups, but there were no significant difference between groups. The number of myonuclei per fibre did not change significantly during the training period in neither group.

The increase in number of satellite cells after strength training was similar to other studies (2). However, the greater increase in thigh muscle CSA in the 3L-1UB group was not preceded by a larger increase in satellite cells, myoneclei nor fibre are. Therefore, the mechanisms behind the greater muscle enlargement by 3 sets in thigh muscles could not be explained by differences in satellite cell activation.

1.Kadi et al. Pflugers Arch 451: 319-327, 2005.

2.Kadi et al. J Physiol 558: 1005-1012, 2004.

3.Rønnestad et al 2004. 9th ECSS Conference abstract.

THE IMPACT OF HIGHLY INTENSIVE INTERVAL LIKE TRAINING ON RESPIRATION

Maassen, N., Vardaxoglou, K., Frische, M.

Medical School Hannover, Germany

The present study compared the impact of 3 weeks highly intensive interval like training and continuous training with similar mean mechanical work on respiration (VO2, VCO2, Ventilation and RER) and their kinetics during and after exercise.

Male subjects (26.9 + 2.3 years), performing ball- and/or endurances sports were assigned to two groups (Interval Group (IG) n=11; Endurance Group (EG) n=10). The average performance in IG was 4.16 + 0.63 and in EG 4.17 + 0.71 Watt/kg. The range of the maximal oxygen consumption was in IG between 0.038 - 0.074 l*kg-1*min-1 and in EG between 0.039 - 0.071 l*kg-1*min-1. The average maximal oxygen consumption was in IG 0.048 l*kg-1*min-1 and in EG 0.047 l*kg-1*min-1. IG conducted a highly intensive interval like training (IT) of 1 hour and EG conducted an endurance training of 1 hour. The average training intensity was 50% of the maximal power reached in an incremental test (Powmax) in both groups. The training was added to their normal training and was performed 3 x per week for 3 weeks. Before and after the training an endurance test (EX) at 80% Powmax to exhaustion followed by a 10 min recovery phase (RP) was performed. Ventilatory parameters were determined breath by breath (Metalyzer IIIb). The values were fitted to a mono-exponential function with a linear term.

The improvement of endurance time in IG was significantly larger than in EG (50% vs. 21%, $p<0.05$). No significant differences were observed in the VO2 neither in the absolute values nor in the kinetics during EX and RP. However, during EX the amplitude of VE increased in both groups (IG: $p<0.02$; EG: $p<0.008$) whereas the linear term decreased (IG: $p<0.02$; DG: $p<0.05$). The linear term correlated highly with the performance times in both groups ($p<0.001$). During RP there was no difference in ventilation between the groups. VCO2 was reduced after both training regimen during EX and RP. The respiratory exchange ratio (RER) was significantly lower during exercise and RP after both types of training. The reduction was significantly larger in IG (EX: $p<0.001$; RP: $p<0.001$) especially during the first minutes of RP. The [Lac] was lower in both groups during EX, whereas there was no difference in [Lac] and total [CO2] in the blood between the training groups during RP.

The different behaviour of VE and VCO2 after training indicates that both are not tightly coupled. The decrease in VCO2 is partly due to a lower buffering of lactic acid. The lower [Lac] is also indicative for a lower carbohydrate combustion and thus for an increased fat metabolism. This is pronounced in IG in the beginning of the resting period when the RER drops rapidly whereas VE, [Lac] and TCO2 shows no difference between the training groups. The tight correlation between the linear term of the ventilation with the performance time shows that VE is a good indicator of endurance capacity.

Supported by BISP: VF 07/01/76/2004.

THE EVALUATION OF THE MUSCLE OF MUSCLE FATIGUE BY SIMULTANEOUS ELECTROPHYSIOLOGICAL AND MECHANICAL RECORDING

Vasilescu, M., Rusu, L.

University of Craiova, Romania

Introduction. Our research propose a modern and complex exploration method of muscle performance by computerized acquisition and analysis of surface electromyography (SEMG) and mechanomyogram (MMG) during voluntary isometric maximal contraction of flexor hand fingers. The evolution of 12 classical (previously described in literature) SEMG and mechanographic parameters and new parameters and indices were analyzed with dedicated software. This modern exploration method allows precise, quantified, analysis of muscle performance and, by linear regressions and statistical analysis, permits to differentiate various groups of subjects.

Methods. Our study has included sixty healthy athletes, who received an medical – sportive confirmation to participate at the trainings and sport competitions. The total group was made of male subjects with age difference, right-handed, professional athletes belonging to a variety of sports.

There has been registered at the same time to these athletes an surface EMG and MMG during an maximal isometric contraction, hand grip type, undertaken till brake point. For the evaluation of the muscle fatigue during effort time we used 38 parameters EMG and MMG.

The program that has been elaborated by us allows the analyses of all the 38 parameters, either continue, or on portions of 410 ms with gaps of 4590 ms.
This way it results, from 5 to 5 seconds, values of all the EMGS and MMG parameters, with whom the program forms for each parameter a curve of time evolution during the entire contraction period.
Because the interpretation of the curves with evolution in time of the parameters previously presented (each having values from 5 to 5 seconds, on all the period of the contraction), it's pretty difficult, we have calculated the I order regression lines, noting for each regression line the values of the slope(ordinate value of a point where the regression line intersects the ordinate) and intercept (shows the brutal change of the parameter because of the fatigue).
For a better comparison, the amplitude of the intercept value modification , we have calculated the slope/intercept ratio. The percentage value of this report, indicates how many percentage of the intercept value (noted 100%) have decreased or increased after 5 seconds of maximal contraction.
Results and Conclusions. From all the results obtained it shows that based on some simultaneous electrophysiological and mechanical recording with the help certain highly evolved mathematical processes, obtaining a lot of parameters , indexes, reports, graphics , mapping etc. With the help of this modern technique, we have studied different athletes categories obtaining very interesting results for the performance and muscle fatigue evaluation.

VISCOUS-ELASTIC PROPERTIES OF PLANTARFLEXOR MUSCLES IN WHITE CAUCASIAN AND BLACK AFRICAN ATHLETES: A PRELIMINARY STUDY

Driss, T., Lambertz, D., Vandewalle, H., Badour, Y., Goubel, F.

Université Paris 10-Nanterre, France

UMR-CNRS 6600, Université de Technologie, 60205 Compiègne
INSEP de Paris

Driss et al. (2003) observed that for a given maximal anaerobic power on a cycle ergometer, vertical jump was 6.8 cm higher in black volleyball players than in Caucasian. A difference between Caucasian and African subjects regarding leg viscous-elastic properties was a possible explanation, as suggested a simulation study (Bobbert, 2001) and experimental data (Fukashiro et al., 2002). The present study investigated possible ethnic differences in elastic properties of ankle plantar flexor muscles in black (BS) and white (WS) male athletes.
Mechanical data were collected on 29 explosive force and sprint type college students (black = 17, white = 12) of regional and national level. Mechanical tests included (i) maximal voluntary contraction (MVC), (ii) musculotendinous (MT) stiffness and (iii) musculoarticular (MA) stiffness. A quick-release technique was used to determine MT stiffness, while subjects maintained different percentage of MVC. The ratio between variation in dynamic torque and displacement (i.e. stiffness) was related to torque and the slope of the linear relationship was defined as stiffness index (SIMT) (Lambertz et al., 2001). Furthermore, MT stiffness values calculated at the different torque levels were normalized with regard to MVC. Sinusoidal perturbations were imposed at different percentage of MVC. The elasticity K of the MA system was calculated by using Bode diagrams and related to torque. The slope of the linear relationship between K and torque was defined as a stiffness index (SIMA). Results were expressed in terms of differences (in %) between black and white subjects. A student t-test was used and statistical significance was set at $P<0.05$.
MVC was significantly lower in BS (-13.9%, $P<0.05$). SIMA was significantly higher in BS (+19.9%, $P<0.001$). Normalized MT stiffness values were significantly higher at low (+28.4%, $P<0.01$) and medium (+13.1%, $P<0.05$) torque levels for BS and showed no significant differences at the highest torque level (+7.1%, $P>0.05$). Consequently, SIMT was significantly lower in BS (-30.8%, $P<0.01$).
In the present study, significant higher SIMA values were found in BS. This result is in agreement with those of Fukashiro et al. (2002) who reported higher muscle stiffness in black athletes, by using the free oscillation method. When studied by the quick-release method, musculotendinous stiffness, expressed by SIMT, was lower in BS of the present study, which was in contrast to Fukashiro et al. (2002) who reported no significant differences in tendon stiffness. However, there was no significant difference between BS and WS for MT stiffness values at the highest torque levels, i.e. for stiffness values probably similar to the tendinous stiffness in the study by Fukashiro.
References

Bobbert (2001) J Exp Biol 204 : 533-542
Driss T et al. (2003) 9th ECSS Congress, Clermont-Ferrand, France
Fukashiro S et al. (2002) Acta Physiol Scand 175:183-187
Lambertz D et al. (2001) J Appl Physiol 90: 179-188.

CARDIOVASCULAR ANALYSIS IN AN AEROBIC CYCLING TEST IN SPRINTERS AND LONG-DISTANCE RUNNERS

Tavares, P., Anjos, I., Parada, J., Ribeiro, G., Rosado, M.F., Santos, A., Fontes Ribeiro, C.A.

Faculty of Sport Science and Physical Education, university of Coimbra, Portugal

The cardiovascular risk with exercise is associated to sympathetic nervous system activation and vagal activity. Some recent studies indicate heart rate recovery in the first minute as a predictor of sudden death and mortality. Thus, the aim of this work is to study the cardiovascular risk by the evaluation of the heart rate and substances responsible for the vascular tone (nitric oxide and catecholamines) in different trained and untrained subjects.
Male volunteers participated in this study: sprint athletes (SA), endurance athletes (EA) and age and sex-matched sedentary controls (SC). All the subjects performed an aerobic maximal graded exercise test in cycle ergometer (Monark 824E), consisting in a constant pedal frequency (60 rpm) starting with 50 W workload and increasing 25W every 2 minutes until fatigue. Before, during and after exercise (for 30 min) heart rate was continuously assessed by using a heart rate monitor (Polar®). Before the exercise test a 10 ml blood sample was collected to analyse plasma nitrates/nitrites (NOx, as measure of nitric oxide) and catecholamines. After exercise, blood was collected again and the referred measures repeated (5 and 30 minutes during recovery). The NOx was measured using a commercial kit (R&D Systems; DE1500). Plasma catecholamine levels were measured by HPLC-ED.
As far as specific VO2max is concerned, there was an increase in both athlete groups but more significantly in EA than SA group, as expected. Heart rate rest values were lower in EA. The maximal heart rate achieved was under the theoretical maximum, except for the control group that reached equal values (calculated and measured). Thus, all subjects used more than 80% of the heart rate reserve, meaning a good chronotropic response and a correct sympathetic nervous system activation. Values under 80% are a predictor of mortality. Nevertheless, the EA maintained a lower heart rate during the test when compared to SC (the highest one). Heart rate recovery after

one minute was above 12 bpm, which means a reduced cardiovascular risk (vagal activity increases properly), since a first minute recovery less than 12 bpm is another risk factor for sudden death and mortality. EA had the highest level for first minute recovery and the lowest heart rate after 30 minutes. Catecholamine levels are in agreement with the degree of sympathetic activation and heart rate values for each group. Concerning vascular relaxation, the EA group showed a higher basal level and a high NOx production after the exercise test when compared to control. Thus, none of the studied subjects present cardiovascular risk. However, the EA group has more exercise benefits that the SA one.

This work was supported by a PAFID programme from the Portuguese Sport Institute and by FCT (Fundação para a Ciência e Tecnologia), Portugal.

ELECTROMYOGRAPHIC ANALYSIS OF AN ABDOMINAL EXERCISE PERFORMED IN TRAINED (BODY-BUILDERS) AND UNTRAINED SUBJECTS

Ribeiro, E., Tavares, P., Ribeiro, G., Rosado, M.F., Fontes Ribeiro, C.A.

Faculty of Sport Science and Physical Education, university of Coimbra, Portugal

Endurance of the abdominal musculature is an essential component of fitness for health and sports performance. A wide variety of different exercises are currently used. However, the effectiveness of neuromuscular training is typically based on anatomical evaluation, empiric measurements or subjective perception. Nowadays, the general public is very interested in abdominal exercises for their body image and in some cases by health reasons, since a good abdominal musculature is essential for trunk support. The important question is to choose the right exercise and how to evaluate its effectiveness. Despite the large number of exercises, literature about its evaluation is lacking. Thus, it was our aim to compare the neuromuscular efficacy of a classic exercise in body builders and in active subjects.

Ten male body builders and ten untrained subjects were recruited and volunteered to participate in the study. The training frequency of the body builders was 5.3 ± 1.5 days/week. Using surface electromyography (SEMG) we measured the Rectus abdominis and Rectus femoris muscles activity in a traditional trunk curl. The feet were placed on the ground with the knees flexed to 140º (start position) and the arms along the body. Subjects elevated the trunk by sliding the hands 12 cm along the body. The feet slide also increased the knees angle. The cadence of the exercise was constant and commanded by a sound repetition. Each subject performed only one exercise until fatigue. During the exercise test the surface electromyographic parameters (RMS-EMG and MPF-mean power frequency) were evaluated in each subject. The EMG recording was made with a MegaWin® ME3000 device. In order to compare individual results the RMS-EMG values were normalized by dividing the obtained values by the maximal contraction of the muscle.

We verified that in the Rectus abdominis the RMS-EMG values were higher and the MPF (Hz) lower than in the Rectus femoris. Nevertheless, the neuromuscular behaviour of these muscles in the both studied groups were different. Thus, concerning the Rectus abdominis there was an increase of the amplitude (RMS-EMG) in the untrained subjects and a decrease (in the last repetitions) in body builders. In the untrained subjects the MPF decrease with the repetitions increase, whereas in body builders the MPF values slight decrease in the first repetitions and then stabilized. In the Rectus femoris muscle the MPF showed no differences between groups and maintained an almost constant value along repetitions. On the contrary, the RMS-EMG values were higher in body builders than in untrained subjects, with a tendency to decrease with repetitions. In the untrained subjects the opposite occurred, since there was a tendency to increase RMS values.

Partial supported by FCT (Fundação para a Ciência e Tecnologia), Portugal.

SEASONAL CHANGES IN BODY COMPOSITION OF ELITE SOCCER PLAYERS

Tofas, T., Theodorou, A., Stavrakoudi, A., Nikolaidis, M.G., Jamurtas, A.Z.

University of Thessaly, Greece

Body composition comprises one of the many factors that affect performance in soccer. The effects of post season on body composition are detrimental in a way that players put on weight and increase their percentage body fat. Therefore, one of the many aspects that the coaching team needs to monitor during the training year is body composition. The purpose of this study was to examine the seasonal changes that occur in body composition of elite soccer players. Twenty-two elite professional soccer players playing in the first Division of the Greek League volunteered. Their mean age and height was 26.6 ± 3.7 yrs and 1.76 ± 3.8 m, respectively. Body mass was measured to the nearest 0.2 kg with the players lightly dressed and barefooted. Percentage body fat was calculated according to published guidelines (ACSM Guidelines, 2000), from seven skinfold measures (average of two measurements of each site) using a Harpenden calliper. Measurements were made at the beginning of preseason (beginning of July), mid-preseason (three weeks into training), at the end of preseason (Mid-August), in September, and every two months thereafter (November, January, March, May) until the end of the season. One way ANOVA for repeated measurements was used to assess differences between pre-season and the following measurements. Data are presented as means ± SEM. Body weight decreased ($p<0.01$) at the mid-Preseason and End-PreSeason measurements. Following those two measurements body weight was not significantly different compared to Pre-Season. Percentage body fat decreased ($p<0.001$) at the mid-PreSeason and remained significantly lower compared to Pre-Season. Body composition seems to rapidly change at the beginning of pre-season. Coaches should not look at the body weight of the players only but pay closer attention to percentage body fat also.

THE ANTHROPOMETRIC, PHYSIOLOGICAL AND MOTOR FITNESS FEATURES PROFILES THAT PARTICIPATING KARATE AT NATIONAL TEAM OF IRAN

Hojjat, S., Tarverdizadeh, B. ,Rasooli, S.A., Behpour, N.

Islamic Azad University, Branch of Karaj, Iran

The main purpose of this project is to search about anthropometric, physical and motor fitness features profiles that participating karate at national team of Iran.

Among those who invited to national team in 2005 year ten people participated in the test voluntary. This project way is descriptive.

Project variable include anthropometric , physical and motor fitness (weight, age height, biacromial breadth , trunk length , hand length , arm length , forearm length , palm length , thigh length , calf length , head circumference , chest circumference , abdominal circumference , proximal thigh circumference , calf circumference , arm circumference , forearm circumference, wrist circumference, wrist breadth,

elbow , knee width , ankle width , five part of body fat and the percent of fat , agility , reaction , balance , speed , power, muscular endurance , muscular power , vo2 max , resting heart rate and exercise heart rate).

The project result shows that:

1. Anthropometric features distance is high performance of karate matches in different weights one of the reasons for changes.
2. Motor fitness variable record distance is high; this shows with participants in some variable low (less) and in some other variable level.
3. Most of the participants in physical variable have high level fitness.

EXPLORING PHASE II HEAR RATE KINETICS DURING SUB MAXIMAL RUNNING TEST IN PROFESSIONAL FOOTBALL PLAYERS

Jemni, M., Mitchell, A., Sands, W.A., McNeal, J.R.

Sport Science Department. Anglia Ruskin University, Cambridge. UK, United Kingdom

Purpose: This study examined sub maximal heart rate (HR) kinetics in outfield professional football players. It attempted to calculate the amplitude of the transition from a walking steady state to jogging steady state HRs.

Method: Eight professional football players (25 ± 5.3 yrs; 180 ± 5 cm; 76.5 ± 4.7 kg) from the English Championship volunteered to participate in this study. They performed six trials of a square-wave transition from 5 min walking at 5.5 km/h to 5 min running at 11 km/h on a treadmill. Thirty minutes of rest was initiated between each 10 min trial. Trials were performed at the same time of day and took place through 15 weeks.

Beat by beat HR was monitored using a Polar S810i HR monitor. HR data were calculated in accordance with a similar experimental designed by Fukuoka et al. (2002). The average of the last 30 sec of the 5th minute was calculated to get HR value for the walking steady state. The average HR of the last 30 sec of the third minute of the jogging was also calculated.

HR amplitude was calculated by subtracting the average HR of the walking steady state from the average HR of the jogging steady state. Fifty percent of this amplitude was considered for all comparisons (phase II HR kinetics). The time required to reach 50% of the Heart Rate Reserve (HRR) was also calculated for further analysis and comparisons.

One way analysis of covariance ANCOVA with repeated measures was performed due to the repeated testing.

Results: Average HR increased from 90 + 10 b/min to 137 + 11 b/min during the transition from walking to jogging. Average HR at 50% of the phase II HR kinetics was 114 + 13 b/min. The athletes reached phase II within an average of 40 + 5 b/min which represented 34 ± 7% of the HRR. The time required to reach phase II kinetics was 328 + 6 sec (28 + 6 sec after the transition). The athletes reached the HR steady states after 465 + 15 sec.

Statistical differences between the trials did not reach statistical significance when comparing absolute HR amplitudes or HRR data ($p>0.05$).

Conclusion: These findings suggest that HR kinetics responses to a sub maximal test do not change through 15 weeks of training time in high level outfield football players. This would suggest that aerobic components of fitness, as measured by HR, are not affected by training sessions and competitions through this period. Further investigations to explore HR kinetics responses to a maximal test are required; these would give an insight on the anaerobic components of fitness during such period.

MUSCLE MAXIMAL CO-CONTRACTIONS OF THE ELBOW EXTENSORS AND FLEXORS DURING ISOMETRIC CONTRACTIONS

Driss, T., Serrau, V., Vandewalle, H., Lesne-Chabran, E., Lepellec-Muller, A.

Université Paris X, 200 avenue de la république, 92000 Nanterre, France. , France

Muscle maximal co-contractions of the elbow extensors and flexors during isometric contractions.

T. Driss 1, V. Serrau 1, H. Vandewalle 2, E . Lesne-chabran 1, A. Lepellec-Muller 1

1 E.A. 2931, UFR STAPS, Université Paris X, 200 avenue de la république, 92000 Nanterre, France. E-mail : tarak.driss@u-paris10.fr

2 INSEP de Paris, 11 avenue du Tremblay, 75012 Paris, France.

The purpose of this study was to investigate the magnitude of integrated electromyography (iEMG) during maximal isometric co-contractions of the agonist and antagonist elbow muscles in order to estimate the force levels during this kind of exercise.

Eight male subjects were instructed to perform maximal unilateral co-contraction exercise which consisted in exerting a maximal co-activation of the agonist and antagonist muscles of the right arm (i.e. a maximal rigidity of the right elbow without external resistance). In addition, they performed bilateral isometric exercises: 1) maximal flexion of the right elbow against the resistance of the elbow extensors of the left arm, 2) maximal extension of the right elbow against the resistance of the elbow flexors of the left arm. iEMG were measured with a MA-300 electromyograph during maximal unilateral and bilateral co-contraction exercises and compared with iEMG collected during isometric elbow flexion and isometric elbow extension against a force transducer at 30, 60 and 100% maximal voluntary force (MVF). All the exercises were performed with the same body and elbow positions (90° flexion of the elbow and a 45° external rotation of the shoulder). We estimated the force level during unilateral and bilateral co-contraction from iEMG data collected during these exercises, with the assumption that there was the same iEMG – force relationship for exercises against external resistance and co-contraction exercises.

iEMG during maximal unilateral co-contractions were equivalent to the iEMG value corresponding to force levels around 55% MVF for the elbow flexors and extensors. The maximal levels of iEMG during maximal bilateral co-contractions were slightly (but not significantly) higher than iEMG during maximal unilateral co-contractions.

The results of the present study suggest that maximal isometric co-contraction exercises could be used to maintain muscle strength in rehabilitation programs.

Keywords: Isometric contraction and co-contraction, Surface electromyography, Biceps brachii and Triceps brachii muscles.

TIME SERIES OF ENDOCRINE PARAMETERS INDICATE DESYNCHRONIZATION OF BIOLOGICAL RESPONSE IN HIGH TRAINING LOAD SITUATIONS

Suhr, F., Yue, Z., de Marées, M., Achtzehn, S., Mester, J.

German Sport University Cologne, Germany

Introduction

The biological responses following high trainings loads are not fully understood. In endurance sports the monitoring of an overreaching and the understanding of the mechanisms inducing overreaching are very important to avoid an overload, a decrease in performance and healthy risks. The aim of this study was to determine the responses of two vascular growth factors (VEGF and endostatin) and muscular growth factors (IGF-1 and HGF), respectively, during a long-term high-intensity cycling intervention.

Methods

Two endurance cyclists were trained with high training loads for about eight weeks. The following measurements were carried out: daily data such as heart rate, body temperature/weight, weekly the anaerobic threshold and oxygen uptake, and three and five blood samples in the morning, respectively, were drawn. The subjects performed 14.1 ± 0.5 hr per week on a cycling ergometer. Time series analyses such as LAMP-fitting, cross-correlation, spectrum- and wavelet-analyses were used to get a better understanding about the biological response regarding high training loads.

Results

The two subjects showed a highly individual biological response with regard to VEGF, endostatin, IGF-1 and HGF. After training input for subject I there was a HGF-increase right before a release of IGF-1. The two vascular growth factors showed a similar pattern. In subject II the mentioned parameters did not react that clear. For HGF there seems to be pre-release compared to IGF-1. VEGF and endostatin were expressed consecutively as well, but the effects for all parameters were not that clear compared to subject I. On the other hand in time-series clear synchronized and desychronized between the training load and the response could be identified. The desychronization indicated a time-lagged response in endocrine parameters especially when it came to an accumulation of the previous loads.

Conclusion

HGF has been shown to initiate and stimulate the activation and proliferation of satellite cells in the skeletal muscle tissue for muscle-repair after damage1. Therefore it is reasonable for subjects I that HGF responses previously to IGF-1, what is able to modulate and stabilize the activated satellite cells. VEGF is a potent mitogen for endothelial cells and endostatin possesses the ability to inhibit the VEGF-induced migration and proliferation2. Because of biological activities of the parameters the detected patterns for subject I seem to logic and subject I obviously was able to tolerate the high training input. Subject II was not in a position to abide the high training load during the whole intervention, and therefore subject II did not show that clear patterns.

References

1. Järvinen, T. A. H. et al.: Muscle injuries.Am J Sports Med, 2005; 33 (5): 745-64

2. Stupack, D. G., Cheresh, D. A.: Apaoptotic cues from the extracellular matrix: regulators of angiogenesis. Oncogene, 2003; 22 (24): 9022-9.

THE EFFECT OF ACUTE GARLIC INTAKE ON BLOOD PRESSURE AND WATER CONSUMPTION IN YOUNG NORMOTENSIVE HUMANS

Botonis, P., Herouvim, E., Stampouloglou, A., Koskolou, M.D., Nassis, G., Geladas, N.D.

Faculty of Physical Education and Sport Science, University of Athens, Greece

Reduction in blood pressure results in high circulating plasma angiotensin-II, which is a stimulus for thirst (Stocker et al., 2000). Garlic is a compound that may lower blood pressure at least after long term use of it (Steiner et al., 1996). The purpose of this study was to examine the effect of acute garlic intake on blood pressure and water consumption. Thirteen healthy normotensive subjects (6 men and 7 women, age: 23 ± 3 years, height: 171.5 ± 9.8 cm) underwent the same protocol on two separate experimental days within a week, in a counterbalanced order. One day before each experiment, preliminary baseline measurements were taken. In the experimental day, the subjects reported to the laboratory after an overnight fast (~ 12 h) and were administered either an aged garlic extract (Kyolic 600 mg; G) or a placebo (C) pill. After a 60-min rest in supine position, they cycled in sitting position for 30 min at 60% of heart rate reserve and, afterwards, they recovered for 90 min lying supine. They were allowed to drink as much water as they liked from the 10th min of recovery onwards. Body mass (BW), mean, systolic, diastolic blood pressure (MAP, SBP, DBP), cardiac output (Q), haematocrit (Hct), haemoglobin concentration ([Hb]) and the subjective feeling of thirst were evaluated at baseline, following the fasting, as well as at certain time points throughout the experimental day. The level of recorded dehydration at the end of exercise was the same in the two experimental conditions (C: 0.9 % BW vs. G: 1% BW, $p > 0.05$). At the 60th min of recovery, MAP (C: 84 ± 7 vs. G: 75 ± 9 mmHg, $p < 0.05$) and DBP (C: 68 ± 6 vs. P: 59 ± 8 mmHg, $p < 0.05$) were lower in G than in C, respectively. Δ values (certain time point value – initial resting value) were also lower in G than in C for MAP at the 60th min (C: 4 ± 5 vs. G: -7 ± 10 mmHg, $p < 0.05$) as well as the 80th min (C: 5 ± 7 vs. G: -2 ± 10 mmHg, $p < 0.05$) of recovery and for DBP only at the 60th min (C: 4 ± 6 vs. G: -6 ± 9 mmHg, $p < 0.05$) of recovery. There were no significant differences between the two treatments in the total water consumption (C: 539 ± 314 vs. G: 603 ± 364 ml, $p > 0.05$), as well as in SBP, Q, Hct, [Hb], plasma volume and the subjective feeling of thirst, at any time point of measurement. In conclusion, although a reduction of MAP associated with a decrease in DBP was observed after G intake, confirming previous results (Steiner et al., 1996), this had no influence on water consumption and the subjective feeling of thirst in young normotensive humans.

References

Steiner M, Khan AH, Holbert D and Lin RI. Am J Clin Nutr 64: 866-870, 1996.

Stoker SD, Sved AF and Stricker EM.. Am J Physiol Regulatory Integrative Comp Physiol 279: R576-R585, 2000.

PHASE III V'O2 INCREASE DOES NOT LEAD TO V'O2 VALUES HIGHER THAN V'O2 MAX DURING PROLONGED INTENSE EXERCISES IN HUMANS

Alfieri, P. 1, Schena, F. 2, Ferretti, G. 3, Esposito, F. 1

1 University of Milan, 2 CeBiSM, 3 University of Geneva, Italy

The aim of this study was to test the hypothesis that maximum O2 uptake (V'O2 max) sets the uppermost limit to O2 flow. If this is so, the V'O2 increase with time during high intensity prolonged exercises (slow component) can not reach V'O2 levels higher than V'O2 max. To

this aim, on 15 amateur cyclists (age, 24±4 yrs; mean ± S.E.M.) V'O2 max was measured during graded cycloergometric exercise. On different days, the subjects performed exercises at 80% and 90% of the previously determined V'O2 max up to exhaustion (W80 and W90, respectively). Measured variables included time to exhaustion (Tlim), power output, V'O2, CO2 production (V'CO2), ventilation (V'E) and blood lactate concentration ([La]). V'O2 max was 4.05±0.08 L•min-1. At the end of W80 (Tlim 1649±145 s) and W90 (Tlim 733±65 s) V'O2 was 3.77±0.13 and 4.08±0.12 L•min-1. V'O2 at the end of W90 was similar to V'O2 max, while at the end of W80 was significantly lower. [La] was increased at the end of prolonged exercises not only with respect to rest, but also compared to values at exercise min 5, indicating anaerobic lactic metabolism contribution to energy production. Compensation of lactic acidosis led to significant increases in V'E and V'CO2 at the end of W80 and W90. In conclusion, the present results support the hypothesis that V'O2 max really reflects the individual maximum aerobic power, without being limited by factors intrinsic with the experimental procedures.

ACUTE EFFECTS OF PASSIVE STATIC STRETCHING ON LEG EXTENSOR MUSCLES: DIFFERENCES BETWEEN SQUAT AND COUNTERMOVEMENT JUMP

Merati, G., Silvaggi, N., Limonta, E., Rampichini, S., Alberti, G.

University of Milan and Federazione Italiana di Atletica Leggera (FIDAL), Italy, Italy

The acute effects of stretching on muscular performance are currently ascribed to mechanical and neuro-muscular mechanisms. Aim of this study was to compare the effects of static stretching on leg extensor muscles during squat jumps (SJ) and countermovement jumps (CMJ). Seven healthy male subjects (age [mean (SD)] 29 (7) yrs; height 177 (5) cm; body mass 81.9 (10.4) kg] participated in this study. After a 10 min warm-up, each subject performed 2 consecutive series of 5 SJ and 5 CMJ in 2 separate sessions on different days in randomized order: in the control (C) session the first SJ and CMJ series were followed by 10 min rest, whereas in the stretching (S) session the first SJ and CMJ series were followed by a passive static stretching bout (10 min), applied bilaterally on quadriceps and gastrocnemius muscles (4 stretches/muscle, 30 s stretch/30 sec rest). Each jump series was executed on a force platform (4 Jump, Kistler, USA). During the whole SJ and CMJ series of either session the EMG signal was simultaneously acquired (Muscle-Lab, Bosco System) from 6 leg muscles (vastus medialis and lateralis, gastrocnemius, gluteus maximus, tibialis anterior, biceps femori). The average, the Root Mean Square (RMS) and the time to EMG signal peak were calculated from the rectified EMG signal. Maximal power, force and velocity did not significantly differ between the first and second jump series, both during C and during S session. However, in the eccentric phase of CMJ, both velocity (+ 0.02 m/s during C session, p=ns; + 0.10 m/s during S session, p<0.05) and power (+26 (52) W during C session, p=ns; +83 (63) W during S session, p<0.05) were significantly increased in the S session only. Average and RMS of the EMG signal did not significantly differ between the first and the second SJ and CMJ series, both during C and during S session. Time to the maximal EMG activation for each muscle did not differ in S and C conditions between the first and the second SJ series; however, a significant delay in the activation of vastus lateralis (+28 (27) ms and tibialis anterior +66 (64) ms (p<0,05)) was observed during CMJ execution in S session only. In our experimental protocol stretching did not significantly reduce the force and power output of the investigated muscles. However, since as previously reported the mechanical effect of stretching is likely to be influenced by knee starting angle, our results may have been affected by the choice of 90° knee starting angle of SJ. Concerning EMG, the observed delay of the maximal activation of EMG signals in vastus lateralis and tibialis anterior muscles suggests the occurrence of a neuromuscular inhibition on the stretched muscles, which is apparent for CMJ only. Thus, CMJ more than SJ, especially during the eccentric rather than the concentric phase, may help to better understand the effects of acute stretching on leg muscles performance.

RATE OF PERCEIVED EXERTION AT A GIVEN EXERCISE-INDUCED DECLINE IN STROKE VOLUME IS HIGHER IN SPINAL CORD INJURED THAN IN ABLE-BODIED INDIVIDUALS

Geladas, N.D., Zacharakis, M., Nassis, G., Kounalakis, S.N., Anastasiadis, M.

National and Kapodistrian University of Athens, Greece

Cardiovascular drift, a phenomenon characterized by progressive increase in heart rate and decline in stroke volume during constant load prolonged exercise, has not been extensively investigated in spinal cord injured athletes on those such data exceed in able-bodied individuals (Bhambhani, 2002; Coyle and Gonzalez–Alonzo, 2001). In a previous study in our laboratory we have shown that exercise-induced stroke volume decline is similar in spinal cord injured (SCI) and able-bodied (AB) athletes (Zacharakis et, 2005). The aim of this study was to compare the rate of perceived exertion (RPE) at a given stroke volume decline in SCI and AB athletes. Eight SCI with high-level spinal cord injury (C7-T6; aged: 32.3±8.4 yrs, mean±sd) and 9 AB (aged: 20.6±1.0 yrs) performed 60-min exercise at 50% of maximum oxygen uptake on a wheelchair roller ergometer in a thermo-neutral environment. Throughout exercise, the following parameters were determined: oxygen uptake (VO2) with a metabolic cart, cardiac output (Q) with the exponential CO2 rebreathing method, heart rate with telemetry, oral temperature (Tor) with an electronic thermistor, and RPE with the 6-20 Borg scale. Rate of perceived exertion (RPE10) at a stroke volume decline equal to 10 ml/beat (SV10) was calculated for each individual by curve fitting. RPE10 was compared between groups with a t-test for independent samples after adjusting for potential covariates. Time for SV10 was estimated at 73.5±51.8 min in SCI and 32.4±13.9 min in AB (P< 0.05). RPE10 was higher in SCI than in AB (16.3±3.0 vs. 11.9±1.8, respectively, P< 0.01). This difference persisted after adjusting for percent of maximum heart rate achieved (80.0±4.6 for SCI and 81.0±4.9 % for AB, P> 0.05) and Tor (37.6±1.1 for SCI and 37.2±0.3 oC for AB, P> 0.05) recorded at SV10. These results show that rate of perceived exertion at a given exercise-induced stroke volume decline is higher in spinal cord injured than in able-bodied athletes. This was independent of heart rate and oral temperature responses. It seems therefore, that spinal cord injured athletes experience greater discomfort for the same magnitude of cardiovascular drift than able-bodied athletes.

References

Bhambhani Y, (2002). Sports Med., 32: 23-51

Coyle E. S., Gonzalez- Alonzo J, (2001). Exerc Sport Sci Rev., 29: 88-92

Zacharakis M. et al. (2005). Book of abstracts, 10th Annual Congress of the ECSS, p. 74.

THE EFFECT OF PROLONGED EXERCISE AND BLOOD SAMPLING ON SERUM ERYTHROPOIETIN CONCENTRATION

Szygula, Z., Pilch, W., Wnorowski, J., Wiecek, M., Zembron-Lacny, A.

University School of Physical Education, Krakow, and University of Physical Education Poznan, Faculty of Physical Culture, Gorzow Wlkp., Poland

Introduction/Purpose: The effect of physical exercise on regulation of EPO synthesis has not been fully elucidated. Some authors have found an increase of erythropoietin concentration [EPO]s after an exercise (Roberts et al. 2000; Schmidt et al. 1991) whereas others were unable to demonstrate any significant changes in [EPO]s (Bodary et al. 1999; Duda et al. 2003). There is also no agreement as to diurnal variation of EPO synthesis (Klausen et al. 1993; Roberts & Smith 1996). Therefore the aim of the study was to compare changes in [EPO]s and PV induced by prolonged exercise and by controlled blood sampling.

Methods

Seven healthy men (20-24 yr) exercised at 55% VO2max till exhaustion on the cycloergometer. Venous blood samples were taken before, immediately, 3 h, 9 h after exercise, on the 2nd and on the 3rd day of the experiment. On the other occasion at the same time schedule venous blood samples were taken at resting conditions. Hemoglobin and hematocrit were determined and relative changes of PV were calculated. [EPO]s was determined by a commercially available radioimmunoassay and corrected for changes in PV. The Fridman's ANOVA with repeated measures was applied to analyze the overall changes. Post-hoc comparison was conducted with Tukey's test. A value of $P < 0.05$ was accepted as significant.

Results

PV decreased by 8.8% ($P < 0.05$) just after exercise whereas a significant increase of PV was observed 3 h later (+3%) and 9 h after exercise (+7.8%). The most pronounced increase of PV was noted the next day (+9%). PV remained elevated 48 h later (+5.6%). [EPO]s increased from 8.0 ± 4.5) mU/l to 8.8±3.5 mU/l 3 h after exercise but the elevation was not statistically significant. A significantly elevated [EPO]s was observed 9 h after exercise (13.7±4.2 mU/l; 71%) as well as the next morning (13.1±5.2 mU/l; 64%) and 48 h later (12.2±4.8 mU/l; 52.5%). In the controlled samples of blood statistically significant increase of [EPO]s was observed in the evening (+38%).

Discussion/Conclusions

The most pronounced elevation of PV observed the next day after prolonged exercise could be the effect of fluid conservation by the kidneys. The elevation of [EPO]s 9 hrs after exercise could be partly result of enhanced EPO synthesis due to the increased oxygen consumption in the kidneys as an effect of intensified sodium reabsorption in renal tubules. Diurnal variations of EPO biosynthesis have to be also taken into consideration. However, an elevation of [EPO]s the next days may be the result of hemodilution due to expansion of PV.

Acknowledgements

This study was supported by a grant from the KBN No 4 PO5D 071 19.

References

Bodary PF et al. (1999) Med Sci Sports Exerc 31: 543-6.

Duda K et al. (2003) Int J Sports Med 24: 326-31.

Klausen T et al. (1993) Eur J Apll Physiol 67:545-8.

Roberts D, Smith DJ (1996) J Apll Physiol 80: 847-51

Roberts D et al. (2000) Clinical Sci 98: 39-45.

Schmidt W et al. (1991) Int J Sports Med 12: 457-61.

CARDIOVASCULAR EFFECTS OF 9 DAYS OF DRY-HEAT ACCLIMATIZATION IN TRAINED MEN

Estevez, E., Del Coso, J., Mora-Rodriguez, R.

Universidad de Castilla-La Mancha, Spain

INTRODUCTION

Dry-heat acclimatization is characterized by a lower heart rate and core temperature during exercise in the heat. Nielsen et al (1991) has also described an expansion of plasma volume and increases in cardiac output directed to non-exercising tissues (i.e., skin blood flow). However, in that classical acclimatization study the subjects were stressed to exhaustion in each session. Our purpose is to investigate if the acclimatization responses are present when exposure time is kept constant and thus strain gradually declines due to the acclimatization process.

METHODS

During 9 consecutive days, seven endurance trained cyclists (VO2max of 61±8 mL·kg-1·min-1) pedalled for 90 min at 63% VO2 max in a hot-dry environment (35ºC; 29% rh; 2.5 m·s-1 wind speed). Plasma volume changes were measured from hematocrit and hemoglobin concentrations (Dill and Costill, 1974). Heart rate (HR), rectal temperature (Tre), arterial blood pressure and forearm skin blood flow were monitored. Cardiac output (Q) was measured at 15 and 90 min of exercise by using a computerized version of the CO2-rebreathing technique of Collier. All the measures were taken on days 1, 3, 6 and 9 of exercise. Two-way ANOVA was used to detect differences among days.

RESULTS

After 90 min of exercise HR was lower in day 9 than in day 1 (142±5 lat·min-1 vs 156±5 lat·min-1; $P<0.05$). Final Tre also decreased in day 9 in comparison to day 1 (39.3±0.2 ºC vs 38.9±0.1 ºC; $P < 0.05$). However, whole body sweat rate (measured by changes in mass loss) was unchanged with acclimatization (~1.2±0.05 L·h-1). In addition, there were no reductions in basal hemoglobin concentrations that remained at 14.3±0.2 g·dL-1. The initial reductions in BV after 15 min of exercise in day 1 were lessened after 6 days of acclimatization (-4.90±-0.6%; -2.49±0.55%; -1.25±1.11% in days 1, 6 and 9 respectively). This allowed a better maintenance of Q and a tendency to increase the skin blood flow ($P<0.05$).

DISCUSSION

In comparison to the traditional results from Nielsen´s group we observed that our well-trained subjects need 9 days of acclimatization to reduce final rectal temperatures. However, heart rate (index of cardiovascular stress) is lower after only 3 days of acclimatization. The improved heat dissipation in day 9 is not accompanied by increased sweat rate. Acclimatization did not expand plasma volume (similar basal haemoglobin) but reduced the exercise induced hemoconcentration (measured at min 15 of exercise). This allowed a better maintenance of Q which may have permitted the increases in skin blood flow (NS). Likely more strenuous exercise (to exhaustion) or exposure time (more than 9 days) are required to increase plasma volume and sweat rate in well-trained unacclimated subjects.

REFERENCES

1. Nielsen, B. et al. Human circulatory and thermoregulatory adaptations with heat acclimation and exercise in a hot, dry environment. J. Physiol., 1993. 460: p. 467-485.

CHILDREN HAVE A HIGHER HYPOXIC VENTILATORY RESPONSE THAN THEIR FATHERS

Kriemler, S., Zehnder, M., Kohler, M., Bloch, K.E., Brunner, H.P., Boutellier, U.

ETH-University of Zurich, Switzerland

Introduction: Chemoreceptor sensitivity plays an important role in the short-term adaptation to high altitude (HA). Decreased ventilatory response to hypoxia (HVR) is a risk factor for the development of high altitude pulmonary edema and possibly of acute mountain sickness (AMS). It is not clear, however, whether HVR is different in prepubertal children and adults nor whether there is a hereditary influence. Isocapnic HVR was therefore measured in 20 fathers (mean age 44.0±4.2y) and their prepubertal children (mean age 10.7±1.1y) at low altitude (LA, 450m) and on day 1 and 2 of HA (3450m) using the partial rebreathing technique. After 15 min of resting ventilation, three levels of hypoxia (PETO2 60, 55, 50 Torr) were randomly induced and kept stable (±2 Torr) for 2 min with 5 min of recovery in between. PCO2 was kept constant at ±2 Torr of values while breathing room air. HVR is expressed as increase in minute ventilation per decrease in saturation corrected for body weight. AMS was measured by Lake Louise Questionnaire. Clustering of HVR within families was tested by correlation analysis of slope differences (deltaHVR) from LA to HA. Results: AMS occurred in 8 children and 7 adults. HVR (corrected for body weight) was significantly higher in children than in adults irrespective of altitude (0.020±0.010, 0.020±0.011, 0.024±0.012 vs. 0.012±0.007, 0.014±0.011, 0.018±0.012 ml*kg-1*min-1*%-1 at 450m, day 1 and 2 of 3450m, respectively, all $p<0.0005$). Only adults significantly increased their HVR on day 2 of HA ($p<0.05$). There was a significant correlation of deltaHVR from LA to day 2 of HA within families ($r=0.59$, $p<0.01$). Individuals with AMS did not show a lower HVR than those without AMS. Conclusion: Children generally have a higher HVR than their fathers which does not protect them from AMS. HVR seems to be genetically influenced.

This study was supported by the Federal Council of Sports, Magglingen, Switzerland.

EFFECTS OF PHYSICAL ACTIVITY ON DIABESITY IN MICE

Rinnankoski, R., Silvennoinen, M., Kivelä, R., Lehti, M., Vihko, V., Kainulainen, H.

LIKES research center for sport and health sciences and Neuromuscular research center, Finland

In the modern world the prevalence of type 2 diabetes is ever increasing, above all because of sedentary lifestyle, overly rich nutrition and obesity. This metabolic disorder results from insulin resistance accompanied by pancreatic islet dysfunction. Exercise training and regular physical activity have been shown to increase fat metabolism, thus potentially reducing the symptoms of this metabolic disease. However, there is a need for more knowledge of the molecular mechanisms underlying the basic defects inducing type 2 diabetes.

The ultimate goal of this pilot study was to collect valuable information for the actual experiment planned to conduct shortly after. The aim of this study was to generate a conveniently designed mouse model, which combines overfeeding and voluntary exercise. With this model the mechanisms and pathways affecting the emergence of glucose intolerance in type 2 diabetes would be investigated.

Male C57BL/6J mice were fed with either normal low fat diet or high fat diet, containing 60 % fat. In order to obtain the weight gain, food consumption and energy intake, the animals and food were weighed once a fortnight. Mice were kept in individual cages and after 17 weeks on the diets, half of the animals had access to voluntary wheel exercise. Customized computer program collected the running data. During the experiment intraperitoneal glucose tolerance tests were also made and fasting plasma glucose and insulin levels were measured. After 34 weeks on the diet, the mice were killed and their lower limb muscles, heart and epididymal adipose tissue were removed, the wet mass weighed and stored for further purpose.

Normal diet and high fat diet mice, both without exercise were compared. High fat fed mice showed significant increases in energy intake, body weight and insulin levels, whereas significant decreases were seen in muscle weight and glucose tolerance in contrast to low fat fed mice. When exercised and sedentary mice on normal diet were compared, there were no significant changes. This indicates that the exercise itself has no remarkable ameliorating effects on body composition in lean mice. In contrast, when high fat diet mice were compared together, exercised mice showed significant decrease in their body weight gain.

As the energy intake and body weight increases in high fat fed mice, the physical activity seems to decrease accordingly. Once the mice have gained weight substantially, the physical activity seems to have only delaying effects on body composition. Based on these results, the voluntary wheel exercise should be started at an earlier stage in the consequent actual experiment in order to find more beneficial effects of exercise on obesity and type 2 diabetes.

EFFECT OF INTERMITTENT HIGH-INTENSITY EXERCISE COMPARED TO MODERATE CONTINUOUS EXERCISE ON GLUCOSE PRODUCTION AND UTILISATION IN INDIVIDUALS WITH TYPE 1 DIABETES

Guelfi, K., Ratnam, N., Smythe, G., Jones, T., Fournier, P.A.

University of Western Australia, Australia

Recently, the glucoregulatory response to intermittent high-intensity exercise (IHE) has been compared to continuous moderate-intensity exercise (MOD) in individuals with type 1 diabetes (Guelfi et al., 2005). The results of this study demonstrated that the decline in blood glucose was less with IHE both during exercise and throughout the first hour of recovery. To determine whether this lesser decline in glycaemia was the result of a greater increment in hepatic glucose production or attenuated glucose utilisation, the present study compared the effect of IHE and MOD on the rate of glucose production (Ra) and utilisation (Rd) during and after exercise in individuals with type 1 diabetes. Nine healthy individuals with type 1 diabetes were tested on two separate occasions during which either a 30-minute MOD or IHE protocol was performed under conditions of a euglycaemic clamp in combination with the infusion of [6,6-2H]glucose and indirect calorimetry. MOD consisted of continuous exercise at 40% VO2peak, while IHE involved a combination of continuous exercise at 40% VO2peak interspersed with 4-second sprints repeated every 2 minutes to simulate the activity patterns of common field sports. The participants were monitored for up to 2 hours of recovery. The exercise-induced rise in glucose Ra commenced sooner with IHE, and was of a greater magnitude compared to MOD. Similarly, glucose Rd rose sooner during IHE, but the increase by the end of exercise was to a similar extent as that elicited by MOD. During early recovery from exercise, Rd rapidly declined following IHE, while remaining elevated after MOD. During the second hour of recovery, Ra and Rd returned to baseline following MOD, but remained elevated after IHE. These changes in Ra and Rd were consistent with a lower glucose infusion rate (GIR) during early recovery from IHE and a higher GIR after 2 hours of recovery compared to MOD ($p < 0.05$). In conclusion, the repeated bouts of high-intensity exercise associated with IHE stimulate a more rapid and greater increment in Ra during exercise and attenuate glucose Rd during early recovery. These findings assist in ex-

plaining, in part, the previous observation that the risk of hypoglycaemia might be lower during and for the first hour after IHE and compared to MOD.

Guelfi et al., 2005. Diabetes 28(6):1289-1294.

INFLUENCE OF CLIMBING STYLE ON PHYSIOLOGICAL RESPONSES DURING INDOOR ROCK CLIMBING ON ROUTES WITH THE SAME DIFFICULTY

de Geus, B., Villanueva O'Driscoll, S., Meeusen, R.

Vrije Universiteit Brussel, Belgium

Introduction: Rock climbing is a sport with a rapid growth in popularity both as a recreational and as an international competitive sport. Previous studies [1,2] investigated the effect of an increasing difficulty on physiological responses. Heart rate and oxygen consumption were significantly higher during harder climbing, compared to easier climbing [1]. While the heart rate increases with climbing angle (increasing difficulty), VO2 does not significantly vary, and causes a disproportional rise in heart rate compared with oxygen consumption [2].

Objectives: 1) to continuously assess oxygen uptake and heart rate and 2) to quantify the extent to which maximal cardiorespiratory capacity, obtained during a graded exercise test on a treadmill, is utilised during difficult rock climbing on four routes with the same difficulty but different in steepness and/or displacement.

Design: Fifteen expert climbers underwent a graded maximal exercise test (GMT) on a treadmill in order to asses their maximal heart rate (HRmax), oxygen uptake capacity (VO2max), respiratory exchange ration (RERmax), lactate concentration (Lct) and ratings of perceived exertion (RPE). At least one week after GMT four routes were climbed, carried out on two separate occasions on an artificial wall in a climbing gym. The four testing routes were equal in difficulty rating (7c, French grading system) but different in steepness and/or displacement. The first route (OR) had a vertical displacement on an overhanging wall. Route VR had a vertical displacement on a vertical wall. Route OT was an almost horizontal overhanging roof with horizontal displacement (roof). Route VT had a vertical displacement on a vertical wall (traverse). VO2 and HR were continuously measured during climbing. Absolute and relative energy expenditure (EE) and RER were calculated. Lct and RPE were taken before and directly after the climbing. Data were expressed as peak values (HRpeak, VO2peak and RERpeak) and as averages over the entire climb (HRavg, VO2avg and RERavg).

Results: During climbing, higher HRpeak and HRavg were found in routes with a vertical upward displacement (OR and VR) in comparison to traversing routes with a horizontal displacement (OT and VT). VO2avg, VO2/kgavg, EE/d, EE/kg/d and lactate concentration were significantly lower in the traversing route (VT) in comparison with the three other routes. No significant differences for VO2peak and VO2/kgpeak were found between the four routes. Climbing seems to cause a disproportionate rise in heart rate compared with VO2. The traverse is done at a lower percent of the running maximum.

Conclusions: Comparing four routes with the same difficulty but different in steepness and/or displacement shows that: 1) routes with an upward displacement causes the highest peak and mean heart rate; 2) the route with a vertical displacement on overhanging wall is physiologically the most demanding; 3) the traverse is physiologically the less demanding.

References:

1. Sheel A. MSSE, 2003, 35(7), 1225-1231

2. Watts P. MSSE, 1998, 30(7), 1118-1122.

Poster presentation (PP)

PP1-02 Training and Testing 1-7 - "Exhibition Hall"

HIGH ABILITY AND TALENT IDENTIFICATION IN SWIMMING, WRESTLING, AND GYMNASTICS

Révész, L., Trzaskoma-Bicsérdy, G., Bognár, J., Géczi, G.

Semmelweis University Faculty of Physical Education and Sport Sciences (TF), Hungary

Introduction

Elite sport demand sportsmen with different anthropological, psychological, mental, social skills, and coordination-conditioning ability complexes. For sport experts examining high ability and talent issues, it can be important to unambiguously assess the contribution of genes and training to individual differences in performance. Sport scientists have been divided over the respective importance of biological and environmental contribution to expertise. The nature and nurture question has been long discussed, theories have been developed but coaches and managers have yet to wait for sport specific practices with their talent developmental work.

Hungarian swimmers, wrestlers, and gymnasts are among the best elite athletes in the world. We have long been proud of their ongoing successes and Olympic, World and European championship medals. Still, there are no identified or documented talent identification and management models for their practices.

Hence, the aim of our study was to examine the specificity of high ability and talent identification in swimming, wrestling, and gymnastics.

Methods

This qualitative study was based on the experiences and viewpoints of well-known coaches (N=12) and one Olympic medalist from the sports swimming, wrestling, and gymnastics. All the coaches have successes as sport specialists at the international level, and most of them participated in the Olympic Games as national coaches or team leaders. Among their competitors there are a lot of Olympic, World- and European Championship medalists. Structured interviews with each participant lasted for an hour, they were taped and transcribed. The answers were analyzed and then were grouped into themes.

Results

Swimmers highly emphasized inherited abilities, such as anthropometrical parameters, flexibility, endurance, coordination, love for sport, monotony bearing, parental support, and sport specific appearance. Wrestling coaches do not consider success as talent in childhood years, but more like a skillful competitor. Besides through systematic training programs, talent unfolds due to genetically determined physical ability complexes and specific psychological factors. In wrestling talent can be easily lost due to social factors, such as financial or family problems, or studies. Gymnasts emphasized flexibility, balance, rhythm, love for sport, overcoming long-time psychological and physical load, parental support, overcoming fear, and aesthetic skills.

Conclusions

Competitive sport is highly specialized. Physical and physiological abilities are very important conditions of sport results in these sports, but they are other factors as well determining high expertise. Preparation in swimming, wresting, and gymnastics tends to be a long and demanding process in which physical abilities, psychological, mental and social factors, and also the time spent with training seem to have of high importance. Based upon this study we cannot support Ericsson's deliberate practice theory.

PREDICTION OF RESTING HEART RATE VARIABILITY FROM TRAINING LOAD TIME SERIES

Di Michele, R., Merni, F.

Faculty of Exercise and Sports Science, Italy

INTRODUCTION

HRV monitoring, economic and non-invasive, allows the detection of possible symptoms of autonomic imbalance and has been suggested as potential tool to prevent overtraining in competitive sport [2]. Previous studies showed that resting heart rate variability (HRV) measures, indices of autonomic function, are influenced by exercise, both after a single bout [1] and training cycles [2]. To date however specific short- and long-term effects of training on HRV parameters are not completely clear. Our aim is to check the predictability of daily HRV measures time series on the basis of training volume and intensity series.

METHODS

HRV was recorded in a middle-distance runner (VO2max = 65 ml*Kg-1*min-1; Age:23,2; height: 175 cm; bm:64,5 Kg), at the awakening, for 90 consecutive days, with a telemeter (Polar S810; Polar Electro Oy, Finland), for 5 min in supine and 5 min in upright position. Data were processed through the HRV Analysis Software 1.1 for windows (developed by The Biomedical Signal Analysis Group, Department of Applied Physics, University of Kuopio, Finland, and free available at the website http://venda.uku.fi/research/biosignal). All the commonly used time and frequency domain HRV measures [3] were computed. The athlete trained once a day, in the evening. Volume (min) and intensity (speed %AT) were recorded. For each of HRV indexes a forecasting model was computed treating training volume and intensity separately as independent variables (predictors). Stationary R-squared (R2) was considered to determine the goodness of the model. The bivariate time series analysis was performed through the software SPSS® 14.0 (SPSS Inc, USA)

RESULTS

Considering training volume as the predictor variable, the upright HR is the better predictable measure (R2=0,505), while for other parameters models are not good (R2<0,3). 4 HRV variables are better foreseeable from the training intensity time series: supine HR (R2=0,581), triangular index in the supine position (R2=0,535), the minimum RR interval after standing up (R2=0,518), and upright HR (R2=0,552).

CONCLUSIONS

Bivariate time series analysis shows that some HRV measures are more influenced by training than others, and may be forecasted with a sufficient accuracy from training load series data. Training intensity seems a better HRV predictor than volume and it should be considered for the predictions by coaches using HRV as a tool for the detection and prevention of overtraining.

1.JAMES DV et AL.Heart rate variability: response following a single bout of interval training. Int J Sports Med. 23(4):247-51.2002

2.PICHOT V et AL.Relation between heart rate variability and training load in middle-distance runners. Med Sci Sports Exerc.32(10):1729-36.2000

3.TASK FORCE OF THE EUROPEAN SOCIETY OF CARDIOLOGY AND THE NORTH AMERICAN SOCIETY OF PACING AND ELECTROPHYSIOLOGY.Heart rate variability: standards of meaurement, physiological interpretation, and clinical use. Circulation. 93:1043-1065. 1996.

HEART RATE RESPONSE TO STEADY STATE RUNNING REFLECTS AEROBIC FITNESS AND RUNNING ECONOMY

Niva, A. 1, Nissilä, J. 1, Pullinen, T. 2, Juuti, R. 2, Kinnunen, H. 1

1 Polar Electro Oy, Kempele, 2 Department of Biology of Physical Activity, University of Jyväskylä, Jyväskylä, Finland

Purpose: Novel technology provides tools to monitor heart rate (HR) and running speed freely in outdoors as well as on treadmill. This study was conducted to test if a minute by minute HR response to submaximal running speed can be used to estimate runner's maximal workload (Wmax), VO2max and running economy. Our goal was to develop a reliable running performance index which could be measured at all running speeds.

Methods: A group of 4 male (mean ± SD, 25 ± 4 y, 180 ± 4 cm, 73 ± 8 kg, 48 ± 2 ml/kg/min) and 9 female subjects (25 ± 3 y, 166 ± 7 cm, 62 ± 9 kg, 39 ± 6 ml/kg/min) took part in a training intervention. The training lasted 12 weeks, starting with 2 to 3 and ending with 4 to 5 weekly running sessions. Intensity was controlled with personal HR monitors, and training sessions were targeted to light (45-60%), moderate (60-70%) and hard (70-87.5%HRR) intensity areas.

VO2max, Wmax and running ECO were measured at weeks 0, 6 and 12. A graded maximal treadmill protocol was used to measure VO2max and Wmax. Two separate constant workload treadmill running sessions, 30 minutes at 60% of initial Wmax and 25 minutes at 75% of initial Wmax, were organized to evaluate running economy. Economy was determined from the difference between theoretical and measured VO2 during final five minutes of the tests. HR response was measured with Polar HR monitors. The three performance tests were always conducted in the same order and separated by at least 48 hours from each other.

A running performance parameter, Running Index (RI), was calculated from minute by minute %HRR and treadmill speed measured during the constant workload tests. The calculation was based on the estimated linear relation between theoretical %VO2 reserve and %HRR. HR drift was compensated so that each minute by minute HR contributed equally in the calculation and corresponded to HR at 12 minutes of running. RI was presented in the same numeric scale as theoretic VO2max.

Results: The subjects trained a weekly average of 158 min (93% of target). Intensity varied between 40 and 90 %HRR and median was at 60-70 %HRR). RI evaluated both at 60 %Wmax (39 ± 6, 41 ± 6, 42 ± 7) and 75 %Wmax (41 ± 7, 41 ± 5, 42 ± 6) showed similar results with VO2max (42 ± 6, 44 ± 7, 43 ± 7 ml/kg/min) at weeks 0, 6 and 12, respectively. RI correlated strongly with Wmax (r = 0.87, 0.68, 0.74 at 60% and 0.84, 0.87, 0.87 at 75% Wmax) and VO2max (r = 0.85, 0.66, 0.67 at 60% and 0.85, 0.86, 0.83 at 75% Wmax). Importantly, the deviation between RI and measured VO2max correlated positively with running economy, and the correlation was the strongest at moderate aerobic speed after 12 weeks of training (r = 0.76 at 60 %Wmax).

Conclusion: The novel performance parameter, Running Index is a reliable indicator of running performance. Along with maximal performance, RI gives information on running economy. Running economy seems to be a strong determinant of HR response at submaximal workloads, especially after running training.

EFFECT OF WEARING AMERICAN FOOTBALL HELMETS ON NECK FUNCTION IN EXTENSION AND FLEXION

Hume, P.J., McCarthy, P.W., Lark, S.D., Heusch, A.I.

University of Glamorgan, United Kingdom

Introduction: Players in contact sports such as American football and Rugby have a higher risk of suffering cervical spine trauma. However, there have been few investigations into the effect of American football equipment upon the cervical spine and no studies using British Collegiate American football players (BCAFs).

Methodology: BCAFs (n=15) volunteered and were matched to non-American football playing university students (controls; n=11). The tests took place in the afternoon and followed a standardized protocol. A cervical range of motion (CROM) device (Youdas et al., 1991) had been modified by adding lasers which could be aimed at targets mounted on the wall to assess repositioning accuracy. An American football helmet was similarly modified. Both were used to measure the subject's CROM and their repositioning error returning to a set point from full flexion or extension. ANOVA, Paired and unpaired comparisons were performed on the data using SPSS software for PC.

Results: BCAFs had significantly better repositioning in flexion ($p<0.005$) compared with controls. The helmet was found to significantly reduce the CROM in extension ($p<0.05$) in both groups.

Discussion: The results show that there is no significant difference between players and non-players in all forms of repositioning when they are not wearing the helmet and when returning to neutral from an extended position wearing the helmet. However, BCAFs appear to have an increased accuracy when returning from flexed posture to neutral when wearing the helmet. The relative specificity of this change (i.e. no change in accuracy from an extended posture) might relate to the reduction of CROM into extension imposed by wearing the helmet (seen in both groups).The improvement in accuracy in the BCAFs suggests that the players have adapted to some as yet unknown additional sensory information that they receive whilst wearing the helmet, which the untrained (controls) were not aware of.

Conclusions: British Collegiate American football players who have had at least 3 years experience have a greater accuracy in repositioning their head (a potential indicator of enhanced proprioception) from a flexed posture which is only apparent when they are wearing an American football helmet. American football helmets appear to significantly reduce the CROM in extension in all parties.

Youdas, J. W., Carey, J. R., Garrett, T. R. (1991) Physical Therapy, 71, 98-106.

ANALYSIS OF COGNITIVE ACTION VELOCITY OF FEMALE HANDBALL GOALKEEPERS AS A BASIS FOR EFFECTIVE TRAINING IMPROVEMENT

Speicher, U., Kleinöder, H., Klein, G., Mester, J.

Institute for Training Science and Sport Informatics, Germany

Introduction: The position of the goalkeeper (GK) is of decisive importance for the success of the team. Nevertheless, there are only few leads for a detailed training improvement. In many cases training units are planned simply intuitively. Therefore it is the intention of the investigation to provide a scientific analysis of actual demands on handball GKs. Cognitive action velocity poses a general demand in handball specific situations such as the start and defence of the counterthrust by the GK. These have been verified as the decisive requirements according to recent match analysis. On this basis appropriate suggestions for training practice shall be provided.

Methods: Cognitive action velocity was tested with 28 female GKs from 1st to 5th league. For this purpose a videographic and a structure dimensional test have been combined. The videographic analysis was used to elucidate the decision process of the GKs. Both the individual solution of handball specific situations itself and the required time budget for decision making were measured. For this purpose a computer program was developed. The video sequences were filmed from the GK´s perspective during different game situations of the counterthrust. The analysis of mental representation clarifies the fundamental perception for each decision. This was realized by adapting the Structure Dimensional Analysis-Motorics (SDA-M; Schack, 2004) to GK specific demands. Thus GKs judged the context of perception by using terms which represented the game situation in question.

Results: All divisions showed significant differences in the situation start of counterthrust with respect to hits and decision time (ONEWAY ANOVA). Moreover, the different levels could clearly be identified by regression, too. The functionality of perceived situation decreases from higher to lower levels. The SDA-M by means of Lambda matrix also confirms the division in different leagues. In the situation defense of counterthrust the best division specific mental structures can be defined. The video analysis allows comparisons with top level and clarifies the drop in performance for each level.

Conclusion: Both tests helped to analyse the gap between the real situation and the perceived impression of the GK. This allows a better training improvement because the training considers the specific aspects of the situation and a better time management as parameters of cognitive action velocity. Typical hierarchy of division can be identified which allows a formulation of specific (start of counterthrust) and general (defense of counterthrust) training aims. This means that the training will become more effective even without the practical experience of goalkeeping. The adequate parameter for training improvement will be provided so that the appropriate exercises for each individual can easily be chosen from existing literature.

References:Schack, T. (2004). The cognitive architecture of complex movement. Int J Sport Exerc Psych; Special Issue PartII: The construction of action-new Perspectives in Movement Science, 2(4), 403-438.

RELIABILITY AND SENSITIVITY OF SPRINT PERFORMANCE THROUGHOUT 3H CYCLING

Currell, K., Kirk, T., Jentjens, R., Jeukendrup, A.E.

University of Birmingham, United Kingdom

When measuring performance or fatigue the protocol used must be reliable, valid and sensitive enough to detect small changes that are relevant to athletes. The aim of this study was to investigate the reliability and sensitivity of power output during a 25s sprint throughout 3h of cycling as a measure of fatigue.

Thirteen male subjects were recruited (Age 27 ± 2 years, VO2max 64.3 ± 0.9 ml.kg-1.min-1, Wmax 367 ± 9 W). The subjects underwent four trials to determine the reliability and sensitivity of the protocol. Three of these trials were placebo trials with the final two trials being randomised and counterbalanced with a carbohydrate beverage (6.67% Maltodextrin solution). Subjects reported to the laboratory between 7 – 9am in a fasted state. The protocol involved cycling at 55% Wmax for 3 h. Every 20 min the subjects performed an all out 25s sprint. Following the sprint the power output dropped to 45% Wmax for 95s to allow the subjects to recover. Subjects were given 60, 30, and 10s warnings that the sprint was about to occur, followed by start and stop. In the five minutes prior to the sprint expired air was collected as well as blood, heart rate and RPE. A 600ml bolus of a placebo drink was given prior to the onset of exercise with a 230ml

bolus given 8min prior to each sprint. Each sprint was analysed for mean and peak power. Measurements of mean power and fatigue index (peak-lowest/peak %) of the mean powers of the nine sprints were also calculated. The placebo trials were analysed for reliability of mean power output over the nine sprints and fatigue index using a coefficient of variation (CV), with 95% confidence intervals. The CV of the mean and peak power of each sprint was also calculated.
There was no significant difference in mean power, peak power and fatigue index between these trials ($P > 0.05$). There was no significant correlation ($P > 0.05$) between the measurement error and any of the power variables. The mean power over the nine sprints had a CV of 9.4% (95% CI 6.9 – 17.3%), peak power had a mean CV of 15.4 % (95% CI 11.3 – 31.0%), and fatigue index 53% (95% CI 45 – 144). There was no significant effect of carbohydrate on mean or peak power and fatigue index ($P > 0.05$). It appears that sprint performance during prolonged exercise is not dependent on exogenous CHO delivery.
Therefore the test did not prove sensitive to carbohydrate feeding, probably because carbohydrate feeding does not fuel the very high intensity sprints. The protocol appears to have a lower variation than other measures of fatigue such as a time to exhaustion protocol (CV ~ 25%) and can therefore be used to describe the fatigue pattern over time.

THE EFFECTS OF PRELOADING USING HEAVY RESISTANCE EXERCISE ON ACUTE POWER OUTPUT DURING LOWER-BODY COMPLEX TRAINING

Schneiker, K.T., Billaut, F., Bishop, D.

The University of Western Australia, Australia

Complex training involves the use of alternating sets of biomechanically similar heavy resistance exercises and explosive exercises. It has been demonstrated that a set of heavy resistance exercise can result in greater acute power output during subsequent low-load power movements (Young et al., 1998). The phenomenon by which the explosive capability of muscle is enhanced after it has been subjected to maximal or near-maximal contractions is referred to as post-activation potentiation (PAP). Complex training has been advocated based on the assertion that acute increases in power output, as a result of PAP, may result in greater chronic adaptations in power development. Based on this premise, complex training may be superior to more traditional methods of training only if the specific training protocol used results in PAP. The purpose of this study was to determine whether preloading using half squats results in PAP and an increase in acute power output during subsequent sets of high-load squat jumps. To do this, nine male team-sport athletes were recruited from a state-level Australian Rules Football club. Participants had prior experience with performance of the half-squat exercise and were familiarized with performance of loaded squat jumps prior to testing. To determine baseline values, participants performed two sets of loaded squat jumps involving six repetitions with the bar loaded to 30% of 1RM. The PAP testing protocol was designed to simulate a complex training session and involved performance of alternating sets of six repetitions of heavy half squats (6RM), and six repetitions of loaded squat jumps (30% 1RM). During all testing sessions, participants performed a standardized warm-up, cadence for squat jumps was kept constant and rest period length between sets was four minutes. Results were recorded as peak power output and mean power output for each set of jumps. Data revealed a trend for increased peak power and mean power for the first set of jumps (3.2% and 2.6%) and the second set of jumps (1.7% and 1.9%). While these results are similar to the 2.8% increase in explosive jump height reported by Young et al., increases in power output failed to achieve statistical significance ($P > 0.05$). While these results may be partially attributed to the large variability in individual responses, it is also possible that PAP improves subsequent low-load, but not high-load, power. In conclusion, it was found that preloading using half squats had no significant effect on peak power or mean power output during subsequent sets of loaded squat jumps. Based on these results, performing alternating sets of 6RM half squats and high-load squat jumps with four minutes of rest between sets may not be an effective protocol for use during complex training.
Young, W. B., et al.. JSCR. 12:82-84, 1998.

WHOLE-BODY VIBRATION-INDUCED IMPROVEMENTS IN STATIC BALANCE CONTROL AND KNEE EXTENSORS AND FLEXORS ISOKINETIC STRENGTH OF MIDDLE-AGED WOMEN

Spilipoulou, S.I., Amiridis, I.G., Oikonomidis, D.

Laboratory of Neuromuscular Control and Therapeutic Exercise, Geriatric Unit, Pathology Clinic, Ippokrateio Hospital, Greece

Spiliopoulou I Stiliani1, Amiridis G Ioannis1, and Oikonomidis Demetrios2

Numerous findings provide evidence in support that mechanical vibration could positively influence many risk factors of falling and enhance muscle strength of the lower extremities (Runge et al. 2000). To add further conclusive evidence on the efficacy of whole-body vibration thirty (58.5+5.3years, 156+6cm, 69+6.2kg) middle-aged women, all free from any neurological, musculoskeletal disease or impairment, voluntarily participated in the study and classified into one of two groups, either the Training Group (TG, n=15) or Control Group (CG, n=15). The TG performed 36 training sessions (40min/session, 3s/week) divided into 3 phases, warm-up, principal phase (30min, mainly isometric exercises such as, standing in a half-squat position with or without handstand to the support) and recovery. An interval protocol was applied alternating muscular contraction and rest time (1:3 to 1:1) progressively increasing training volume and intensity (from 15Hz, 2mm, 10sec to 30Hz, 8mm, 45sec). During training, participants were encouraged to strongly contract their muscles especially knee extensors and flexors, taking into account their level and session number. Three postural tasks (5 sec) of increasing difficulty were performed: a. Normal Quiet Stance, Sharpened or tandem Romberg Stance and One-Legged Stance. Peak-to-peak amplitude (CοPmax) and standard deviation (CoPsd) of Center of Pressure (CoP) oscillations along the Anterior/Posterior (A/P) and Medio/Lateral (M/L) axis were calculated from ground reaction forces (Kistler 9281C, 1000Hz). All tests were performed with Eyes Open (EO) and Eyes Closed (EC). To evaluate isokinetically the knee extensors and flexors moment, participants performed 3 maximal concentric actions in 5 angular velocities (600, 1200, 1800, 2400 and 3000.s-1) as well as 3 maximal eccentric actions in 2 angular velocities (600, 1200.s-1), randomly presented in an isokinetic dynamometer (Cybex Norm, NY). Statistical analysis revealed that after training, TG had significantly lower ($p<0.001$) and less variable ($p<0.001$) CοP excursions than the CG in both A/P and M/L direction. Increased postural requirements induced greater ($p<0.01$) CoPmax and CoPsd values for both groups. Post hoc analysis of a significant STANCExGROUPxVISION interaction ($p<0.01$) revealed that TG demonstrated a greater restriction of CoPmax and CoPsd under EC than under EO conditions, across all balance tasks. Constant Angular Moments developed during concentric (60, 120, 1800.s-1) and eccentric (1200.s-1) actions by knee extensors and eccentric (60, 1200.s-1) actions by knee flexors were significantly ($p<0.05$) increased after training, for the TG. In conclusion, this study revealed that the vibration intervention had direct influence on static balance control especially with eyes closed and knee extensors isokinetic strength of middle-aged women.
REFERENCES
Runge M, Rehfeld G and Resnicek (2000) J Musculoskel Interact 1: 54-58.

HEART RATE AND LACTATE PROFILE IN BEACH SOCCER

Lederhilger, B., Trauner, T., Schwameder, H.

University of Salzburg, Austria

Beach soccer is a young and growing sport with 20 national teams currently in Europe. It is played barefoot on a sand-pitch (38x28m) with 4 players and a goalkeeper in each team. The specific format (three periods of 12 min each, free substitutions, free kicks without barrier, 'always a winner' and high goal average) make the sport dynamic and attractive for the spectators (www.beachsoccer.com). A game lasts about 1 hour with an average playing time of 36±8 min per player.

Only little is known so far about the physiological demand in beach soccer and about the specific game activities. Beach soccer is often compared with soccer and therefore it is important to know whether or not the specific demands and training programs for soccer can be transferred to beach soccer.

The purpose of the present study was to analyse heart rate and blood lactate of the Austrian and Swiss beach soccer national teams (17 players total) during two games and to perform diagnostic tests prior to the game. Specific game activities were simultaneously documented (Trauner 2006). The results were compared with studies in soccer (Reilly & Craig 2005, Sassi 2005) and basketball (McInnes 1995).

Heart rate was measured (Polar S810) with a 5 s interval before, during and after game one, game two and a 20-m shuttle run on sand. The shuttle run was used as a performance diagnostics test. Lactate samples were taken from the earlobe: prior to the games and the shuttle run, before and after each activity, 3, 6, 9 and 12 min after the games and the shuttle run. The samples were analysed using a Biosen 5040. The data from the two games and teams were averaged. Data from the two games were correlated with the data of the shuttle run.

The players showed maximal heart rate (HRmax) and maximal lactate (Lmax) during the shuttle run. The average HRmax during the shuttle run was 188±9 bpm. The average maximal heart rate during the games was 98% of HRmax. The mean heart rate during the games was 167±13 bpm (89% of HRmax). On average the players were 56% (20 min) of the active time between 90-100% of HRmax, 34% (12 min) between 80-90% of HR max and 10% (4min) below 80% of HRmax. On average Lmax was 11.1±2.7 (6.9-15.0) mmol/l in the shuttle run and 8.1±3.6 (4.7-14.9) mmol/l during the games.

The different involvement of a player in the games and the time of sampling cause a wide range of blood lactate accumulation. Regarding heart rate and lactate profiles in beach soccer were found to be very similar to small-sided games in soccer (Reilly & Craig 2005, Sassi et al, 2005) and in basketball (McInnes et al 1995). Training programs of soccer need to be adjusted to the high energy demands of beach soccer players. The demands in beach soccer differ from soccer due to the specific characteristics. In particular, the influence of the sand and the small pitch needs further investigations.

Trauner (2006). Univ. Salzburg.

McInnes et al (1995). JSS.

Reilly&Craig (2005).Sci&Fo II.

Sassi et al (2005). Sci&Fo V.

MUSCLE DE-OXYGENATION AND NEUROMUSCULAR FATIGUE DURING REPEATED SUPRA-MAXIMAL EXERCISE

Racinais, S., Bishop, D., Denis, R., Lattier, G., Mendez-Villaneuva, A., Perrey, S.

University of Montpellier, France

Purpose and Methods: Central fatigue has been suggested to "protect" the muscle from further peripheral fatigue (and damage), but at the expense of a truly maximal performance. In order to investigate if the decline in power output across sprint repetitions is associated with evidence of a central fatigue concomitantly with changes in peripheral metabolic parameters, nine healthy male subjects performed a repeated-sprint test (consisting of ten, 6-s, maximal sprints every 36 s). Oxygen uptake was measured breath-by-breath, vastus lateralis muscle de-oxygenation was assessed continuously using near infrared spectroscopy and surface electromyograms (EMGs) of both agonist (vastus lateralis) and antagonist (biceps femoris) muscles were recorded. Prior to and following the fatiguing cycling exercise, maximal voluntary force, neuromuscular efficiency (NME = force / RMS activity) and the percentage of muscle activation by voluntary drive (twitch-interpolated method) were measured.

Results and discussion: Consistent with previous research, our data showed a significant power decrement during the repeated-sprint test ($P < 0.05$). For the first time however, our data indicate that there is an increase in muscle de-oxygenation during this kind of exercise which seems to be the result of an inability to restore pre-sprint levels of oxygen saturation during the 30 s of recovery following each sprint. Indeed, our results showed that the increase in [HHb] engendered by each sprint remained fairly constant throughout each sprint repetition (+21.34 ± 1.56 ?mol.L-1), suggesting that the ability of the subjects to utilize available O2 was well preserved. However, at the end of each recovery period, [HHb] failed to return to the end-recovery value of the previous sprint ($P < 0.002$) leading to a progressive muscle de-oxygenation. Consistent with the hypothesis of a central fatigue concomitant to peripheral change, the progressive muscle de-oxygenation during repeated bouts of short-term exercise was coupled with a significant decrease in EMG activity ($P < 0.05$).

Our results also showed a significant decrease in maximal voluntary force (-16.5%, $P < 0.05$) after the cycling test which can be explained by both a significant impairment in NME (-11.4%, $P < 0.05$) and a significant decrement of the percentage of voluntary activation (-3.0%, $P < 0.05$). In consequence, our hypothesis that there is a central limitation to the performance of repeated-sprint exercise was also supported by a significant decrease in voluntary activation from rest to post exercise MVC. This decrement has previously been observed after prolonged running, but this is the first time that a reduced maximum voluntary activation has been reported following repeated-sprint cycling exercise.

PHYSIOLOGICAL PROFILES OF JUDO ATHLETES AND CLIMBERS: A COMPARISON

Pocecco, E., Holztrattner, E.

Institute of Sports Science, Austria

Introduction. Judo and climbing both use the whole body, but in different ways. In the literature there is apparently neither a comparison between spiroergometric parameters of athletes of these two sports nor research focusing its attention on the development of a laboratory test lasting the duration of a judo/climbing competition (about 5 minutes), regarding maximum arm and leg performance.

Purpose. The aim of this study was to describe and to compare maximum arm and leg performance attributes of male adult judo athletes (n=6) and climbers (n=7) of different rank, derived from laboratory tests, which are similar in duration to a competition (5 minutes).

Material and Methods. Anthropometric measurements included height, body weight, Body Mass Index (BMI) and body composition (BIA). The tests consisted of a continuous incremental load test with the arm crank ergometer (Pstart=25W, power increment units body weight dependant, intending to peak at about 5 min) and in a 5 min test on the cycle ergometer with a constant maximum sustainable work load (torque factor=0.5). Recorded parameters during the tests were: maximum power (Pmax) during arm cranking and mean power (Pmean) during cycling; heart rate, VO2peak, ventilation and respiratory exchange ratio.

Results and Discussion. The only anthropometric parameter that differed markedly between the two groups of athletes was the BMI (significantly lower among climbers) reflecting probably different constitutional types.

Climbers had nearly the same arm and leg relative power values (upper body: Pmax=2.73±0.28W/kg, lower body: Pmean=4.41±0.29W/kg) as judokas (upper body: Pmax=2.75±0.33W/kg, lower body: Pmean=3.95±0.46W/kg), but their VO2 values for reaching those performances were significantly higher (climbers – upper body: 39.4±2.7ml/min/kg, lower body: 58.0±3.6ml/min/kg vs. judokas – upper body: 30.0±3.5ml/min/kg, lower body: 50.2±6.4ml/min/kg; t-test – upper body: $p<0.001$, lower body: $p<0.05$). In contrast, performance of judo athletes may depend more on anaerobic capacity. The reason of these differences could probably be explained by the different focus in the additional conditioning training: endurance (climbers) vs. strength (judokas).

The correlations between upper and lower body physiological parameters of both groups (climbers – power: $r=0.759$, $p<0.048$; VO2 peak: $r=0.918$, $p<0.004$; judokas – power: $r=0.812$, $p<0.001$; VO2peak: $r=0.574$, $p<0.013$; arm Pmax vs. legs' VO2peak: $r=0.637$, $p<0.004$) reflected the general state of training of the whole body, since in judo as well as in climbing both upper and lower body are involved in determining the performance. A similar result was that of the athletes of the 1987 Canadian National Judo Team, among whom the physical work capacity with the arms (PWC170) was significantly correlated with the VO2max as determined from the treadmill aerobic test (1).

References

1. Thomas, S. G. et al. (1989). Can J Sport Sci, 14(3), 142-147.

MOTORCYCLING COMPETITION: IS CARDIAC LOAD DEPENDENT TO TRACK? A CASE STUDY

D'Artibale, E. 1, Tessitore, A.1+2 , Tiberi, M.1+3, Capranica, L. 1

1 Iusm of Rome, 2 Vrije University of Brussels, 3 Asur Marche, Italy

Introduction

The high accelerations and the speed of the motorcycling road races require a relevant physical effort, which might depend on characteristics of the track (Ceccarelli, 1999; Gobbi et al, 2005; Jacobs et al, 2002). However, there is a lack of scientific information regarding the rider's physical load depending on different tracks. Thus, the aim of this study was to evaluate the cardiac load of a rider during the competitive season of the European Motorcycling Road Race Championship.

Methods

A male rider (age 21 yrs, height 167.5 cm; body mass 69.8 kg; BMI 24.9; percentage of body fat 12.9 %; VO2max 67.2 ml/min/kg), competing in the 2005 European Road Race Championship (600SuperSport class), gave his written consent to participate in this study. Data were collected during the seven grand prix of the Championship (track length: 3854±472 m; right curves: n = 6.7±1.6; left curves: n = 6.3±1.3). Each competition was organized during three consecutive days, which included two 25-minutes free practice trials, two 25-minutes qualifying trials and an official race (total length 79.4±8 Km; track condition: dry; ambient temperature: 25.6±4 °C; humidity: 53±15%). The rider's heart rate (HR) was recorded during competitions (Team System, Polar, Finland) and the intensity of performance was calculated as percentage of his HRmax. Furthermore, a questionnaire was used to assess the level of difficulty of the tracks. Significant differences ($P<.05$) between competitions were tested by means of the analysis of variance and chi-square test. The Pearson correlation was used for correlation analysis between the HR data, the performance score variables, the questionnaire scale variables.

Results

During the race, the mean speed of the participant was 143.7±12.7 Km/h, mean time was 32'51"± 4'28" and his ranking was always within the first four positions. Significantly ($P<.05$) higher HR values were found during the official race (occurrence of HR ≥90% HRmax: 97±5%) with respect to the qualifying trials (occurrence of HR ≥90% HRmax: 68±15%) and free practices (occurrence of HR ≥90% HRmax: 53±20%). A significant positive correlation ($r=.76$; $P<.05$) was found between the frequency of occurrence ≥90% HRmax and mean speed of the race. No correlation between frequency of occurrence of %HRmax and score of the track difficulty questionnaire.

Conclusion

The present study shows that motorcycling performance requires a high cardiac load, which is correlated with the high mean speed of the races. Instead, the cardiac load does not reflect the subjective perception of track's difficulty. The results indicate that to ride the motorcycle at high speed, riders might benefit from a specific training aiming at improving their cardiovascular fitness level.

References

Ceccarelli R (1999). Medicina dello sport, 52: 323-7

Gobbi AW, et al. (2005). Br J Sports Med, 39: 927–31

Jacobs PL et al. (2002). Med Sci Sports Exer, 34:2085-90.

RELATIONSHIP BETWEEN PLANTAR PRESSURE AND SUBJECTIVE PERCEPTION PROPERTIES DURING LANDING ON MATS

Pérez, P., Llana, P., Alcantara, E.

University of Valencia (Spain), Spain

INTRODUCTION: Landings suppose a great stress for the muscle-skeletal system and a great challenge for the gymnasts. There are several studies whose analysed kinetic and kinematic foot variables during landings on different mats or surfaces (1), but magnitudes or plantar pressure pattern on foot zones are not study yet to identify injuries or mats properties. The objectives of this study were: a) analyse the maximum plantar pressure in different anatomical foot zones, and b) describe the plantar pressure pattern and its relation with gymnast stability and properties perception on different mats. METHODOLOGY: Five male gymnast with national and international sports level performed 5 valid drop jumps, from a height of 0.8 m, on 6 different mats. Plantar pressures in right foot were evaluated by system

instrumented insoles Biofoot/IBV 2001®. After 5 valid landings on each mat, the gymnast valued with a survey the properties perception in mats. The statistical analysis was made by statistical package SPSS.10. RESULTS: A similar pattern in a plantar pressure was observed in all mats. ANOVA identified several statistically significant differences ($p<0.05$) in different zones by mat. Factorial analysis identified the relations between foot zones, and identified 4 factors that are represented with a 83.80% of the total explained variance. Results about properties perception in non-parametric analysis of variance did not show any statistically significant differences ($p< 0.05$). Significant correlation ($p<0.01$) were identified in a nonparametric correlations analysis on perception and pedobarography variables. DISCUSSION: Results showed great pressure in CH (785 ± 231.9 Kpa), followed of H5M (352.6 ± 124.3 Kpa) and rest zones had similar magnitudes (near 200Kp).

A THEORETICAL ANALYSIS OF THE TAPER IN COMPETITIVE SWIMMERS

Thomas, L., Mujika, I., Busso, T.

University of Saint-Etienne, Athletic Club Bilbao, France

The mathematical model of training responses proposed by Busso (2003) allowed simulations to analyse the factors affecting the efficiency of the period of reduced training before a competition, termed taper (Thomas and Busso 2005). That study showed that greater solicitations before the taper would allow reaching better performances, but would demand a greater reduction of the training loads over a longer period. Nevertheless, the characteristics of the optimal taper in that report did not match very well the data of the literature, which suggests that the reduction of training volume should reach 60 to 90% over a period ranging from 4 to 28 days (Mujika and Padilla 2003). These discrepancies could arise from the data used to derive the model, which came from 6 non-athletic subjects enrolled in a controlled experiment on a cycle ergometer. The aim of the current study was thus to examine the factors which could affect taper efficiency in an athletic population.

The model of Busso (2003) was applied to 8 elite swimmers over two entire seasons in real training conditions. The model parameters were individually determined by fitting the modeled performances to the actual ones. Afterwards, the model parameters were used to estimate for each subject the characteristics of the step taper which would maximize performance for two simulated situations before the taper: (1) a regular training corresponding to the average training done by the subject (without OT) and (2) with an overload training corresponding to an increase of 20% of the training amounts over the 4 weeks before the taper (with OT).

The fit between modeled and actual performances was statistically significant for the 8 swimmers (r^2 ranged from 0.45 to 0.63, $P<0.005$). The optimal taper yielded to a higher gain in performance with than without OT (3.6 ± 2.6% vs 2.0 ± 1.6%, $P<0.005$) for an optimal duration longer with than without OT (22.4 ± 13.4 d vs 16.4 d ± 10.3, $p<0.05$). However, there was no statistical difference in the optimal rate of training reduction (67.4 ± 27.0% with OT and 65.3 ± 30.5% without OT).

These findings confirmed that the pre-taper training would influence the characteristics of the optimal taper. A greater overload before the taper would require a longer taper duration. However, contrary to our previous report, the greater overload would not require a greater relative reduction of training during the taper. The theoretical characteristics of the optimal taper in this study were better in line with the data from the literature. This showed that a highly trained athlete would need a greater reduction of training over a slightly shorter period than a less trained subject. The large observed inter-individual differences also pointed out the importance of the individualization of the taper programme.

Busso T. Med Sci Sports Exerc 35:1188-1195, 2003.

Mujika I. and Padilla S. Med Sci Sports Exerc 35:1182-1187, 2003.

Thomas L. and Busso T. Med Sci Sports Exerc 37:1615-1621, 2005.

HEAT TRANSFER CHARACTERISTICS OF ROWING HEADGEAR WITH RADIANT HEAT FLOW

Bogerd, C.P., Brühwiler, P., Heus, R.

Empa Material Science and Technology, Switzerland

The head is one of the strongest sensors determining human thermal comfort. For this reason several thermal manikin studies have been conducted in reducing heat stress on the head. These studies focused on optimizing convective and/or evaporative heat loss. Radiant heat flow, though often mentioned as a potential factor, has been studied relatively little. Considering that radiant heat flow easily delivers 25 W to the head alone during the summer in temperate climates, this suggests that large differences among different headgear (types) could exist. Shielding solar heat flow while maintaining heat loss close to optimal favors comfort perception and might reduce heat strain. These considerations motivated the development of a prototype rowing headgear (PRH) (Bogerd et al., 2005). The goal of this study is to compare that PRH with other widely-used sports headgear in a non-sweating condition on i) net heat transfer, ii) radiant heat flow, and iii) convective heat flow.

The following headgear were studied: i) the PRH, ii) a white cotton cap (CW) and iii) a black cotton cap (CB). The experiment was carried out for different radiant arrangements: i) without radiation (NoRad), ii) with 18.7 W radiant heat flow from directly above (90) and iii) with 9.6 W radiant heat flow from an angle of 65° (65). Wind, ambient temperature and humidity were kept constant at 4 m∙s-1, 22 °C and 50%. The measurements were then repeated for arrangements NoRad and 90 with headgear PRH, CW and CB in combination with a wig.

All headgear reduced the radiant heat flow: ~80% for the caps and 95% for the PRH. Furthermore, the radiant heat flow contributed maximally for 13% to the net heat transfer indicating that convective heat flow is a more important heat transfer parameter under the tested condition. The PRH reduced convective heat flow only minimally and was therefore the only headgear outperforming the nude head in a radiant environment. The extra heat transfer obtained with the PRH in the most optimal condition and compared with the nude head is 12 W. It is known from studies with artificial cooling that a cooling power as low as 12 W results in a reduction of heat strain for pilots carrying out a flight simulator in a warm environment (Williams & Shitzer, 1974). However, it is unknown if the PRH results in a reduction of heat strain for athletes. Wearing a wig greatly reduces convective heat flow but shows similar qualitative results. The PRH is shown to be more effective in reducing heat stress of the head compared to traditional rowing headgear under the tested conditions.

Bogerd CP, Heus R & Willems JWM (2005). A sun shading headgear used by a Dutch Olympic sculler: A comparative study. Proceedings of ICEE, Ystad, Sweden, 22-26 May: 396-399.

Williams BA & Shitzer A (1974). Modular liquid-cooled helmet liner for thermal comfort. Aerospace Med., 45, 1030-1036.

PHYSIOLOGICAL, HORMONAL AND TECHNICAL ASPECTS OF THE SOCCER GOALKEEPER: A CASE STUDY

Cortis, C. 1, Tessitore, A. 1+2, Meeusen, R. 2, Pagella, A. 1, Capranica, L. 1

1 IUSM of Rome, Italy, 2 Vrije University of Brussels, Belgium, Italy

Research on the performances of soccer goalkeepers lagged behind that on the other soccer roles. Thus, the aim of the present study was to investigate physiological, hormonal and match analysis aspects of a soccer goalkeeper during a one-week competitive microcycle.

Methods

A soccer goalkeeper (age: 21 yrs; height: 185 cm; weight: 80 kg) participated in this study. His heart rate (HR) was continuously recorded (Polar, Finland; sampling = 5 s) during five 2-hour training sessions/week and a competitive match. After the warm-up, first half, and second half of the match, peak blood lactate concentrations (La), countermovement jump (CMJ) and bounce jumping (BJ) performances were measured. Pre-exercise baseline after two consecutive resting days was established for salivary cortisol (C) sampled at 8 a.m., 2 p.m., 5 p.m., and 10 p.m., and morning urinary epinephrine (EPI), norepinephrine (NE), and dopamine (DP). The same sampling schedule was maintained for the training sessions and the competitive match. The goalkeeper was filmed during his trainings and the competitive match. Videotapes were analyzed to evaluate the following motor activity parameters: running, walking, jumping, and inactivity. Thus, the following information was calculated: a) the time spent in each activity; b) the occurrence frequency for each category's; c) the percentage of total time spent in each activity. Analysis of variance (ANOVA) and chi-square tests were applied to verify significant differences ($p<0.05$).

Results

During training, mean HR was 121 ± 21 beat/min (corresponding to 61 ± 11% HRmax), with 75% of HR values <130 beat/min. During the match, the goalkeeper was actively involved in 58 occasions, while spent the rest of the match at low intensity activities (inactivity: 55%; walking: 35%), with 63% of HR values >130 beat/min. Peak La values were 2.7 and 1.8 mM at the end of the 1st and 2nd half, respectively. Both CMJ and BJ performances decreased at the end of the match (before match: CMJ 45 cm, BJ 35 cm; 1st half: CMJ 41 cm, BJ 35 cm; 2nd half: CMJ 38 cm, BJ 26 cm). At the end of the match catecholamines showed higher values (EPI: 168 mcg/l; NE: 321 mcg/l; DP: 772 mcg/l) and remained elevated the day after the match (EPI: 8 mcg/l; NE: 50 mcg/l; DP: 543 mcg/l) than baseline (EPI: 6 mcg/l, NE: 18 mcg/l, DP: 286 mcg/l) and trainings (EPI: 5 ± 3 mcg/l; NE: 19 ± 7 mcg/l; DP: 318 ± 81 mcg/l). Also C showed a similar trend with respect to baseline (8 a.m.: 11.8 ng/ml; 2 p.m.: 4.6 ng/ml; 5 p.m.: 2.1 ng/ml; and 10 p.m.: 1.2 ng/ml) for both trainings (8 a.m.: 10.0 ± 0.9 ng/ml; 2 p.m.: 4.0 ± 0.9 ng/ml; 5 p.m.: 5.1 ± 3.6 ng/ml; 10 p.m.: 1.4 ± 0.3 ng/ml) and match (8 a.m.: 12.6 ng/ml; 2 p.m.: 8.9 ng/ml; 5 p.m.: 29.2 ng/ml; 10 p.m.: 1.8 ng/ml).

Conclusion

Considering the low HR values and the elevated hormonal levels of the soccer goalkeeper, a training program should be focused primarily on the enhancement of all-out activities and on the stress management during competition.

CORRELATION BETWEEN KICKING PERFORMANCE, HORIZONTAL JUMP AND SPRINTING PERFORMANCE

Sporis, G. , Vueti, V., Mihai, V., Jukic, I.

Faculty of Kinesiology University of Zagreb, Croatia

Kicking is the one of the most important skill in soccer. The most frequently used soccer kick are the full-instep kick and the inside-of-foot-passing shot. The full-instep kick is normaly used for generation of a fast ball speed and this type of kick was used in this study. The relation between sprinting ability and performance of athlete in the field (like kicking performance) is subject of controversy not only in biomechanics, but also in other research fields dealing with muscle power.

Twenty-seven croatian national football team members (U-15) (mean (SD) age 15.8 (2.9) years, height 173.5 (5.5) cm, weight 62.1 (5.4) kg) were tested for maximal sprinting ability (sprinting 0-30 m and time over 5, 10, 20 and 30m were recorded), horizontal jump and kicking performance. The velocity of kicking was measured by a Stalker radar gun (from a standing position players took 5 meter run up and perform penalty kicks into the unguarded soccer goal). Time of sprinting was recorded by photocells. Horizontal jump was measured whit standing long Jump test (SLJ). The Person product-moment correlation was used to determine the relationship between selected variables. $P<0.005$ was considered significant.

The mean performance of sprinting test over 5m (sp5) was 1,44 (0,1) sec, 10m (sp10) 2,21 (0,12)sec, 20m (sp20) 3,53 (1,14) sec and over 30m (sp30) was 4,71 (1,19) sec. Standing long Jump (SLJ) 211,09 (15,56) cm, mean ball velocity measured by radar (vb) was 94,4 (4,38) km/h. There was a strong correlation between kicking performance (vb) and sprinting performance in all four sprinting variables sp5 ($r =0,49$, $p<0,05$) sp10 ($r =0,51$, $p<0,05$). sp20 ($r =0,45$, $p<0,05$) and sp30 ($r =0,54$, $p<0,05$), and between kicking performance and body weight BM ($r =0,53$, $p<0,05$). No significant correlation was found between kicking performance and standing long jump.

In soccer, sprinting performance affects kicking performance and can be influence by meters of run up and velocity of foot in the moment of contact whit a ball. Ability which is important in first 5 meters of sprinting is starting reaction, followed by explosive movements, and we can conclude that motor abilities which are in the basis of sprinting and kicking performance are similar. However, the relationship between these parameters and kicking performance has not been fully investigated. Further study is required to determine how these parameters influence kicking performance.

PHYSIOLOGICAL CHARACTERISTICS OF ELITE FEMALE WATER POLO PLAYERS: CHANGES FROM PREPARATORY TO COMPETITIVE PHASE OF TRAINING

Marrin, K., Bampouras, T.M.

Edge Hill College of Higher Education, United Kingdom

There is a dearth of information available on the physiological characteristics of female water polo players, and in particular differences in characteristics between periodised training cycles. The aim of this study was to determine the changes in the physiological characteristics of elite female water polo players between the preparatory and competition phases. Eight female players from the Scottish National squad (mean ± s: age 23 ± 3.1 years, height 169.1 ± 3.5 cm, mass 64.2 ± 5.7 kg) participated in a test-retest design. Subjects completed a battery of tests comprising a number of assessments to provide a profile of the water polo player. The battery of tests were conducted on two separate occasions; the first trial in the preparatory phase (Trial 1) and the second in the competition phase (Trial 2) of training. Body fat percentage was predicted from four skinfold measurements (biceps, triceps, subscapular and suprailiac). Peak oxygen uptake

was assessed via an incremental treadmill test to exhaustion, with expired air being analysed using a Cardio2 automated gas analyser. Anaerobic power (peak power, mean power and fatigue index) was measured via the Wingate anaerobic test and leg power was estimated using a vertical jump test. The Multistage Swimming Shuttle Test (MSST) was utilised as a sports specific test of aerobic power. Normality of data was examined using the Kolmogorov-Smirnov test and subsequently confirmed. Paired t-tests were conducted to determine any differences in the characteristics between the two testing occasions. Significance level was set at $P < 0.05$. The results (mean ± s) of the tests for Trial 1 and Trial 2 respectively were: mass 64.2 ± 5.7 and 63.4 ± 5.3 kg, body fat percentage 22.6 ± 3.9 and 19.3 ± 3.8 %, peak oxygen 52.8 ± 2.5 and 51.9 ± 5.2 ml·kg-1·min-1, peak power 651.7 ± 65.4 and 609.3 ± 34.7 W, mean power 452.1 ± 41.7 and 449.1 ± 41.0 W, fatigue index 48.5 ± 3.7 and 45.2 ± 10.9 %; vertical jump 33.5 ± 8.0 and 33.8 ± 7.6 cm; MSST 35.7 ± 43.3 and 43.3 ± 14.8 shuttles. The percentage differences between Trial 1 and Trial were: mass 1.1 ± 3.3 %; body fat 14.6 ± 9.1 %; peak oxygen uptake 1.7 ± 7.7 %; peak power 5.3 ± 14.9 %, mean power 0.0 ± 11.6 %; fatigue index 6.6 ± 21.4 %; vertical jump –1.7 ± 12.8 % and MSST – 15.9 ± 18.6 %. Significant differences were found between trials for body fat percentage ($P = 0.006$) and MSST ($P = 0.045$). No significant differences were found between other variables. The results suggest that the players were more muscular with a higher sport specific aerobic power in the competition phase, reflecting training adaptations due to the periodised training cycle. However, these improvements did not affect any of the anaerobic power measures and occurred without any concurrent increase in peak oxygen uptake. The latter findings may be attributed to the lack of specificity of these tests. Further studies should include more sport specific tests to provide a more complete profile.

SYSTEMATIC ANALYSIS OF RUNNING SPEED LOADS IN THE WORLD CLASS TENNIS

Pieper, S., Gemperlein, A., Weber, K.

Institute of Movement Science for Games in Sport , Germany

Introduction: The modern elite tennis has changed during the last years essentially. Comparatively young players like Andy Roddick (USA) and Roger Federer (Switzerland) play in a more dynamic way than in former times (higher stroke velocity and stroke precision). Athletic as well as conditioning demands are increasing. The importance of speed in tennis is undisputed among tennis practitioners as well as among theoreticians. Nevertheless, there exists only partly sufficient knowledge of quality and quantity of tennis-specific running speed demands. With the following contribution we could show some important results by the systematic analysis to characterize the running speed demands in elite tennis. Method: For the study thirteen clay court matches are analyzed in the men's singles during the World team cup in 2004 after a systematic criteria catalogue. The results are from 22 top players (age 26±2 y; height 184.9±5.8 cm; BMI 23.6±1.1 kg/m2). All players were at the investigation period placed on the Entry list of the ATP under the top 60. The different tactical adjustments of the players reach from the classic defensive player about the allrounder as far as the offensive player with dominant services. Therefore we can go out with the examination property of a representative sample of top world class players. The present player's observation contains all rallies from 327 pure service games and eight tie-breaks. Results: We determined that in 29% of all strokes the players are under time pressure. In 85% of these situations they run in the baseline to the side. In this connection runs to forehand corner are dominated with 55%. The rate of stroke errors under time pressure amounts to approximate 22%. The highest number of unforced errors lies with strokes under high time pressure (27%). Running distance by strokes under time pressure average four meters whereas run to forehand corner on baseline being the most frequent running direction is clearly followed by run to backhand corner. Run to net rank close up on third place. Conclusion: The game analysis covers the rising importance of running speed in the elite tennis. Compared to earlier works the findings show a bigger frequency in pressure of time situations. In modern clay court tennis every fourth stroke is played under pressure. Besides, the player causes an unforced error with approximate every fifth stroke. To our conviction the shown characteristics of running speed in elite tennis have to be equally simulated in tennis training. Start and sprint speed have to be practiced to running distances from 3 to 8m to the side, especially to forehand as well as to backhand side with or without subsequent changing direction (including stroke) on the baseline.

EFFECTS OF STRENGTH, ENDURANCE AND COMBINED TRAINING ON BLOOD TESTESTRON & CORTISOL CONCENTRATION, VO2 MAX, ANAEROBIC POWER, MAXIMUM STRENGTH AND BODY COMPOSITION IN UNTRAINED MEN

Ghahramanloo, E., Alinejad, G.

Tarbiyat Modares University, Iran

The purpose of this study was to compare the effects of three kinds of exercises (endurance, resistance, and concurrent) on blood testestron & cortisol concentratin bioenergitic characterization, maximum strength and body composition on non athletes.

Participants: 35 graduate students of TMU, randomly selected and then divided into three groups; (E; n=13, S; n=9, C; n=13)

At first blood sampling, maximum aerobic and an aerobic power, maximum strength in four movements (bench press, squat, lat pull down, and leg curl) were measured. Following this the participants conducted eight-week training program.

Endurance Training Program involved running with 65% of Max HR for thirty minutes per session and three sessions per week where the HR reached 80% towards the end of the program.

Resistance Training Program involved conducting three sets of bench press, squat, pull down and legs curl With 60% of M.S, 12 repetitions per set and three sessions per week where the intensity reached 80% of 1RM and where the repetition dropped to 6-8 towards the end of the program.

The Concurrent Training Program involved combining both of E and S groups program.

After eight weeks the variables were measured one more time in the post-test. Based on the findings of this study, Vo2 max in E group achieved maximum increase whereas the minimum increase was observed in the S group.

The rate of increase of testron and cortisol did not show any significant differences between these groups. Vo2 Max changes showed significant difference between E, S group. The rate of increase in aerobic power did not indicate any significant difference among the three groups. Similarly, the rate of increase in maximum relative strength in bench press, squat and lat pull down exhibited significant difference between S and C with E. therefore, adding strength training endurance training isn't detrimental to the improvement of vo2 max. Likewise, endurance training along with strength training doesn't have any negative effect on the improvement of maximum strength. Concurrent training is similar to endurance and resistance training in that it is conducive to enhancing body composition in non athletes.

COMBINED TRAINING INDUCES SPECIFIC METABOLIC AND STRUCTURAL ADAPTATIONS IN ELDERLY WITH HIGH INITIAL VO2 MAX

Verney, J., Kadi, F., Charifi, N., Feasson, L., Castells, J., Piehl-Aulin, K., Denis, C.

Research Unit PPEH, EA 3062, University of Saint Etienne, France

Purpose: We previously reported the effects of endurance training on satellite cells content (Charifi et al. 2003) and muscle capillarisation (Charifi et al. 2004) in still active elderly. In the present study, we investigated the specific effects of endurance and resistance training in similar elderly. A lower body (LB) endurance and upper body (UB) resistance training program was planed. We reported the effects of this combined training on fiber type, fiber area, enzyme activities and satellite cells. Muscles of interest were the endurance trained vastus lateralis and the resistance trained deltoideus. Methods: Ten healthy active elderly men (73 ± 4 yr, pre-training VO2max: 35.8 ± 7.3 mL•min-1•kg-1) were tested before and after 14 weeks of combined training (3 times.wk-1). Training session consisted in 3x12 min of interval training on a bicycle for endurance and 3x12 min of UB resistance exercises. Biopsies were taken from vastus lateralis and deltoideus. Fiber type, satellite cells, capillaries and cells expressing developmental myosins were identified by immunohistochemistry. Fiber area of type I and type IIA was measured and an index of microvessels tortuosity was calculated. Results: No significant alterations were observed in fiber type, fiber area and myonuclear number in both muscles. After the training period, significant increases in Phosphofructokinase (PFK) ($P<0.05$) and citrate synthase (CS) activities ($P<0.01$) were observed in resistance-trained deltoideus and the activity of hydroxyacylcoA dehydrogenase (HAD) and CS were significantly increased ($P<0.01$) in the endurance-trained vastus lateralis. Tortuosity of the microvessels increased significantly in vastus lateralis (+27%, $P<0.01$) but not in deltoid muscle. The number of satellite cells per fiber increased significantly ($P<0.05$) after training in both vastus lateralis and deltoideus. Percentage of fibers expressing developmental myosins increased (ns) in vastus lateralis (+50%) and deltoideus (+125%). Conclusion: Active elderly people submitted to a mixed training program (endurance LB and resistance UB) demonstrated muscle-specific metabolic adaptations. These were associated to an increase in the number of satellite cells per fiber both in the endurance and resistance trained muscles.

Charifi N, Kadi F, Feasson L, Costes F, Geyssant A and Denis C (2004). J Physiol 554(Pt 2): 559-69.

Charifi N, Kadi F, Feasson L and Denis C (2003). Muscle Nerve 28(1): 87-92.

A THREE-DIMENSIONAL ANALYSIS OF BACKWARD FLIC-FLAC IN MALE AND FEMALE GYMNASTS

Lovecchio, N., Grandi, G., Galante, D., Milesi, I., Grassi, G.P., Ferrario, V.F.

Università di Milano, Italy

Introduction - During the performance of gymnastic techniques, a proper body form (reciprocal position of the various parts of the body in space, their movements during the execution of the routine) is the key indicator of the correctness of the movements (1, 2). In a previous study, we analyzed the body trajectories during the performance of backward flic-flac (back handspring), and we focused on some technical parameters of the first flight (2). In the present study, the analysis was extended to the complete technique.

Methods - Six male (mean age 20 y, height 168 cm, weight 69 kg) and three female (mean age 19 y, height 163 cm, weight 59 kg) experienced gymnasts were measured. Thirteen retro-reflective markers were positioned on: right and left lateral malleolus, fibular head, greater trochanter, acromion, olecranon, styloid process of the ulna; vertex. Each gymnast performed three series of five repetitions of flic-flac, starting from the standing position. The movements were recorded by an 8-TVC optoelectronic system (100 Hz sampling rate), within a working volume of 380 x 380 x 280 cm. The 3D metric coordinates of each marker were used to calculate: the lengths of first, second and total flights; the horizontal distance between foot and hip just before the beginning of the first flight; the maximum vertical position of hips during the first flight; the elbow flexion and inter-wrist distance during the double-arm support phase; the vertical displacement of the acromion during the courbette.

Results – On average, the first flight was somewhat shorter than the second flight (49% of total), and its length was more consistent within each gymnast (coefficient of variation first flight 7% men, 9% women; second flight 11% men, 13% women). The horizontal hip movement just before the beginning of the first flight was 17% of standing height (37% of the lower limb length in men, 39% in women); the maximum hip vertical distance during the first flight was 58% (men) and 62% (women) of standing height. During the double-arm support phase, the elbow flexion was 16% (men) and 15% (women) of the upper limb length; the inter-wrist distance was 34% (men) and 23% (women) larger than the inter-acromion distance; the inter-wrist line had a mean angle with the inter-ankle line at start of 8 deg (men) and 15 deg (women). The vertical displacement of the acromion during the courbette was 39% (men) and 28% (women) of the upper limb length.

Conclusions - Technical measurements are qualitatively approximated by visual observation of coaches and referees. In the current study, a series of technical measurements were obtained from 3D reconstructions of repeated backward flic-flac. The method could supply data for a quantitative analysis of the routine, to assess the effect of training, as well as to measure the influence of individual characteristics on the execution of the technique (2).

1. Med Sci Sports Exerc 2001;33:1182-8

2. Int J Sports Med 2005;26:134-8.

VO2 /W-RELATIONSHIP DURING RAMP CYCLE EXERCISE DEPENDS ON THE METABOLIC MEASUREMENT SYSTEM

Boone, J., Bouckaert, J., Koppo, K.

Ghent University, Ghent, Belgium, Belgium

Purpose: To test if the slope of the O2-uptake ( ) / workrate (W) - relationship during ramp cycle exercise can be influenced by the metabolic measurement system used. Methods: Eight physically active males performed two ramp cycle exercises (25 W.min-1 or 30 W.min-1). On one day the respiratory parameters were measured with a MedGraphics CPX/D system and on the other day with a Jaeger Oxycon Pro. For both tests the /W – curve was determined and the best fitting linear regression for the data above and below the ventilatory threshold (VT) were calculated . From this regression analysis the slopes above (S>VT) and below (S<VT) VT for both tests were determined and compared. Results: For the test with the MedGraphics CPX/D, S<VT was significantly steeper than S>VT (9.9 ± 1.5 ml.min-1.Watt-1 and 8.7 ± 1.5 ml.min-1.Watt-1 respectively), whereas the opposite was observed with the Jaeger Oxycon Pro system (9.9 ± 0.4 ml.min-1.Watt-1 for S<VT and 10.8 ± 0.5 ml.min-1.Watt-1 for S>VT). When the slopes between the two tests were compared, S<VT did not significantly differ, whereas S>VT was significantly steeper during the test with the Jaeger Oxycon Pro. Conclusion: The results of the present study demonstrate that the deviating results found with the MedGraphics CPX/D (i.e. a downward deflection of the /W – relationship) can not be reproduced with another metabolic measurement system.

TRUNK MOVEMENTS DURING ERGOMETER ROWING. A THREE-DIMENSIONAL NON INVASIVE STUDY

Galante, D., Lovecchio, N., Casiraghi, E., Andreoletti, M., Sforza, C.

Università di Milano, Italy

Introduction - Rowing is a strenuous sport that stresses the body with a highly repetitive activity. Literature reports several recent studies on technical execution models, on spine movements and strengths developed during simulated rowing (1), but actual three-dimensional (3D) literature data on body movements are still incomplete.

Methods - We devised a protocol for the quantitative, three-dimensional assessment of body movements during ergometer rowing (2), and applied it to seven high-level agonist oarsmen (age range 20-27 years, body weight 70-98 kg, standing height 180-193 cm). The oarsmen rowed on an ergometer (Concept 2 model) at 28 strokes/min. The three-dimensional movements of 21 body landmarks (left and right ankle, knee, greater trochanter, hip, shoulder, elbow, wrist, tragus; spinous process of C7, T2, T12, L2, L4) were detected by an optoelectronic instrument with a sampling rate of 120 Hz (SMART System - B.T.S., Milan, Italy) during eight strokes (11th-20th stroke). An additional landmark was positioned on the horizontal part of the ergometer to provide a reference. The trial was repeated three times for each rower. Nine infrared-sensitive cameras were positioned at a variable height from the floor, at various angles of a working volume of 200 x 150 x 250 cm to film each oarsman from different points of view (calibration accuracy of 0.01%). Dedicated software computed the range of motion of the posterior angles of the cervical (tragi to C7), thoracic (T2-T12) and lumbar (L2-L4) spine segments relative to the horizontal axis (1), at catch and final. Angular statistics was used to obtain mean values and relevant standard deviations across the eight strokes.

Results - The angles computed in three trials were well repeatable, with coefficients of variation up to 1% (head and neck), 2% (thoracic spine) and 7% (lumbar spine). The head and neck were approximately in line with the horizontal at catch (tragus-C7 vs. horizontal 164°), and they extended at finish (139°). The thoracic spine (T2-T12 vs. horizontal) extended of approximately 67° during the stroke; weightier oarsmen had lower ranges of motion ($r=-0.925$, $p<0.01$). The average range of motion of the lumbar spine (L2-L4 vs. horizontal) was 53°, and it was larger in younger oarsmen ($r=-0.788$, $p<0.05$).

Conclusions - The method allowed a complete measurement of the dynamic characteristics of the body during ergometer rowing. Ranges of motion of the trunk and timing of maxima and minima were in good accord with literature data (1, 3), while no data were found for head movements. The measurements agreed with conventional technical teaching. Further studies could develop useful methods to screen the movements in subjects with muscular-skeletal injuries; additionally, stress during rowing and recovery after training could be quantitatively assessed (4).

1. Clin Biomech 2000;15:772-6

2. Proc. 9th IASK, 2005, p. 176

3. Clin Biomech 2003;18:704-11

4. Proc. 9th IASK, 2005, p. 19.

MODELING OF TRAINING AND SPORT PERFORMANCE IN SHOOTING

Gulbinskiene, V., Skarbalius, A.

Lithuanian Academy of Physical Education, Lithuania

The continual analysis of the training loads and results variation allows to manage the sport performance (Mester, Perl, 2000; Mujika et al., 1996). On the principles (Gulbinskiene, Skarbalius, 2005) of 27 weeks successfully used previous training model (rwith shot=0,510; rwithout shot=0,321) was designed 22 weeks training program for the shooter T. S. youth age member of Lithuanian rifle team in order to carried out individual interaction of training model and sport performance. Training program was made up of microcycles and computed in minutes. Sport performance was tested by Rika Home Trainer computer program during last 13 weeks and sports results of the main competition (22th week). Mathematical statistics: mean±SD, Pearson's correlation, regression were used to analyze the interaction of training program and sport performance. The two different training programs were applied in 2005/2006 experiment: basic training program prevailed 1–9 weeks (the aim – technique, training without shot) and specific training program prevailed 10–22 weeks (the aim – result: testing and competition). There was reduced training volume (training time&shots) from the 6th to 8th (three weeks) and from the 12th to 13th weeks (two weeks) of the specific training program (Banister et al., 1999). In first case there was used fast taper – training volume reduced 75% and results grew up 2,8% (Houmard, Johns, 1994). Interaction between results variation and training time with shot was r=-0,422 and without shot – r=-0,593. In the second case there was used step reduction taper – training volume was reduced 20% and results grew up 2,1%. Interaction between results variation and training time with shot was r=-0,826 and without shot – r=-0,253. Research results allows to make statement that for the shooter T. S. individual training program was optimal when 8 weeks of tapering had been used and 75% of specific exercises had been applied.

1. Banister, E. W., Carter, J. B., Zarkadas, P. C. (1999). Training theory and taper: validation in triathlon athletes. Journal of Applied Physiology, 79(2): 182-91.

2. Gulbinskiene, V. Skarbalius, A. (2005). Individual shooting training model of 27 weeks preparation period. In W. Starosta, S. Squatrito, Proceedings of the 9th International Scientific Conference Sport Kinetics 2005 „Scientific Fundaments of Human Moevement and Sport Practice".

3. Houmard, J. A., Johns, R. A. (1994). Effects of taper on swim performance. Practical implications. Sports Medicine, 17(4): 224-32.

4. Mester, J.&Perl, J. (2000). Grenzen der Anpassung- und Leistungsfähigkeit aus systemischer Sicht- Zeitreihenanalyse und ein informatisches Metamodell zur Untersuchung physiologischer Adaptionsprozesse. Leistungssport, 30(1): 43–51.

5. Mujika, I., Busso, T., Lacoste, L., Barale, F., Geyssant, A., Chatard, J. C. (1996). Modeled responsses to training and taper in competitive swimmers. Medicine and Science in Sports and Exercise, 28(2): 251–8.

INFLUENCE OF RECOVERY INTENSITY ON PERFORMANCE DURING A SINGLE INTERMITTENT SESSION IN YOUNG ATHLETES

Thevenet, D., Tardieu-Berger, M., Prioux, J.

UFR STAPS , France

Introduction: The improvement in VO2max is generally explained by the fact that the exercises allow a high level of VO2 (90-100% VO2max) to be maintained (Wenger & Bell, 1986). Thus, time spent at VO2max (tVO2max) during exercise leads to improve performance.

The aim of this study was to determine the influence of recovery intensity on the total exercise duration, the time spent at VO2max and metabolic parameters during a short supramaximal intermittent exercise model: the 30s-30s in young athletes. Methods: Eight endurance trained males (mean age 15.88 years (0.48)) performed 4 field-tests until exhaustion : an incremental test to determine their VO2max (57.42 ml.min-1.kg-1 (2.17)) and MAV (17.88 km.h-1 (0.16)), then in a randomized order, 3 intermittent exercises consisting in repeating 30s runs at 105% of MAV alternating with 30s active recovery: 1/ 50% of MAV (IE50), 2/ velocity (vLT) associated with second lactate threshold (LT) (IELT) and 3/ velocity (vLT-d) ranging between 50% of MAV and LT (IELT-d). The delta (d) is the velocity associated with LT minus half of the difference between vLT and 50% of MAV (For a subject with a LT corresponding to 75% of MAV : vLT-d = 62.5% of VMA: [75-((75-50)/2)]). All tests were followed by a continuous test at MAV plus 1 km.h-1 in order to determine VO2max of the day (Dupont et al., 2003). Finger blood samples were obtained 2min after each test for measurement of pH and ion bicarbonate concentration ([HCO3-]). Results: tlim was significantly longer for IE50 than IELT ($p<0.001$) and IELT-d ($p<0.01$) and it was significantly longer for IELT-d than IELT ($p<0.05$). Mean tVO2max expressed in absolute value was not significantly different between IE50 and IELT-d and it was significantly higher during IE50 and IELT-d compared with IELT. Mean tVO2max expressed in relative value was significantly higher during IELT-d compared with IE50 and IELT. pH at the end of IELT was significantly lower compared with IE50 ($p<0.05$) and IELT-d ($p<0.01$).There was no significant difference in pH values between IE50 and IELT-d. [HCO3-] at the end of IELT-d was significantly higher compared with IE50 and IELT-d ($p<0.05$).There was no significant difference in [HCO3-] values between IE50 and IELT. Discussion: These results suggest that the choice of recovery depends on exercise objectives. In other words, in order to improve the aerobic system power, active recovery at vLT-d will be chosen. In the same way an active recovery at 50% of MAV will be chosen to improve the aerobic system capacity.

References

Dupont G et al. (2003). Int. J. Sport Med. 24(4): 291-7.

Wenger HA & Bell GJ (1986). Sport Med. 3: 346-56.

EARLY SPECIALIZATION VERSUS MULTILATERAL DEVELOPMENT: COMPARISON OF BODY COMPOSITION, PHYSICAL PERFORMANCE, AND PHYSICAL ACTIVITIES BETWEEN THE CZECH AND NORWEGIAN YOUNG CROSS-COUNTRY SKIERS

Randakova, R.

Faculty of Physical Education and Sport, Charles University in Prague, Czech Republic

The aim of this study was to evaluate the differences in the estimate of body fat percentage and amount of fat-free mass as well as the differences in physical performance in relation to different approach to coaching of children and physical activities in general between the Czech (in average n=12 boys) and Norwegian (n=6 boys) young regularly trained cross-country (X-C) skiers aged 13. Bioimpedance analysis was used for the determination of body composition and physical performance was estimated on the basis motor tests results twice a year before and after preparatory training period within the 3 years in the field conditions. We have found non-significantly greater FM by 0.7 %, expressively greater FFM by 3.0 kg, together with significantly and markedly higher level of physical performance in the most of physical performance variables in Norwegian X-C skiers compared to Czech X-C skiers. Norwegian approach to training of children seems to be very different to Czech access. Organized training in Norwegian young X-C skiers takes place within the less frequency and total volume, with markedly more variety of exercises and training methods, and combined with another sports and various physical activities in contrast to Czech skiers at the same chronological age. Norwegian coaching of young X-C skiers seems to be more all-round and generally centred on develop a variety of fundamental skills and motor abilities, more dynamic, and strictly negative towards early specialization using specificity exercises and training methods specific to the needs of X-C skiing against Czech approach to coaching of young skiers. In contrast to Czech conditions at school, Norwegian X-C skiers have the same physical programme including the same number of P.E. lessons such as their class mates because of missing specialized X-C skiing classes. Norwegian X-C skiers mostly combine training in terms of X-C skiing with training aimed at the other sport, together with many others various leisure physical activities in general all the year including winter competitive season. The total volume, frequency and a variety of physical activities in terms of school and after school including training seem to be expressively greater in Norwegian X-C skiers compared to Czech X-C skiers. Followed differences in the physical programme between the Czech and Norwegian young X-C skiers affected the differences in body composition and physical performance in the most of observed parameters, i.e. in Norwegian favour. Increased focus on specialization in training of young X-C skiers does not mean the higher level of physical performance. Hence, early specialization in training of young X-C skiers is unjustified. The all-round training seems to be sufficient for young X-C skiers at observed age. It appears that an existence of special sport classes with the specialization in X-C skiing at elementary school is not necessary. This study was supported by The Research Council of Norway.

PEAK POWER OUTPUT IN RESPONSE TO WHOLE-BODY INCREMENTAL SIMULATED SWIMMING USING A NOVEL ERGOMETER

Swaine, I.L., Dunford, M.J., Hunter, A.M., Carlton, K.J., Wiles, J.D., Coleman, D.

Canterbury Christ Church University, Except University of Stirling, United Kingdom

Introduction: The purpose of this study was to quantify the peak power output in response to incremental whole-body simulated swimming on a novel laboratory-based ergometer. This ergometer can measure the power output from each exercising limb during simulated swimming.

Methods: Eight masters swimmers with a mean age of 25.2 * 6.6 (yrs), stature 1.78 * 0.10 (m) and body mass of 79.2 * 3.4 (kg) gave written informed consent and participated in exercise testing on a simulated swimming ergometer (SSE). All subjects performed an incremental simulated front crawl swimming test to exhaustion. From this test, peak power output (Wpeak), peak oxygen consumption (VO2peak), peak heart rate (HRpeak). Also, individual limb power outputs were plotted during the incremental test.

Results: The mean values of Wpeak, VO2peak and HRpeak were; 302 * 28.2 W, 3.7 * 0.88 l.min-1, 179.3 * 7.2 b.min-1 respectively. On average, the contribution to the total power output from the legs and arms was 37.2 * 5.8 % and 62.8 * 4.1 % (respectively).

Conclusion: These results show that it is possible to measure limb power outputs during whole-body simulated swimming, using this novel laboratory-based ergometer. There have been no studies of limb power output during free swimming with which to compare our results for simulated swimming. However, the leg-kick appears to make a much greater contribution to overall power output during simulated swimming than it does to propulsive power during free swimming, as shown in previous studies.

PLANNING OF CHILDREN AND ADOLESCENT DISTANCES IN ORIENTEERING

Smila, B., Fernate, A.

Latvian Academy of Sport Education, Latvia

The aim of the research: to analyze the correspondence of children and adolescent orienteering distances to the criteria stated by LOF in D,H 10 – 18 age groups in Latvia main orienteering competitions.

The methods: investigation and analysis of 106 orienteering distances, inquiry, mathematical statistics.

The organization of the research: 14 distances of the Latvia Cup competitions for D,H 10 – 18 age groups have been analyzed during 2005 season. Each stage of the distance was analyzed, particularly, what technical elements should be used by the participants of the definite age group according to the distance planning criteria in order to get to the control markers. In addition, after all Latvia Cup competitions the inquiry was carried out where the leading coaches, children parents and young orienteers answered the questions about the correspondence of the planned distances to the guidelines and criteria worked out by LOF and described in LOF competition rules.

The results:

Having summed up and analyzed the correspondence of 14 Latvia main orienteering competition distances to D,H 10 – 18 age group technically-tactical preparation in 2005, we conclude:

In the groups D,H 10 the most characteristic mistake is that there is no delimitative orienteer (the marker tape is not visible enough when a child has made a mistake and gone too far);

-In the group D,H 12 distances the most characteristic mistakes are: there is no attack point orienteer before the control point; the control point is too far from handrail orienteer (more than 200 m);

-In the group D,H 14 distances the most characteristic mistake is: the winner times do not correspond to the ones stated in LOF competition rules what can be explained mainly by too complicated area;

-In the group D,H 16 distances the most characteristic mistake is: the winner times do not correspond to the ones stated in LOF competition rules;

-In the group D,H 18 distances the most characteristic mistakes are: the winner times do not correspond to the ones stated in LOF competition rules, separate stages of the distances are the same as in adult elite group distances;

-In total in 47 % of all distances there were planning mistakes;

-According to the expert (14 youth coaches; 12 children parents who train their children themselves; 42 young orientieres` aged 10 – 18) opinion when planning the distances in 50 % of the cases the distance planners have not observed the distance planning criteria (guidelines) stated by LOF.

References:

1. http://www.orienteering.org/rules/footo_rules/index2.htm

2. Scraf P. Route choice and an empirical basis for the equivalence between climb and distance. Scientific Journal of Orienteering, Vol. 12, No. 2 1998

3. Rosen A. Distance Planning For Childs//Orienteering World:IOF,1992.No.2.

4. Pearson J. A different Perspective on Orienteering at school//Primary PE Focus, Great Britain: Physical Education Association, 1994.Spring.

RATINGS OF PERCEIVED EXERTION AND PHYSIOLOGICAL RESPONSES DURING AN INCREMENTAL LABORATORY TEST IN RHYTHMIC GYMNASTS

Douda, H., Panayiotou, G., Volaklis, K., Tokmakidis, S.P.

Democritus University of Thrace, Greece

Rating of perceived exertion (RPE) is widely used to evaluate physical activity, prescribe the exercise intensity during athletic performance and reveal functional abilities during laboratory tests (DeMello et al., 1987). The purpose of the present study is to examine the RPE in relation to performance ranking and physiological responses during maximal exercise between elite and non-elite female rhythmic gymnasts. Thirty-nine female rhythmic gymnasts (n=39), age 13.07±1.6 yrs, height 151.3±8.2 cm, weight 36.7±5.6 kg and body fat 13.9±1.08% participated in the study. The athletes were divided into two groups (elite, n=15 and non-elite, n=24) according to their competitive level. VO2max was determined in the laboratory using a continuous incremental exercise protocol on a cycle ergometer up to exhaustion. HR was continuously monitored with an electrocardiograph during exercise, while blood lactate was measured 3 minutes after maximal exercise. During the last 10 seconds of each stage, RPE were obtained using the 6 to 20 scale by pointing to the appropriate number (Borg, 1982). The multiple analysis of variance was applied and independent samples T-tests were used in the follow-up procedures. Pearson correlation coefficients were employed to measure the relationship among RPE and physiological measures. The analysis of data indicated that both groups gave similar values in the heart rate response [F1,37=1.59, p>.05] and blood lactate measurements [F1,37=0.03, p>.05]. Significant differences were found in VO2max [F1,37=43.03, p<.001] between elite and non-elite athletes. The RPE as well as the VO2max values were higher for elite athletes. In addition, the correlations in RPE vs physiological characteristics vary between elite and non-elite athletes, but a high correlation was obtained between RPE vs competitive performance score (r=.83, p<.01) only in elite athletes. The results of the present study indicated that rating of perceived exertion seems to provide the appropriate exercise intensity in young elite rhythmic gymnasts. Indeed, elite gymnasts had higher RPE as compared to non-elite athletes especially at maximum exercise intensity due to their ability to stress themselves more. Non-elite athletes misjudged the intensity of exercise to some extent and consequently failed to obtain the suitable levels for optimal exercise testing. On this evidence, some researches declared that Borg's scale seems to be inappropriate for preadolescent children who exercise (Pfeiffer et al., 2002; Leung et al., 2002) while others pointed out the usefulness of this practice (Ward, & Bar-Or, 1995; Lamb, 1996). Therefore, our data revealed that RPE seems to be a good performance indicator for rhythmic gymnasts and coaches should trust the perception of effort in their athletes.

References

Borg GAV (1982). Med. Sci. Sports Exerc., 14, 377-381

DeMello J.J. et al (1987). Med. Sci. Sports Exerc.,, 19: 4:354-362.

Lamb KL (1996). Ped Exerc Sci, 8, 337-350.

Leung ML et al. (2002). Percl Mot Skil, 95:1047-1062.

TRANSDISCIPLINARY ASPECTS OF ORIENTEERS` TRAINING PROCESS

Fernate, A. 1, Smila, B. 2, Grants, J. 2

1 University of Latvia, 2 Latvian Academy of Sport Education, Latvia

Holistic education is an education in which spiritual, social, emotional, moral, and physical growth are valued in addition to cognitive development (Miller,1996). The new notion of "whole" preserves the multidimensional aspect of the object of study. Hybridization reflects the need to accomplish tasks at the boundaries and in the spaces between systems and subsystems (Gibbons, et al l994,). The transdisciplinary approach (Nicolescu, 1996) sets forth for consideration a multi-dimensional Reality, structured by multiple levels replacing the single level of classical thought -- one-dimensional reality. This proposal is not enough, by itself, to justify a new vision of the world.

The scientific problem stems out of theoretically argued and empirically approved facts of the physical literacy (Whitehead, 1990) development facilitating, developing the basic structure of orienteers' integrative work capacity development model that creates a humanistically oriented, theoretically based transdisciplinary approach to the training process.

The aim of the research: working out the model of orienteers' integrated work capacity development, creating a humanistically oriented, theoretically based transdisciplinary approach to the training process, which would facilitate the possibilities for orienteers to improve their sport proficiency.

The research methods are theoretical and empirical. The methodological basis of the research is formed up from scientists' conclusions about the paradigms of education theories, the holistic approach, the investigation of outdoor sports, the evaluation of bio-motor (dermatoglyphics (n=100), laboratory experiment and modeling), psycho-motor and social aspect of integrative capacity development and the essence of mental capacities. 69 (14-16 years old) orienteers, 36 top orienteers, 30 orienteers of different degree of preparedness, 100 LASE students, 1221 athletes of other kinds of sport.

Results of the research are interrelation between orienteers' physical and mental capacity during physical load is noticed, the most informative physical and mental capacity indices in orienteering and creating the improvement model of orienteers' integrative capacity, creating a humanistically orientated, theoretically based transdisciplinary approach to the training process that would facilitate the possibilities to develop sport proficiency.

Gibbons, Michael, et al. (l994). The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies. London: Sage.

Miller J.P., Drake S.M.(1996). Holistic education and practice.Orbit., Vol.23, No 2.

Nicolescu N.(1996).La transdisciplinarité , manifeste, Le Rocher, Paris, coll.

COMPARISON OF TWO SPECIFIC ICE HOCKEY ENDURANCE FIELD TESTS, ON-ICE AND OFF-ICE, WITH A CYCLE ERGOMETRY-LACTATE THRESHOLD TEST IN JUNIOR ELITE PLAYERS

Clenin G., Fluri P., Altorfer R., Zürcher, S., Tschopp, M., Marti, B.

Swiss Federal Institute of Sports Magglingen, Switzerland

Introduction: The endurance capacity of ice hockey players is believed to play an important role in performance . Lactate threshold tests conducted on a cycle ergometer are commonly used. However, there is a lack of sport specific ice hockey field tests in performance assessment.

Research question: How does the endurance capacity of elite ice hockey players as assessed by a laboratory lactate threshold test on a cycle ergometer compare to a) a progressive stage test using a Slidingboard method (off-ice) and b) a progressive Skating stage test (on-ice)?

Methods: 29 Ice hockey players from the Swiss National Junior team (18.7y ± 0.6, 182cm ± 5.6, BMI 25.5 ± 2.0) completed over the course of 3 days 3 different endurance capacity tests: The slidingboard-Test (SB) is an off-ice test, where the athlete attaches a gliding board on the bottom of his shoes, which slide on a mat the width of two leg lengths. The athletes slide sideways from one end of the mat to the other at a given rhythm by a cadence meter. This pacing starts at a cadence of 18/min and increases gradually with the best performance at a cadence of 31/min.

The ice skating test in a figure eight (8erT) is an on-ice test with full equipment with a length of the figure eight of 160 meters. The initial pacing is at 15km/h, with an increase per stage of 1 km/h for every 320 meter.

The incremental lactate threshold test on a cycle ergometer was used to determine the individual anaerobic threshold (LTT). First stage was at130 W and increased 30 W every 3 minutes. All tests were completed to voluntary exhaustion. Heart rate, lactic acid concentrations and rating of perceived exertion (RPE) were collected.

Results: The maximal speed in the 8erT had a high correlation ($r=0.73$; $p<0.01$) with the LTT in W/kg, whereas the maximal performance in SB test had a low correlation ($r=0.39$) with the LTT. The correlation between the 8erT and the LTT was less strong when compared in absolute terms ($r=0.56$). Time to exhaustion in the LTT was 22min, in SB 11min and in the 8erT only 9min. Maximal lactate concentration was significantly ($p<0.001$) higher in the LTT than in SB or 8erT, but in SB clearly lower. Maximal RPE was significantly lower in the 8erT than during the LTT.

Conclusions: Assuming that the performance level in the field test on-ice (8erT) is most relevant to icehockey specific endurance capacity, we found a surprisingly good correlation between the 8erT and the cycle ergometry test (LTT), and only a low correlation between the two tests thought to be both hockey-specific (8erT, SB). We feel that the SB test is not an adequate test to measure endurance capacity of ice hockey players. However the results of the LTT when reported in relation to BW, over estimated the endurance capacity of the lightweight players, while the results in absolute terms overestimated the endurance capacity of the heavy players.

DISABILITIES AND LIFESAVING SPORT

Magini, V., Vossel T., Dapretto, L., Robert, P., Andreana, G.

University Institute for Movement Sciences, Rome, Italy

INTRODUCTION

People with disabilities can be involved in lifesaving programs according to their level of disability.

This concept has been supported by the experience acquired in lifesaving activities since 2003 at the Department of Human Movement and Sport Sciences, University Institute for Movement Science in Rome.

This activity allows students to become lifesavers and/or lifeguards; moreover, about 25% of students having physical and sensorial disabilities had the possibility to successfully become assistant – lifesavers / lifeguards.

Lifesaving as sport is an activity which aims to train lifesavers in rescue operations, through specific competitions. Currently, in literature, nothing has been written about lifesaving practising with disabled people .

MATERIALS AND METHODS

Almost 30 athletes with physical disabilities belonging to two relevant swimming teams in Rome (Villa Fulvia and Santa Lucia Sport) were observed. These athletes showed different levels of physical disability, classified from S2 to S10 according to "Paralympics International Committee" parameters.

Two specific events were proposed: these were included in the "Competition Manual of Lifesaving Section" of Italian Swimming Federation - 50 M swimming with obstacles (vertical, 50 cm deep) and 50 M heavy-bag (3 Kg) carry.

The training period lasted four months, from November 2005 to February 2006.

RESULTS

All the athletes completed successfully the 50 M swimming with obstacles.

The second event presented some troubles: not all the athletes with disabilities classified from S2 to S5 could complete the 50 M heavy-bag carry, as it was too difficult to them.

DISCUSSION AND CONCLUSION

The experience showed how all the athletes involved in this programme had reacted with extreme interest to the lifesaving sport activities; moreover,

it has been accepted by the group with great satisfaction.

This study has been extremely useful for its social impact: as a matter of fact, it has increased water self confidence for all the athletes involved.

This project demonstrates that lifesaving as sport activity should be considered, in relation to these two events, and integrated with the swimming programme, as a new and revolutionary offer for people with disabilities.

ACKNOWLEDGMENTS

The Authors thank for the support given to the clubs "Santa Lucia Sport" and "Villa Fulvia", and Aquatic Department of C.I.P. (Italian Paralympics Committee).

L. Michelini " Handicap e sport" S.E.U. Roma

M. Porciani "Sport Handicap" Sperling and Kupfer Editori Milano

Magini V., Dapretto L. et al "Physical education and water safety in Secondary School – pilot study" ECSS 2004 Book of Abstract.

SPECIFICATION OF EPISODE CLASSES IN SOCCER AS CONTRIBUTION FOR MODELLING

Gäbe, M., Holzer, C., Hartmann, U., Radig B., Beetz, M.

Technical University Munich, Faculty for Sport Science, Germany

1. Introduction

Within the co-operation project „Football Interaction and Process Model" of TUM and Cairos technologies corp. an automated model to represent match behaviour in soccer will be developed. Segmentation and classification belong to those basic factors of modelling (Perl et al. 2002).

With a view to map the soccer game completely (Lames 1994), Cairos technologies corp. offers a suitable approach of information acquisition. Permanent independent identification of observed objects provide a basis for a high automation-level of the soccer-information-system.

2. Method

Amongst other the TUM applies to the information-theoretical processing of the position data based on an expressive model.

Starting point of the model construction is the continuous tracking of the ball and all players. Based on the movement information the modelling to perform in several hierarchic levels (Holzer 2003). One primary component of the whole model is the episode model. It is used for the segmentation of the continuously data flow in sports-practically relevant episode classes. The direct interaction possibilities between ball and player forms an episode structure with increasing complexity. The originated episode classes cross all superior model levels and have to be defined conceptual.

3. Results

By the above-mentioned approach a model with several levels was developed. The >>Movement Model<< represents the fundamental part. The next level is the >>Episode Model<< in which the basic segmentation takes place. Consecutive hierarchically the >>Situational Model<<, the >>Tactical Model<< and on the top the >>Analytic Model<< follow.

Structurally the >>Episode Model<< is characterised by so-called >>Ball-operation-episodes-classes<< as well as >>Sub-classes<< and generates >>Hyper-classes<<. The increasing complexity of the model levels complicates the well-defined determination of the >>Hyper-classes<<.

Based on the mentioned model structure a catalogue of potential episode classes was compiled. Their definition was developed under an uniform procedure according to principles: a) existing definitions, b) description of the situation and c) determination by the position data. In the process automatic detection and classification of the several episodes was a priority criterion.

Literature

Holzer, C.: Match analysis by transmitter postion measurement, Proceedings 8th annual congress European college of sport Science, 2003, p 229

Lames, M.: Systematische Spielanalyse. Verlag Philippka, Münster 1994

Perl, J.; Lames, M.; Glitsch, U.: Modellbildung in der Sportwissenschaft. Verlag Hoffmann, Schorndorf 2002

This project is funded by the German Research Foundation (DFG-Code: 254068).

TIME AND TECHNIQUE ANALYSIS OF A JUDO FIGHT: A COMPARISON BETWEEN MALES AND FEMALES

Van Malderen, K., Jacobs, C., Ramon, K., Evert, Z., Deriemaeker, P., Clarys, P.

Hogeschool Antwerpen; Vrije Universiteit Brussel; Vlaamse Judo Federatie, Belgium

Introduction

In a previous presentation exercise and recuperation times of a judo fight were reported as well as the distribution between nage waza fight (standing) and ne waza fight (ground fight). Moreover, the techniques used and the efficiency of the techniques were analyzed for the different weight categories. However, data were only obtained after analysis of the males competition. It was the aim of the present experiment to determine these parameters for male and female athletes during the Belgian Senior Championship 2004 and to compare the time and technique profiles between the males and females.

Methods

All matches of the Belgian national championships (November 2004) were video taped and analysed.

Analyses were performed per weight category. Only first round fights were analysed in order to avoid dominant patterns of judoka's continuing in subsequent rounds.

Results

No differences were found for the total activity time and the total interruption time for the males nor for the females when comparing the different weight categories. Mean total activity time was 152 ± 100s while mean interruption time was 71 ± 65s. For the females total activity time was 87 ± 66s while mean interruption time was 36 ± 30s.

The mean duration of the actions (time between "mate" and hadjimi" both nage waza and ne-waza) was for the males 18.8 ± 9.0s and for the females 19.9 ± 7.3s. The mean duration of the interruptions for the males was 9.13 ± 5.1s and for the females 7.5 ± 6.2s. The distribution of the activity time between nage waza and ne waza for the males was 84.7 % versus 15.3 %. For the females we see a slight different pattern with a distribution of respectively 65 % nage waza fight and 35% ne waza fight.

The rank order of the used techniques for the males was: sweeps (39.5%), pick ups (21.6%), hip throws (20,4%), shoulder throws (12,4%) and arm throws (6.5%). For the females the following rank order was found: Sweeps (45.2%), hip throws (24.8), pick ups (11.1%) arm throws (9.9%), shoulder throws (9.1%). For the males the most efficient throws were from the group hand techniques (efficiency = 20%) while the least efficient were from the group of sweeps (efficiency = 5.3%). For the females the most efficient throws were from the group of pick ups techniques (efficiency = 36.7%) while the least efficient were from the group of sweeps (efficiency = 5.5%).

Discussion

Our preliminary analyses indicate that total activity time is longer for male judokas compared to female judokas. However, the intermittent activity pattern of active fight and interruptions was comparable for both sexes. Our results indicate equally that the ground fight seems to be more important for the female judokas compared to the male judokas. For both sexes the sweeps were the most frequently used techniques but with a very low efficiency. The weak differences found between male and female competition do not ask for specific training programs for males and females.

IS INITIAL AEROBIC PHYSICAL PERFORMANCE LEVEL ASSOCIATED WITH THE CHANGES IN VO2MAX DURING 8-WEEK MILITARY BASIC TRAINING?

Tanskanen, M., Uusitalo, A., Huovinen, J., Linnamo, V., Kyröläinen, H.

University of Jyväskylä, Finland

The fitness level of conscripts entering to military service has declined. Since 1979 to 2004 the mean distance of 12 minute running test has declined from 2760 m to 2434 m, and the number of recruits in "good" and "excellent" categories in muscular strength tests has decreased from 67 % to 41 % during the years of 1992 and 2004 (Santtila et al. 2006). When physical fitness level of the conscripts varies, it is not known, whether the training load is suitable for all the conscripts. Therefore, the purpose of the present study was to assess if the basic military training (T) has similar effect on aerobic physical performance of the conscripts with the different initial aerobic capacity.

To determine the maximal oxygen uptake (VO2max), 59 voluntary conscripts (mean age of 19 yrs) performed the treadmill test (speed and/or inclination increasing every three minutes) three times during T; week 1(wk 1), 5 (wk5) and 8 (wk8). Pulmonary ventilation was measured on-line using breath-by-breath-methods. Mean values of registrations at every minute were used in further statistical analysis. Based on the wk1 test VO2max (ml/kg/min), the conscripts were divided into the three groups; VO2max>46 ml/kg/min - group 1 (N=18), 41-45 ml/kg/min - group 2 (N=21), <40 ml/kg/min - group 3 (N=20). In addition, the body-weight (BW), BMI, waist-hip ratio (WHR), relative fat (F%) and fat free mass (FFM) were determined. During the 8-week T there were 23 dropouts, 20 of them because of upper respiratory track infections (URTI). Thus in the final analysis the total N was 36 conscripts (group 1 N=11, group 2 N=16, group 3 N=9).

The conscripts responded to training with a significant increase (11%, $p<0,01$) in VO2max since wk1 until wk5. VO2max increased in the group 3 by 20 % from 34 to 41 ml/kg/min ($p<0,001$), and significantly less ($p<0.05$) in the group 2 by 10 % from 43 to 48 ml/kg/kg ($p<0,001$) and in the group 1 ($p<0,001$) by 4% from 51 to 53 ml/min/kg ($p<0,05$). The group 1 had significantly lower BW, BMI, WHR and F% than group 3 ($p<0,05$-$0,001$). The group 2 had significantly lower BMI, WHR and F% than group 3 ($p<0,05$-$0,001$). From wk5 to wk8 VO2max did not change significantly in any studied groups and BW did not change throughout the whole T. F% decreased and FFM increased in group 1 ($p<0,05$), while WHR decreased in group 2 ($p<0,05$) and F% in group 3 ($p<0,001$).

The present study shows that the initial aerobic physical performance influences the changes in VO2max during 8-week T. The lower the initial aerobic physical performance the more remarkable increase was found during the first 5 wk of T after which many URTIs was observed. However, it should be emphasized that the best group also increased their aerobic capacity. The relatively high physical training load with the other army stressors could sensitize the recruits for the viruses around the army circumstances, which could also be one reason for stagnation of increase in physical aerobic performance.

BIOMETRIC PROFILE OF BELGIAN KAYAK ATHLETES

Duquet, W., Deriemaeker, P., Okunkova, O., Clarys, P.

Vrije Universiteit Brussel, Faculty of Physical Education and Physiotherapy, Belgium

Introduction: In several studies high bodyweight together with a high fat free mass and a low fat mass is found in kayak athletes. The aim of the present study was to determine the profile of the Belgian kayak athletes and to compare with other international studies.

Methods

Thirty eight Belgian kayak athletes (27 male and 11 female) were examined. Categories were made in function of sex, age (Aspirants (A) 15-16y, Juniors (J) 17-18y, Seniors (S) 19y), discipline and level. Bodyweight, 6 lengths, 4 breadths, 9 girths and 6 skinfolds (SF) were measured, allowing amongst others the calculation of fat% and somatotype.

Results

For the male athletes, in function of age, group A athletes had smaller values than the S and J for all parameters, except for the ectomorphy component. The A were at average 14 kg lighter than the S and J, who did not differ from each other. Significant differences were found for 7 of the 9 body girths. Handgrip strength of A was significantly lower compared to S and J. Respective somatotypes were: for A 1.4 - 4.1 - 3.6 (ecto-mesomorph); for J 1.6 - 4.4 - 3.2 (ecto-mesomorph); for S 1.9 - 5.0 - 2.6 (ecto-mesomorph). Discriminant analysis indicates that in S athletes neck girth is for 75% sport level predictive. Kayak discipline discrimination for the male athletes can be done for 90% on the following predictors: arm girth (tensed), SF subscapular, SF medial calf.

For the female athletes, average somatotype was: for the A 3.0 - 3.7 - 2.6 (endo-mesomorph); for the J 3.4 - 3.6 - 2.3 (endo-mesomorph); for the S 2.6 - 4.0 - 2.4 (balanced mesomorph).

When considering male and female athletes in comparison with international studies Belgian kayak athletes have lower mesomorphy but comparable endomorphy and ectomorphy.

Conclusion

For the male kayak athletes we found significant differences in function of age and level. Again for the male athletes some of the evaluated parameters had a very high predictive value for the level (neck girth) and for the discipline (arm girth tensed, SF subscapular and SF medial calf.

Our results indicate that in Belgian kayak the mesomorphy component is dominant which corroborates the international literature. However, when comparing Belgian athletes with international and Olympic athletes we found a significant lower mesomorphy component and comparable endomorphy and ectomorphy component.

COMPARISON OF MOTOR ABILITY OF YOUTH PRACTISING AND NOT PRACTISING EASTERN COMBAT KUNG-FU SPORTS

Witkowski, K., Stefaniak, T.

University of Physical Education , Poland

Rapid development brought many positive and also negative elements into human life.

The main goals of the paper were differences between motor abilities of youth practising kung-fu combat sports and their idle peers, the level of physical fitness of youth at age 14-17 years and evaluation of motor ability at sportsmen.

The investigated group comprised 44 persons aged 14-17 years including 22 subjects practising kung-fu sports and 22 not practising any sport. In the research, The International Test of Physical Fitness was applied in which points scales for evaluating physical fitness of the Polish youth are used.

In speed and agility tests, non-training youth achieved better results. Such an astonishing result may be the effect of greater pressure put on sequence of movements and endurance training at sportsmen. The results in endurance test confirm this point of view. The youth practising kung-fu sports were much better in this trial. The greatest differences were noted i static and dynamic strength and power tests. The subjects training sports achieved essentially better results. Both groups were almost identical in relative power test.

Conclusions

1. The level of physical fitness of youth at age 14-17 years is average in both groups.

2. The youth practising eastern combat sports represents a little higher level of motor ability than their non-training peers. There are no cases of low physical fitness in any group.

3. The youth who practised training proved much better in static and dynamic strength as well as power. In agility and endurance trials, they were also superior but in lesser extent. The non-training group keeps up with their practising peers in flexibility, speed and relative power.

4. Much attention must be paid to improvement of all motor features to advance the level of general physical fitness in both groups.

5. Sport training influences physical fitness at youth at age 14-17 years but its impact is not so decisive as on the higher level of sport training.

CHANGES IN MATCH-SPECIFIC SPRINTING PERFORMANCE IN RELATION TO TRAINING LOADS IN ELITE RUGBY LEAGUE PLAYERS

Coutts, A., Sirotic, A., Knowles, H.

University of Technology, Sydney, Australia

Introduction

To date, no studies have examined the development of match-specific sprint performance during the preparation phase of training in elite team sport athletes. Therefore, the purpose of this study was to examine the changes in match-specific running performance in relation to training loads during a match simulation during the preseason preparation in professional rugby league players.

Methods

Ten top professional rugby league players completed a 12 min rugby league specific match running protocol, based from recent time-motion analysis (1), on a non-motorised treadmill (NMT) (Woodway Force 3.0) and computer simulation interface at the commencement of preseason training and at 2, 4, 10 and 12 wk of preseason training. The intermittent running protocol was designed so that seven 2 s sprints (including a repeat sprint bout of three 2 s sprints in 90 s) were completed. Total distance, sprint distance, peak sprint power, maximal speed, repeated sprint bout distance and power were taken as performance measures during each 12 min NMT protocol. High-intensity, endurance running performance was measured with a maximal 5 min maximal run (5TT) for distance on each testing week. Training loads were recorded for each training session using the session-RPE method (2) and HR were also recorded. One-way ANOVA and Pearson's correlations were calculated with  set at 0.05.

Results

The weekly training load during the preseason was 2644 ± 263 AU. There were significant improvements sprint distance (24.8±15.8%), mean peak sprint speed (12.0-26.5%) and mean sprint power (43.2-66.5%) for each of the seven sprints, as well as repeated bout sprint distance (22.4±15.4%) and power (47.8±12.3%) in the 12 min NMT protocol following 4 wk of training and these improvements continued to significantly improve until week 12. After 4 wk of training, the power and distance covered during each sprint was significantly improved. 5TT performance did not significantly improve. The players global RPE and HR during the 12 min NMT protocol tended to decrease with increased training. The change in total sprint distance (r=0.79) and repeated sprint bout distance (r=0.79) were both related to total time spent above 92% HRmax.

Discussion/Conclusion

These results show large increases in both individual 2 s sprint efforts and repeated-sprint ability with 12 wk of training. Importantly, the key performance changes were related to time spent >92% HRmax. Furthermore, there was a large variability in time spent >92% HRmax despite players completing similar training programs, highlighting the need for individualised physical training programs. Collectively, these results show that specific high-intensity training is an important determinant of match-specific running performance improvements during pre-season training in top level professional rugby league players.

References

1. Sirotic, A. C. et al. (2005). J. Sci. Med. Sport(4): s67

2. Foster, C. et al. (1995). Eur. J. Appl. Physiol.(4): 367-72.

THE EFFECTS OF TWO METHODS OF PLYOMETRIC AND WEIGHT TRAINING ON THE KICKING, EXPLOSIVE POWER AND THE SPEED OF SOCCER PLAYERS

Hojjat, S., Tarverdizadeh, B., Sheikh, A.K.

Islamic Azad University, Branch of Karaj, Iran

Introduction

Increasing knowledge of trainers and athletes about new methods in soccer is one of the

most important factors in developing soccer. Constant changes has mad it clear that soccer has gone beyond a mere sport and changed into since of soccer.

Based on these arguments and regarding the importance of strength, speed and explosive power in soccer, the researcher tried to investigate the effects of two methods of plyometric exercise and weight training on the mentioned factors.

Material and methods

To investigate the study and achieve the intended purposes,20 male players, aging 17-20 among the 140 players participating in Mahabad city adult team were underwent the training and selected .

The selected group divided randomly in to equal groups .The pre-test was composed of kicking test .Vertical jump and running velocity 45m (V45m).Plyometric and weight training were participated by two respective groups during 24 sessions within 8 week.

Having given the post-test and obtaining the data, the researcher came up with the following results :(finally data assessment by statistically methods: paired-samplesT.test, two indepent –samples T.test and Levene test

Results

1. There is a significant relationship between the plyometric training and the kicking, explosive power and the speed of players.

2. There is a significant relationship between weight training and kicking, explosive power and the speed of players.

3. The analysis of the data showed that the effect of plyometric exercises on explosive power and speed is more than the effect of weight training on the respective factors, while there is no significance difference between the two methods on players on players kicking.

PRE- AND POST-DECISIONS OF TOP HANDBALL COACHES BEFORE AND AFTER GAMES AND TRAINING SESSIONS

Sequeira, P., Rodrigues, J.

Sport Sciences School of Rio Maior, Portugal

The purpose of this study is to find out if the coaches' decisions before and after a training session before a game, during a game and during a training session after a game are consistent or if there are any changes.

Our sample was composed by 6 handball coaches, 18 handball games and 33 handball training sessions from the 2000/2001 and 2001/20002 seasons. We interviewed each coach in 3 games, 3 training sessions before the games and 3 training sessions after the game, in a total of 108 interviews. The development of the interview was based on the SOTA observation system.

Before the training sessions before the game the coaches' main decisions are: spend short time in organization, demonstrate some exercises, much prescriptive information, some questioning, long period of pressure, positive affective interactions and short time in silent observation.

After the training sessions before the game the coaches' main decisions were: spend more time in organization than he planned, demonstrate some exercises, short time with prescriptive information, some questioning, pressure during some time, positive affective interactions and spend much time in silent observation.

Before the game the coaches' main decisions are: give much prescriptive instruction, some questioning, pressure during a long period of time and spend some time in silent observation.

After the game the coaches' main decisions were: gave much prescriptive information, some questioning, long period of pressure, positive and negative affective interactions and not much time in silent observation.

Before the training sessions after the game the coaches' main decisions are: spend short time in organization, demonstrate some exercises, give much prescriptive instruction, some questioning, no pressure, positive affective interactions and spend much time in silent observation.

After the training sessions after the game the coaches' main decisions were: spend time in organization, no demonstrations, gave much prescriptive instruction, no questioning, no pressure and much time in silent observation.

Concerning the results we identified that the coaches decisions before and after the training sessions is much more consistent then before and after the handball competitions.

Santos, A. & Rodrigues, J. (2004). Relational analysis between the soccer coach expectation and behaviour instruction, during the soccer competition. CD-Book of Abstracts from the 9th Annual Congress-European College of Sport Science, 41.

Schmitt, K. & Hanke, U. (2001). Congruent and Incongruent Athlete-Coach-Interaction-Enhancing Communication Skills when giving and receiving feedback. Program and Abstracts of AIESEP International Congress, 238-240.

Sousa, M. & Rodrigues, J. (2004). Coaching beach volleyball in U.S.A. and Portugal, at the major national leagues. Analysing the Beach Volleyball coach decisions, expectations and behaviour. CD-Book of Abstracts from the 9th Annual Congress-European College of Sport Science, 266.Schwameder H et al (1999). J Sports Science 17: 969-9.

ENHANCING VERTICAL JUMP PERFORMANCE OF VOLLEYBALL ATHLETES – A COMPARATIVE STUDY BETWEEN RUBBER BAND ASSISTED AND TRADITIONAL PLYOMETRIC TRAINING

Angelo, R., Carvalho, A., Mourão, P., Pereira, N., Carvalho, C.

Higher Education Institute of Maia, Portugal

Introduction: Successfull participation in team sports requires specific use of pre-determined skills. When analyzing global game-play performance in Volleyball we are able to easily assess the importance of vertical jumping abilities for an increased rate of success in both offensive (spiking) and defensive (blocking) skills. Vertical jumping is thus perceived as a fundamental skill for further development in order to achieve higher performance levels. The ability to jump higher is mostly associated with muscle mechanical properties and is consistently based in lower limb muscle power output. In this way when facing the recent development of team sports we are certainly persuaded to search for new and improved methods for training optimization. Therefore our main goal in this study was to compare the effects of a new plyometric training program based in rubber band resistance, with those most commonly obtained through the use of traditional plyometric training methodologies.

Methods: For this purpose we used a sample of 12 volleyball players randomly assigned among two experimental groups. The first group of subjects (G1) performed rubber band resistance plyometric training and the other one performed traditional plyometric training. Both groups we subjected to the same training volume and exercise type. As such each group performed 8 weeks of two times per week plyometric training, wich consisted in three sets of 12 repetitions in 6 specific plyometric exercises, with 30 second recovery time between repetitions and 120 second recovery time between sets. The ony methodological difference between training programs was the use or not of rubber bands for increased muscle work intensity. Power output of the lower limbs was determined through Bosco's protocol using the ErgoJump electromechanical device in the following parameters: Squat Jump, Counter Movement jump, CMJ for blocking, CMJ for spiking and Drop Jumping from 40cm Height. Statistic t-tests (both independent and repeated measures) were applied to the obtained data matrix in order to assess between and within group difference.

Results: Our results demonstrated that both of the experimental groups presented stattistically significant vertical jumping improvements in all of the selected testing parameters (with the exception of G2 in counter movement jumping). When comparing both protocols with each other we verified that in general G1 (ruber band group) presented slighly higher test performances than those obtained by G2, however this differences were not stattistically significant.

Conclusion: After thorough data analysis we may conclude that allthough G1 presented slightly higher performances than G2 these differences were not sufficiently significant to consider that the rubber bands allow for an increased performance and should be used to replace traditional plyometric training methods. We believe that plyometric training is essencial for an increased vertical jumping ability however the traditional methods still prove themselves to be most efficient and practical.

EVALUATION OF POLING FORCES AND TIMING IN ROLLER SKIING AT DIFFERENT GRADES

Pellegrini, B., Bortolan, L., Schena, F.

CeBiSM, Center of Bioengineering and Motor Sciences, Italy

INTRODUCTION

A significant part of the propulsive force in cross country and roller skiing is generated by poling forces. The amount of this contribution changes significantly depending on technique adopted and total power required. Arm propulsive action can be evaluated using poles instrumented by means of force transducers. From force data parameters like cycle and poling duration, peak and average force can be extracted. The availability of pole inclination data could provide additional useful information as they allow to decompose force vector into perpendicular and parallel component, the last being the sole responsible to forward motion.

The aim of this study was to evaluate time variables, force, force decomposition during roller skiing to deter-mine the effect of increasing slope.

METHODS

Nine male cross-country skiers (years, body weight, height) members of the Italian National Team partici-pated to the study. The tests were performed in diagonal stride technique using roller skis on a large tread-mill. A speed of 10 km/h was chosen whereas the inclination was increased by 1° every 3min starting from 2° to 9°.

The pole forces was measured by a single-axial force transducer mounted inside the pole grip. An opoele-tronic motion capture system was used to record pole inclination. Both force and kinematical data were re-corded for the left side and for a 20 second period each step.

Cycle and poling phase duration were extracted from data force. Duty cycle were then calculated as ratio between poling and cycle duration. Pole inclination data were used to decompose force value into parallel and perpendicular component respect to forward direction. Average total, parallel and perpendicular force were calculated over poling duration.

RESULTS

Cycle duration show a significant decrease with the slope increasing due to a decrease of the recovery phase while the poling phase remains substantially unchanged. Duty cycle that has a value of 33% for the lower grade increase starting from 4° and reach a value of 40% at 9°. Average force and has a mean value of 50.1±9.0N at minimal elevation and shows linear increase with the slope reaching a value of 67.3±17.9N at the maximum grade. Parallel force component remains always lower than the perpendicular one with a mean ratio of 73.2% between them. Both parallel and perpendicular force increase but a greater increase for parallel component has been found.

DISCUSSION

Skiing at increasing grade requires significant changes on both time-related variables and poling forces. and power values. The increase of the duty cycle demonstrate that the proportion of the cycle spent generating propulsive forces from the pole was greater at steeper

grade. Significant linear increasing has been found for total poling force and this force decomposition become more effective for propulsion.

REFERENCES

Millet G. Y. M. et al. (1997) Med.Sci.Sports Exerc. 30, 1637-1644.

Holmberg,H.C. et. Al. (2004) Med.Sci.Sports Exerc. 37, 807-818.

COMPUTER SIMULATION OF THE KINETICS OF THE MUSCULAR ENERGY METABOLISM IN AN INDIVIDUAL TIME TRIAL - A CASE STUDY

Weber, S., Platen, P.

Ruhr Universität Bochum, Germany

Introduction

Modelling the drag and the performance in individual time trialling (ITT) has been in the focus of several research projects in the recent past (Basset 1999). The power output has thereby often been taken as constant. For this study a computer simulation (CS) of the energy metabolism (EM) has been developed to explore the basic mechanisms which underlay the sustained power.

Methods

One elite cyclist (male, 62kg, 178cm, 22yrs) performed two lab tests on a cycling ergometer to determine his maximum aerobic (VO2max) and maximum glycolytic (VLamax) performance. Four days after these tests, the subject competed at the national 30km ITT championships. The data of the lab tests were used to predict the power output during the race (Mader 2003, Weber 2003). To calculate the kinetics of the EM during the race, the power output was recorded using a SRM powermeter. The possible racing speed was calculated considering the course profile and available equipment (Basset 1999).

Furthermore two hypothetic scenarios (S1 and S2) were used in a computer simulation to explore unused potential for increasing the overall performance. In S1 the VLamax was reduced by 10%. S2 was based on a different pacing strategy at three ascends. Instead of a higher power output during the climb and therefore a lower in the descend, the power output was kept constant in S2 throughout the climb.

Results

The subject had a VO2max of 77.0 ml/min/kg and a VLamax of 0.54 mmol/l/s. There was only a small difference between predicted and actual power output as well as riding speed (305 vs. 297 Watt / 44.5 kph vs. 43.9 kph).

The CS of the EM during the ITT showed that the lactate concentration was approx. 3 mmol/l in the middle of the race but up to 5-8 mmol/l in the beginning and the end of the ITT. The calculated saturation of the pyruvatedehydrogenase complex (PDH) with pyruvate was -0.008 ±0.09 mmol/l/min.

In S1 the saturation of the PDH would have been at a higher VO2 (59.7 ml/min/kg vs. 61.6 ml/min/kg). Therefore the available power output would have been increased to 310 Watt, resulting in an increased racing speed by 0.23 kph and a total time saving of 38s.

According to the CS, S2 would have resulted in a smaller lactate accumulation during the two ascends in the ITT. The time loss in the uphill would have been smaller than the saving in the downhill part. According to the computer model, this different strategy would have caused a time saving of 6s.

Discussion

This investigation indicates the potential of CS as a tool to increase cycling performance. Applied to races such as ITT, they can provide rather exact metabolic profiles of the race situation which could help creating better competition results.

A test ride on a given course prior to the race, which is a common practice in professional cycling, would furthermore make it possible to suggest a better pacing strategy.

Basset (1999) Med. Sci. Sports Exerc.

Mader (2003) J. Appl. Physiol.

Weber (2003), Comp. Sc. Sports.

PHYSICAL ACTIVITY OF WOMEN DURING PREGNANCY

Psalman, V., Ruzickova, D.

Faculty of Physical Education and Sports Bratislava, Private gynaecological clinic, Bratislava, Slovakia, Slovakia

Introduction. It is known that human being have different level of physical activity. It depends on many factors like interests, habits of family, friends and neighbours, type of job, leisure time, health etc. Based on physical activity and personal energy during pregnancy women can be devided into these three groups. The first group is better stimulated to act physical activity and women have more energy. Second group seems to be neutral and women do not react for pregnancy changes. Women which belong to the third group are negatively influenced by pregnancy changes, they have less energy, fatique is increased, they need more sleep and less physical activity.

Methods. Six months observation confirmed above mentioned information. We could see women which belonged to all three groups. Special physical activities and appropriate exercises very realised with women which belonged to groups 1 and 2. The first group consisted 41 women, the second one 32 and the third one 58. The age of observed women was in range from 22 to 35. Specific physical loading was analysed with the help of heart rate monitoring system Polar.

Results. During the observed period women from the first group had their exercise two times a week and the second group of women practised just once a week. Each practise session lasted 90 minutes and was led by experienced and well educated assistent. Specific loading during the exercise sessions brought following values of heart rate: 75 to 83 in lying and sitting positions in light intensity, 81 to 105 in moderate activity and 101 up to 121 in the highiest possible activity. These values are high enough comparing to normal before pregnancy values with their personal heart rate max from 179 to186. All recorded values are very individual based on actual state, special skills, length of pregnancy, mood, exhaustion and so on. The level of measured heart rate represents both physical and psychological loadings.

Conclusions. Properly done physical activities with suitable exercises are highly recommended almost to all expectant mothers. There exists some exception in risk pregnancy. Gynaecological experiences show that adequate exercises realised in suitable intensity are very helpful during the childbirth which should be less complicated.

A RE-APPRAISAL OF THE RELIABILITY OF THE 20 M MULTI-STAGE SHUTTLE RUN TEST

Lamb, K., Rogers, L.

University of Chester, United Kingdom

The progressive, maximal Multi-Stage Shuttle Run test (MSSRT) is used widely in many sporting, occupational health and PE settings to predict maximal oxygen uptake (VO2max). However, studies that have set out to quantify the test-retest reliability of the MSSRT have typically used inappropriate statistics and/or one of two possible calculation methods for deriving their predictions of VO2max (PVO2max). Moreover, most studies have not considered the impact of habituation on performance and therefore the value of examining whether its reliability improves after a third repeat trial. The aim of this study was to assess whether the test-retest reliability of the MSSRT is affected by having a third trial and the method of deriving the PVO2max scores. Twenty-two healthy male (20.9 +/- 1.5 yr, 79.6 +/- 9.3 kg, 1.79 +/- 0.07 m) and 13 female (19.6 +/- 1.0 yr, 67.9 +/- 10.8 kg, 1.62 +/- 0.07 m) active university sports players volunteered to take part. Each participant performed the MSSRT (Brewer et al., 1988) on three occasions, one week apart, under very similar environmental conditions. Individual total numbers of completed shuttles (TSC) were calculated along with PVO2max values using both an equation (Léger et al., 1988) and a table (Brewer et al., 1998). The consistency of the TSC and PVO2max scores across trials (t1 v t2, t1 v t3 and t2 v t3) were quantified with the 95% Limits of Agreement (LoA) analysis (Bland and Altman, 1986). The mean (+/-SD) TSC in each trial was 93.4 (28.8), 98.7 (30.4) and 96.5 (27.7) for t1, t2, and t3, respectively. Analysis revealed t2 and t3 means to be significantly ($p< 0.05$) higher than t1, but not different to each other. The overall mean PVO2max scores from the equation method (52.5 ml/kg/min) were significantly higher than the table (46.9 ml/kg/min), whilst the t2 and t3 scores (both 50.1ml/kg/min) were significantly higher than t1 (48.9 ml/kg/min), but not different to each other ($p> 0.05$). The LoA for the TSC were -5.3 +/- 16.3, -4.3 +/- 19.2 and 0.8 +/- 18.2 shuttles for t1-t2, t1-t3 and t2-t3, respectively. For PVO2max via the table method, the LoA were -1.4 +/- 5.0 (t1-t2), -1.3 +/- 5.8 (t1-t3) and 0.0 +/- 5.5 ml/kg/min (t2-t3), and for the equation method -1.1 +/- 4.7 (t1-t2), (t1-t3) and 0.0 +/- 5.0 ml/kg/min (t2-t3). Whilst these results suggest that systematic bias is eliminated after the first trial (due to habituation), a relatively large amount of random error remains, regardless of the type of score calculated. Hence, among our sample the MSSRT does not appear to have sufficient reliability to be able to detect changes in PVO2max following appropriate training. Moreover, as the PVO2max scores differ due to the method used to calculate them, it is recommended that emphasis is placed on the TSC as a performance indicator, rather than the PVO2max.

References

Brewer J et al. (1988). NCF, Loughborough, UK

Léger L et al. (1988). J Sports Science 6: 93-101

Bland JM and Altman D (1986). Lancet i, 307-10.

POSITION SPECIFIC SOMATOTYPES OF TOP-LEVEL AND JUNIOR AUSTRIAN MALE HANDBALL PLAYERS

Clarys, P., Taeymans, J., Clijsen, R., Rothe, H., Duquet, W.

Vrije Universiteit Brussel, Belgium , Belgium

Introduction

Position specific somatotypes have been reported in different team sports. It was the aim of this study to investigate the position specific (wing attack (W) and back court (B)) anthropometric characteristics and somatotypes (S) of top-level and junior male handball players.

Methods

Sixteen handball players (W=7;B=9) (26.4 ± 4.4 yr) from an Austrian 1st league team and nine junior players (W=4; B=5) (5.3 ± 0.6 yr) participated in this study. Anthropometric measurements were conducted using the ISAK guidelines. Somatotypes were calculated using the Heath-Carter method.

Results

Mean height (HGHT) of the 1st league W players was 183.9±4.7cm and mean weight (WGHT) was 93.9±9.2kg while mean BMI was 27.7±1.4kg/m2. Mean S were 4.0–6.7–1.2 (± 0.6–0.5–0.3). Mean HGHT of the 1st league B players was 194.1±4.1cm and mean WGHT was 95.3±8.2kg while mean BMI was 25.3±2.4kg/m2. Mean S were 3.1 –5.3–2.6 (±1.1–1.6–1.1). The differences in HGHT, BMI, meso- and ectomorphy between the W and B players were significant ($p<0.05$). Compared to the data of the B players, the relatively low SD of the W players indicated small variance (distribution). Compared to the B players bisceps and abdominal skinfolds (SF) of the W players were higher ($p<0.05$). The HGTH difference between the W (183.9±4.7cm) and the B players (194.1±4.1cm) was significant in the stepwise discriminant analysis and was discriminative for 83.1% whilst the bisceps and abdominal SF were discriminative for 39.4% and 56.1% resp. Mean HGHT of the junior (JR) team was 179.1±6.2cm and mean WGHT was 70.5±12.3kg while mean BMI was 21.9±2.9kg/m2. Mean S were 3.5–4.4–3.3 (±1.4–1.1– 1.3).

Discussion

S of elite W handball players (endomorphic mesomorph) form a cluster whereas the mean S (balanced mesomorph) of the B show larger standard deviations (SD). In function of playing position, W players in our sample tend to be more endomorphic compared to B players but less ectomorphic. HGHT is a strong discriminant for W or B players, meaning that in 83.1% of the cases, players with higher values on HGHT are B players. The results of the B players are comparable with studies from top European handball players (2.9-5.1-3.0) and with Croatian/Bosnian B players (3.0-4.6-2.7). In our team, endomorphy in W players is high compared to the references. In the JR team, mean S is central but with a high degree of variance (mesomorph-endomorph to mesomorphic ectomorph). This may be related to maturity status. Therefore, coaches may recruite the mesomorph-endomorph JR players for later W players, whereas the mesomorphic ectomorph JR players may become later B players.

Conclusion

Compared to the reference values, the W players have a higher degree of endomorphy but are less ectomorph. HGHT is strongly discriminative for player position. S of the W players form a cluster. Mesomorph-endomorph JR players may become later W players, whereas the mesomorphic ectomorph JR players may become later B players.

INVESTIGATION INTO THE RELATIONSHIP BETWEEN ANAEROBIC COMPONENTS OF PHYSICAL FITNESS (POWER AND CAPACITY) AND AEROBIC POWER IN PARALYMPIC ATHLETES WITH LOCOMOTOR DISABILITY

Bernardi, M.1,2, Alviti F.1, de Blasiis E.1, Di Giacinto B.1, Guerra E.1, Marini, C.3, Sardella F.3 and Marchetti M. 1.

1Sc. Spec. Medicina dello Sport- Dpt. Fisiologia Umana e Farmacologia - Univ. of Rome, 2Comitato Ital. Paralimpico (C.I.P.), 3Istit. Nazionale di medicina e Scienza dello Sport, CONI, Italy

Anaerobic power (AnP) and capacity (AnC) have been demonstrated to be directly associated with performance in numerous sports practiced by athletes with locomotor disability (LDA)1-3. In subjects with spinal cord injury (SCI) AnP has been also correlated with performance in activities of daily living 4. AnP and AnC are typically assessed through "sprint" all-out exercise tests (AOts). AOts are supposed to be the most appropriate stimuli to increase both lactate and growth hormone blood concentration 5-,6. We formulated the following hypotheses related to Paralympic LDA:

1. AnC, expressed as total mechanical work (MWtot) carried out by a LDA either in a time limited AOt or in an up to exhaustion AOt, is strictly dependent on his active muscles and his functional class (FC).

2. A direct association exists between MWtot and oxygen consumption peak (VO2peak), confirming a previously stated positive correlation between anaerobic and aerobic power in SCI individuals 7.

3. Blood lactate peak (BLp) is associated more with MWtot than with mean power (mP).

Seventy-two male LDA (41 with SCI, 17 amputees, 8 with poliomyelitis, 1 with spina bifida, 3 with orthopedic disorders, 2 with cerebral palsy), competing in Athens 2004 Summer Games (40 LDA) and in Turin 2006 Winter Games, underwent to an arm cranking ergometer (ACE- ER800, Cosmed, I) maximal incremental exercise test to evaluate their V'O2peak (Quark b2, Cosmed, I). Summer games group performed an ACE 30 second long constant torque Wingate test (W-AOt). Winter games group performed an ACE constant power (CP-AOt), at 130-150%V'O2peak intensities. Earlobe blood samples were collected at the end of both AOts to evaluate BLp.

The two groups did not differ in age, mass, height, skin-fold measurements (sum of biceps, triceps, subscapulae and suprailiac), FC (6.87±1.8) and V'O2peak (30±8.7 ml-1•kg-1•min-1). W-AOt results (mP 311±99 watt; MWtot 9.2±3 kJ;) were directly correlated with FC (r=0.62; r=0.79) and V'O2peak (r=0.54; r=0.58). In CP-AOt mP (235±56.9 watt) correlated with FC and V'O2peak (r=0.61; r=0.55) but not MWtot (17±5.2 kJ). BLp (9±1.8 mM in W-AOt; 11±2.4 mM in CP-AOt) correlated with MWtot in both tests (r=0.53; r=0.67) and with mP only in W-AOt (r=0.47).

Anaerobic mP is affected by aerobic power in LDA. Grouping together the AOT results of all LDAs, MWtot resulted highly correlated with BLp (r=0.71), demonstrating the strict relationship between sprint performance and anaerobic metabolism.

1. Bhambhani. Sport Med 32:23-51, 2002

2. Lees, Arthur. Ergonomics 31:1529-37, 1988

3. Vanlandewijch et al. Int J Sports Med 20:548-54, 1999

4. Janseen et al. Paraplegia 32:844-59, 1994

5. Green, Dawson. Sports Medicine 15:312-27, 1993

6. Stokes. Growth Hormone & IGF Research 13:225-38, 2003

7. Janseen et al. Med Sci Sports Exerc 25: 863-70, 1993.

THE EFFECT OF HIGH-INTENSITY INTERVAL TRAINING COMBINED WITH APPLICATION OF EXTERNAL PRESSURE ON THIGHS ON PEAK POWER OUTPUT

Keramidas, M., Kounalakis, S.N., Anastassopoulos, S., Nassis, G., Koskolou, M.D., Geladas, N.D.

National and Kapodistrian University of Athens, Greece

The purpose of this study was to investigate the effect of a short-term, high-intensity interval training combined with thigh external pressure application (90 mmHg) on peak power output (PPO).

Twenty-one healthy young untrained participants (6 men and 15 women) were stratified (for age, sex and aerobic capacity) and randomly assigned either to a control (CON) or to an experimental (CUFF) training group (CON: n = 10, age = 22.70±4.72 yrs, height = 168.78±12.34 cm, mass = 67.60±18.69 kg, and VO2max = 2.56±0.78 l/min; CUFF: n = 11, age = 23.00±3.85 yrs, height = 168.15±6.22 cm, mass = 61.41±9.69 kg and VO2max = 2.24±0.50 l/min). All participants performed one incremental exercise test to exhaustion without cuffs (VO2maxNor) and another one with thighs cuffs inflated to external pressure of 90 mmHg (VO2maxPress) before as well as after the training program. The PPO was defined from VO2maxNor and VO2maxPress as the last completed work rate plus the fraction of time spent in the final non-completed work rate multiplied by 20 Watts. Both groups trained 3 days/week for 6 weeks. The CON group trained on cycle ergometer without cuffs, whereas the CUFF group trained with cuffs on thighs inflated at external pressure of 90 mmHg (cuffs deflated during active recovery) at the same relative intensity. Each training session consisted of 2-min work : 2-min active recovery bouts. The intensity of training work rate was at 91.00±12.22% of VO2maxNor for CON group and at 89.53±6.57% of VO2maxPress for CUFF group. In both groups, the mean duration of the training session was 32.50±2.73 min.

Both VO2maxNor and VO2maxPress did not change with training in any of the two experimental groups. Nevertheless, regardless of training type, PPO improved by the end of training period ($p<0.05$). Moreover, after training CUFF group improved PPO (ΔPPO) in both tests clustered together more than CON group after training (CUFF: ΔPPO: 34.39 ± 21.85 Watts; CON: ΔPPO: 18.17 ± 38.47 Watts, $p<0.05$).

The increased PPO in CUFF group maybe indicative of a higher contribution of anaerobic system to the total energy expenditure after this specific training. In conclusion, short-term, interval training combined with external pressure of 90 mmHg on thighs increases PPO despite unchanged VO2max.

References

Anastassopoulos et al, (2005). 10th Annual congress of the ECSS

Kuipers et al, (1985). Int. J. Sports Med., 197-201

Warburton et al, (2004). Med. Sci. Sports Exerc., 36, 991–1000.

EFFECT OF HIGH-INTENSITY INTERVAL TRAINING ON MAXIMAL AND SUBMAXIMAL PERFORMANCE

Keramidas, M., Kounalakis, S.N., Nassis, G., Koskolou, M.D., Geladas, N.D.

National and Kapodistrian University of Athens, Greece

The purpose of this study was to examine the effect of short-term, high-intensity interval training on respiratory responses and muscle oxygenation during maximal and submaximal exercise.

Ten healthy (3 men and 7 women) young untrained subjects (age = 22.70±4.72 yrs, height = 168.78±12.34 cm, mass = 67.60±18.69 kg, pre-training VO2max = 2.56±0.78 l/min) volunteered to participate in this study. All participants were required to train 3 days/week for 6 weeks on cycle ergometers. Each session consisted of interval training using 2-min work : 2-min active recovery bouts at 91.00±12.22% and 52.61± 16.81% of VO2max, respectively. The mean duration of each training session was 33.12±2.56 min. Initially, the subjects performed an incremental exercise test to exhaustion (VO2max), one 6-min bout of submaximal constant work rate exercise (Sub) at 77.23±2.99% of the initial VO2max and a short intensive performance test (time to fatigue at 150% of peak power output) (TF150). After completing the training program, the subjects repeated the Sub and the TF150 tests at the same absolute workload as before training. The coefficient of variation for the TF150 was 0.19±0.01%.

Whereas oxygen consumption and muscular oxygenation measured by near infrared spectroscopy (NIRS) during maximal effort did not change with training, TF150 increased significantly (pre: 58.54 ± 12.73 sec; post: 79.89 ± 9.32 sec, $P<0.05$). In addition, VO2, VCO2 and VE were significantly lower during Sub after training ($P<0.05$). These changes observed after training were accompanied by significantly ($p<0.05$) lower values of total hemoglobin (HbT), a reflection of blood volume and an index of leg blood flow measured with NIRS.

Thus, the aforementioned specific high-intensity training regime improves maximal and submaximal performance probably by enhancing the contribution of anaerobic mechanism in the total power output production and/or by improving muscular efficiency.

References

Costes et al, (2001). Med. Sci. Sports Exerc., 33 (9), 1484 – 1489

Lindsay et al, (1996). Med. Sci. Sports Exerc., 28 (11), 1427 - 1434

Neary et al, (2002). Med. Sci. Sports Exerc., 34 (11), 1725 - 1732

Warburton et al, (2004). Med. Sci. Sports Exerc., 36 (6), 991 – 1000.

HEART RATE MONITORING AT OFF SHORE SAILING

Psalman, V., Kasa, J., Balás, J.

Faculty of Physical Education and Sports Bratislava, Slovakia

Introduction. Off shore sailing belongs to very popular sport and recreational activity for many people. Main advantages are: excellent nature conditions, permanently changing situations, crews consisted of many sailors and experienced skipper. High level skipper is able to arrange everything which is regarding to sailing and staying during days and nights. Based on each personal sailing experiences and skills there is a real possibility to find the best and suitable place and position for everybody. Depending on skills and abilities there is a choice to sail in recreational way or to do it as a sport.

Methods. One week sailing trip brought ideal and continual possibility to watch 9 person crew. Age of crew was from 18 to 24 years, skipper had 44. Forty two feet long boat was choosen and all crew members were from Slovak sailing clubs. But individual sailing skills and level of sailing experience were very different. The whole experiment was realised in variable sea conditions in Adriatic in September 2005. Specific sport loading was analysed with the help of heart rate monitoring system Polar. Also quality of special sailing skills in different wind and wave conditions and positions on the boat were taken into the consideration.

Results. During daily sailing trips in various wind and wave conditions we could diagnostic specific loading and following values of heart rate were obtained: starting at the easiest conditions and positions with 93 beats per minute and finishing at the most difficult conditions (very strong wind and huge waves) in skipper position and achieving values at about 170 (maximum 174). All recorded values appear to be strictly individual based on specific conditions, sailing skills, exhaustion and responsibility. Above mentioned factors are connected not only with physical loading but also with specific sailing loading which includes psychical attributes as well. There appeared also some signals of anxiety and scare mostly in cases of very big distance from the shore and during sailing in skipper position responsible for the whole crew at heavy sea conditions.

Conclusions. All mentioned factors work together and heart rate monitoring with maximal values indicates suitable and appropriate loading. From this point of view we can advice this type of specific loading which offers a very quality sport activity. Except of almost optimal loading the off shore sailing has a positive influence for development of sailing skills, coordination abilities, especially balance abilities. Also stress situations are under the control. For these reasons we can highly recommend off shore sailing for males and females in any age with different sailing skills.

KINETIC RESPONSE OF CORTISOL AND TESTOSTERONE TO FOUR DIFFERENT EXERCISE PROTOCOLS PERFORMED BY WELL TRAINED SWIMMERS

Rama, L., Rosado, M.F., Teixeira, A.M.

Faculty of Sport Sciences and Physical Education Coimbra University, Portugal

The aim of this study was to clarify the possible role of salivary testosterone and cortisol as useful non-invasive markers of training load. Although contradictory research results exist, some studies point to the advantage of these hormonal markers (1).

Twelve male swimmers of the Portuguese national team (17.030.89 years old, height 177.107.16cm, weight 66.457.16Kg, 7.330.88 years of training), participated in this study. During 10 days they performed 4 protocols: two swim aerobic tasks – a 20 minutes continuous swim and an intermittent 5 x 400 meters with 45" rest; and two land protocols- the Luc Léger running test aiming to estimate the VO2 max, and the Wingate Anaerobic Test used to determine the maximal anaerobic power. Both swimming tasks were preceded by a normalized warm-up. The schedule used on this study alternated land and water protocols, with at least 48 hours between testing sessions. All sessions took place at the same hour of the day (7.00 pm). During the study athletes participated on their normal training schedule corresponding to a stabilizing workload period. Capillary blood samples were taken after exercise to evaluate lactate. Heart Rate and perception of effort (Cr10) were also controlled. Saliva samples were colleted for determination of cortisol and testosterone concentrations. These were determined using ELISA kits (Salimetrics, USA) according to the manufacturer instructions. The testosterone/cortisol ratio (T/C) was also determined. The collection time points were: immediately before de exercise;

15', 1,5h and 2,5h after; in the next morning at wakeup; and 24h after the test. To compare the testosterone and cortisol values between moments and protocols, the Wilcoxon test was used.

Our results showed that: i) significant higher values of salivary cortisol and lower T/C were found immediately after the intermittent aerobic protocol. ii) higher values of testosterone and T/C were found 1,5h after the Wingate test. iii) no significant differences were found between the initial and the 24 hours after values for cortisol, testosterone and T/C for the swimming protocols and the Wingate test. On the other hand with the Luc Léger test, the 24 hours after values were still significantly higher for cortisol than the initial ones. When variation between the initial values and the other time points were compared, differences were found between the 24h time point for the Luc-Léger and the T20 tests, for the cortisol concentration and the T/C. For the testosterone concentration the higher variations were found for the Wingate and Luc-Léger tests 2,5h after. In general, the swim protocols induced less variation in the parameters studied than the Wingate and Luc-Léger tests. In the latter both the cortisol and the T/C were still affected 24h after the test.

1. Chatard JC, Atlaoui D, Lac G, Duclos M, Hooper S, Mackinnon (2002). Cortisol, DHEA, Performance and Training in Elite Swimmers. Int. J. of Sports Med.23: 510:515.

SPORT DIRECTORS REPRESENTATIONS ABOUT THE SOCCER COACH

Costa, J.P., Rosado, A.

Sport Sciences School of Rio Maior- Institute Polythecnic of Santarém, Portugal

Introduction

This study intends to identify the representations of soccer directors concerning coaches' competencies profiles and their education models. We also analyse their conceptions about coaching and initial and continuous coach education. The study describes soccer director's general demographic characteristics, their general level of education, the representations of the soccer coach functions and competency profiles, their view of coach education access conditions and about the entities they see as responsible for initial and continuous professional education, the strategies of continuous education they value and the sources of professional knowledge perceived by them as important to be a coach.

Method

In this study the subjects were 50 soccer directors. Data gathering was obtained through a questionnaire. An independent "specialist validation" process was undertaken to assure the validity of the instrument. Several measures of fidelity were also undertaken. We confirmed the normality pre-requisites with the Kolmogorov-Smirnov test and the homogeneity of variances with the Levene test. We applied Anova One-Way test with the post-hoc calculations.

Results

The directors value a multifaceted function and competency profile, eclectic, where different aspects of the scientific, pedagogical and human being education are, globally, view as important. About access conditions to initial coach education, the director's thinks that all candidates should have access to the coach career (not being necessary experience as player) if they have an age between 18-21 years and possesses specific formal training. They value the secondary education (12º year) as the education entry level. The coach initial education must be carried through sport and the educative system. They value continuous education and emphasise the need of lectures, the frequency of recycling work shops and the observation of coach experts.

Discussion/Conclusions

Sport directors are very important in sport development. Describing their representations about coach education can contribute to enhance sport and coach education. We have to consider, also, the opinions of the different sports agents, to get a broad picture of coach education, contrasting several views, representations and perspectives. This approach is a fundamental step in the coach education and certification process.

References

Costa, J. (2005) A Formação do Treinador – Análise das Competências, Modelos e Necessidades de Formação. Tese de Mestrado não publicada, UTL – FMH.

SOCCER COACH´S REPRESENTATIONS ABOUT COACH EDUCATION MODELS

Costa, J.P., Rosado, A.

Sport Sciences School of Rio Maior- Institute Polythecnic of Santarém, Portugal

Introduction

This study intends describe soccer coach education in Portugal. We, also, analyse the influence of coaches' demographic variables in their conceptions about initial and continuous coach education. The study describes coach's general demographic characteristics, their general level of education, the self representation of their education courses, their view of coach access conditions to formal professional training and about the entities they see as responsible for professional education and training.

Method

In this study the subjects were 116 coaches. Data gathering was obtained through a questionnaire. An independent "specialist validation" process was undertaken to assure the validity of the instrument. Several measures of fidelity were also undertaken. We confirmed the normality pre-requisites with the Kolmogorov-Smirnov test and the homogeneity of variances with the Levene test. We applied Anova One-Way test with the post-hoc calculations.

Results

Coach's value a multifaceted function and competency profile, eclectic, where different aspects of the scientific, pedagogical and human being education are, globally, view as important. In the evaluation of their formal education, contents, education strategies and the pedagogical level and knowledge of the teachers and instructors were assessed. In a general, the satisfaction levels are satisfactory. Practical component duration was clearly the dimension less satisfactory. About 45% of the participants did not participate in continuous training programmes. About access conditions to initial coach education, coaches thinks that all candidates should have access to the coach career (not being necessary experience as player) if they have an age between 18-21 years and possesses specific formal training. About the entrance education level we verify some dispersion; each group tends to value the educational levels they possess and prefers access conditions that meet its own qualifications. The coach initial education must be carried through sport and the educative system. They value continuous education and emphasise the need of lectures, the frequency of recycling work shops and the observation of coach experts.

Discussion/Conclusions

Coach educational models must consider their opinion about the profession [1]. Describing their representations about coach education can contribute to enhance sport and coach education. In their view, education models must be more diverse and reflexive, accommodating new competencies and looking to develop skills seen, nowadays, as necessary. Formal education must, also, be more qualified and an emphasis on continuous education was seen as fundamental.

References

[1]. B., S, & S. (1995). Sport. 38 (3), 46-51.

PLASMATIC AMINO ACIDIC BALANCE AND DIET SUPPLY DURING CYCLING TRAINING

Merni, F., Faina, M., Bargossi, A.M., Fiorella, P., Posabella, G.

Faculty of Exercise and Sports Science, Italy

Introduction

Structural and functional molecules (enzymes) at roots of life are proteins, the daily protein intake is basic in the sport world.

In the last years food integration with amino acids (AA), mainly branched chain (BCAA), has become of frequent use in the resistance sports too. In fact the BCAA are used by the muscles also for energetic purpose (1,2), therefore BCAA are considered particularly useful during heavy training or race periods.

Our aim is to analyze the relationships among different AA in the plasma, through some systematic controls executed on cycling national Italian team, during various training periods (aerobic or anaerobic) with BCAA supply.

Methods

In a period of 7 month, 11 athletes of the national pursuit team were monitored, through 5 gathering and 5 venous blood samples.

In the 1st two gathering the job was mostly aerobic. A supply of 0.1 [g]∙per [kg] per day of BCAA was provided. A wash out or control period was performed in the month before the 2nd gathering. In the 3rd gathering the training was mixed: aerobic and anaerobic, while in the last 2 gatherings the training was in track and mostly anaerobic.

A 21 AA plasmatic chart has been executed with specific chromatographic techniques (HPLC) on coldly separated plasma.

The blood samples were always executed in the morning, under at least 8 hours of food abstinence and after an easy training day. The blood was collected by 19 gauge needle on Li-Eparine and placed to 4 [°C] Crioplast, centrifuged and the serum was finally frozen to -20 [°C] and analysed.

Pearson correlation, cluster and Factorial Analysis have been used to study the relationships among the AA.

Results

Most elevated correlation coefficients (r) have been found among the BCAA (Leu-Ile .86, Val-Ile .77, Val-Leu .72).

r>70 has been found also between: Thr-Ser .85, Thr-Gln .73, Thr-Met .702, Lys-Orn .73.

r>60 are numerous (12): 5 of them refers to relationship among BCAA and other AA.

Cluster analysis (hierarchical and not) shows 3 defined AA groups:

a) BCAA b) Ser, Thr, Gln, Met c) Lys, Orn, Pro, Cys.

The Factorial analysis, with Varimax rotation, explains 75% of the variance with 4 factors (Fct):

– 1st Fct(25%) introduces elevated saturations with BCAA, Tyr, Ala.

– 2nd (20%) explains the variance of Ser, Thr, Gly, Gln, while Met is saturated with all this 2 Fct

– 3rd (19%) comprises Lys, Orn, Pro, Cys.

– 4th is saturated better with the Phe; while Glu and His are saturates in the 3rd Fct too.

Data projection on factorial axis, varying experimental conditions, show that supply gives unlike results in the BCAA than in other AA like Orn, Lys, Cys. The aerobic or anaerobic training brings to unlike answers for Phe group.

References

1.Tipton KD et al (1999). Postexercise net protein synthesis in human muscle from orally administered amino acids. Am J Physiol 276 628-34

2.Rasmussen BB et al (2000). An oral essential aminoacid-carbohydrate supply enhances muscle protein anabolism after resistence exercise. J Appl Physiol 88: 386-92 .

MOVEMENT ANALYSIS OF DEGENERACY IN BASKETBALL SHOOTING AT VARIABLE DISTANCES

Mayer-Kress, G., Chiang, H., Liu, Y.

Penn State University, United States

There are infinitely many ways to shoot a basket, a phenomenon known as "Degeneracy" especially for top players. We are interested in the behavioural origin of this variability under the most simple constrains of the player standing undisturbed at different distances from the basket.

We examined 3 basketball players of different skill levels with 126 clean shots for each player from 21 positions systematically arranged relative to the basket. The angular kinematic data of lower limbs (LL) and upper limbs (UL) were derived from a 3-D motion capture system "PhaseSpace" using 480 Hz sampling rate. A 3-D regression analysis on the 3 lower joints (LJ) and the 3 upper joints (UJ) peak angular velocity showed a higher linear correlations among the LJ compared to the UJ. Further examination of the spatial relation between every 2 joint angles for the UJ and the LJ showed similar results: UJ relations were more variable than their LJ counterpart, and further away from the basket more variability was observed in the UL relations. We conclude that the LL performed a more consistent movement pattern in providing the basic support and strength for the shooting movement whereas the more variable UL movement controls the performance accuracy. The movement degeneracy of the basketball clean shot resides largely in the UL, especially in the coordination between elbow and wrist movement.

EVALUATION OF RAPIDITY IN KARATE

Merni, F., Pecoraioli, F.

Faculty of Exercise and Sports Science, Italy

Introduction

Rapidity is an important ability of many sports, in karate it becomes a performance's conclusive factor and it is important to study this ability. The purpose of this study is to compare groups of karate apprentices with male and female Sport Science Faculty students using general and karate specific tests. We will try to underline the possible differences on reaction time between the expertise levels and also between genders.

Methods

The examined sample contains: 16 males (MS) and 14 females (FS) students, and 6 males (MK) and 5 females (FK) karate apprentices from two clubs. The average ages are (MS 22.4 yr; FS 21.5 yr; MK 20,8 yr; FK 20,4 yr). The average anthropometric data are: weight (Kg) MS 75.5; FS 54.5; MK 77,8; FK 55,8, height (cm) MS 177.8; FS 161.5; MK 178,8; FK 163,6), arm's length (cm) MS 62,8; FS 57,1; MK 61,7; FK 57,0.

The following tests have been used for rapidity evaluation:

1) Drop test, following Lehman's indications, that appraises the contact time (seconds*10-3) on electric footboard on the ground, after a fall of 20 cm.

2) Tapping test to detect of two feet cyclic frequency (Hz).

3) Punch simplex test, that consists of voluntary execution of karate punch technique (gyaco-tzuki) recorded using a punch-bag fitted without stimulus. The punch-bag was hung so that the centre was set at the height of the subject's solar plexus (Layton). The measurement was made in seconds*10-2 from start with photocells and stop with shoot detector.

4) Punch reflex test, an execution of the same technique after a light stimulus.

An independent samples T test was used to discover the significant differences between groups.

Results

Drop test, tapping test, punch simplex don't show significant differences between groups. The average values are:

Drop test 0,160±0,022 s,

Tapping test 11,6±1,3 Hz. Calculating the rapidity quotient, as proposed by Lehmann (QR=tap. freq./drop), the average value is 73,9±12,8.

Punch simplex test 0,479±0,069 s.

Punch reflex test 0,429±0,095 s.

In this case there are significant differences between male experts (0,498 s) and students (0,374 s), and between male and female (0,493 s) students.

Conclusions

The results, particularly in the last test, show that students are faster than experts. Students' better results can be explained thanks to the atypical starting signal and the different movement execution in its preparatory phase. This conclusion agrees to Mori S. et al. statement.

References

Layton C., "Reaction movement time and sidedness in Shotokan Karate Students" (Perceptual and Motor skill n° 76 ,1993, p 765-766)

Mori S., Ohtani Y.,Imanaka K., "Reaction time and anticipatory skills of karate athletes" (Hum. Mov. Science. n° 21, 2002, p. 231-230),

Lehmann,F. "Zur Beziehung zwischenSchnelligkeit als neuromuskülare Leistungss-voraussetzung und maximaler Laufgeschwindikeit im sprint Nachwuchstraining" Leistungssport, 21,4, 1992 p. 13-19.

EFFECTS OF ELITE RHYTHMIC GYMNASTICS TRAINING ON VOLUMETRIC BONE DENSITY AND BONE GEOMETRY OF PREPUBERTAL GIRLS AS ASSESSED BY PERIPHERAL QCT

Michopoulou, E., Leontsini, D., Tournis, S., Raptoy, P., Michalopoulou, M., Krekoukia, M., Fatouros, I., Godolias, G., Taxildaris, K., Lyritis, G.

Democritus University of Thrace, Greece

Introduction

Several cross-sectional studies have shown that high impact weight-bearing activity is beneficial for the load-bearing sites of the skeleton (1). Elite female gymnasts favour a low body fat mass and weight for the somatotype required to perform the complex movements associated with the specific sport activity (2). Moreover, prepubertal elite rhythmic gymnastics (RG) athletes are subjected to strenuous physical training and substantial psychological stress that may influence subsequent pubertal development. Although, the impact of intense RG training on growth and pubertal development has been adequately studied (3), it is not clear whether RG affect positively or negatively prepubertal bone geometry as this is assessed by peripheral quantitative computerized tomography (pQCT). The aim of the present study was to study bone geometry in prepubertal RG elite athletes relative to healthy controls.

Methods

This was a cross-sectional study. Tibias of 30 elite prepubescent female rhythmic gymnastics athletes (RG) and 30 age-, sex-, body weight- and height-matched controls (C), aged 10–11 yr, were scanned at midsite by using pQCT to determine volumentric bone density, periosteal circumference, pericortical circumference, cortical thickness, polar moment of inertia, strength strain index. Clinical evaluation included body composition (percent body fat assessed by skinfold measurement), body mass index (BMI), and breast and pubic hair assessment development according to Tanner's stages of prepubertal development. Skeletal maturation was determined by x-ray of the left hand and. Bone age was determined according to Greulich-Pyle standards (14). Data were analyzed with t-test ($P<0.05$).

Results

The two groups had comparable bone age and prepubertal development. There were no differences between groups in body composition and BMI. RG athletes had higher (14%) volumetric bone density, pericortical circumference (9%), cortical thickness (15%) polar moment of inertia (21%) and strength strain index (18%) than that of the controls. No significant differences were noted for periosteal circumference.

Discussion

We conclude that elite rhythmic gymnastics training affects positively the mechanical properties of prepubescent girls bone and this response is related to geometric adaptations.

References

1. Lima F, et al. (2001) Med Sci Sports Exerc 33: 1318–1323.
2. Georgopoulos NA, et al. (2002) J Clin Endocrinol Metab 87:3169–3173
3. Georgopoulos N, et al.1(999) J Clin Endocrinol Metab 84: 4525–4530.

MOTOR SKILLS AND PHYSICAL PERFORMANCE IN BRAZILIAN WHEELCHAIR BASKETBALL PLAYERS

Zoppi, C.C., Almeida, M., Schwingel, P.A., Sá, C.K.

Faculdade Social da Bahia , Brazil

There are scanty data in literature concerning parathletes fitness level. This situation turns difficult to establish standards that could lead to performance enhancement and comparisons between different training level athletes as well. Purpose: The purpose of this study was to describe some of the main physical characteristics and motor skills that determine athletic performance in wheelchair basketball. Methods: Five male local level wheelchair basketball players (mean ± SD: 45.4 ± 9.6 years old; 73.6 ± 6.6 kg of body mass; 85.4 ± 3,8 cm of seated stature), all of them had more than five years of experience in this sport modality. Voluntaries were submitted to the Wingate test, handgrip measurement, upper body power by medicine ball throwing (2Kg) and performed a shuttle run using each one their own wheelchair. Results: Results are here presented as mean ±SD, maximum and minimum values. Peak Anaerobic Power 420,2 + 80,1 W (Range:504,0 - 334,8 W). Low Anaerobic Power 133,3 + 27,2 W (Range:153,6 and 90,0 W), Total Work 7083,6 + 1291,5 N.m (Range: 8568,0 and 5535,0 N.m), Mean Anaerobic Power 236,1 + 43,1 W (Range: 285,6 and 184,5 W) Shuttle run 17,9±1,6 s (Range: 20,3 and 16,1 s), Right Hand Grip 14,5±1,6 psi (Range: 17,0 and 13,0 psi), Left Hand Grip 13,9±1,9 psi (Range:16,0 and 11,5 psi), Upper body power 4,0+ 0,4 cm (Range: 4,7 e 3,5 cm). Conclusion: Although we had reported here the results from a small size sample, this study presented some preliminary standard data concerning experienced wheelchair basketball players motor skills and fitness level as well. Other statement that arises from this work is the need to enlarge the size of the sample to accurate the values and therefore the comparison standards for wheelchair basketball players.

INFLUENCE OF SPRINT TRAINING UNDER HYPOXIC CONDITIONS ON THE RATE OF MUSCLE OXYGEN CONSUMPTION AFTER MAXIMAL PEDALING EXERCISE

Ito, O., Katsumura, T., Kawahara, T.

Japan Institute of Sports Sciences, Japan

Recently we reported that peak pedaling power output was improved by sprint training in the hypoxic conditions. The purpose of this study was to investigate the hypothesis that hypoxic sprint training improves the rate of muscle oxygen consumption during and after maximal pedaling exercises.

Fourteen male students aged 21.6±0.8 yrs participated in this study. They underwent 10 weeks (2 times / a week) sprint training using cycle ergometer (PowerMax VII, Combi). Seven subjects trained at a simulated altitude of 3000m (14.5%O2) for 8 weeks following 2 weeks training in normoxia (Hypoxic group). The other seven subjects trained in normoxia throughout the period of training (Normoxic group). Peak power output during 15 seconds maximal pedaling exercise tests were measured before and after training. Moreover, oxygenations at vastus lateralis musle during and after tests estimated from kinetics of oxygenated hemoglobin (O2Hb/Mb) and deoxygenated hemoglobin (HHb/Mb) were measured using near-infrared spectroscopy (NIRO-300, Hamamatsu photonics). The rates of muscle oxygen consumption were determined as a gradient of O2Hb/Mb decrease by intermittent arterial hemostasis after pedaling tests.

In normoxic group, peak power output during maximal pedaling exercise tests significantly increased only during initial 2 weeks of training period, whereas they kept on increasing throughout training period in hypoxic group. There was significant difference between groups for increasing ratio of peak power at the end of training (Normoxic group: 3.7 +/- 3.3%, Hypoxic group: 11.5 +/- 4.9%). The rate of muscle oxygen consumption after maximal pedaling test significantly improved by hypoxic training. Furthermore, it was significantly related between peak power output and the rate of muscle oxygen consumption after sprint training. These results suggest that the improvement of the rate of muscle oxygen consumption by hypoxic sprint training would contribute to the increase of peak power output.

TESTS OF PHYSICAL EVALUATION AND PERFORMANCE LEVEL: COMPARISON BETWEEN NATIONAL AND REGIONAL BOXERS

Michielon, G., Scurati, R., Roione, G.C., Longo, S., Invernizzi, P.L.

Faculty of Exercise Sciences, University of Milan, Italy

INTRODUCTION

Several studies in the fighting sports have evaluated the efficiency of a specific training or the capacities of the athletes. Using some "field" evaluation test many authors have studied the explosive force of the lower limbs (Bosco 1985 and 1992, Iglesias 2001), the simple responses to a visual stimulation (Simkin 1969, Zatsiorsky 1971) and looked at tests to evaluate the fatigue condition in the fighting sports (Stercowicz 1995 and 1999, Franchini 1998).

The aim of this study is to compare the results of some specific evaluation test of physical capacities between national and regional level boxers.

METHODS

The study involved 5 national boxers of Italian senior national team (age 22±1.2, height cm 172.8±5.3, weight kg 63.9±4.5, BMI 21.39±1.18) and 5 athletes practicing boxing at lower level in regional-level teams (age 23.2±0.8, height cm 173.6±3.1, weight kg 68.1±4.8, BMI 22.60±1.36).

The athletes were tested in the squat jump test (SJ) and in the counter movement jump (CMJ) by a Microgate Optojump.

Other tests using the Optojump placed on vertical plan were submitted to evaluate the upper limbs. The following measures have been recorded: the response time from a visual stimulation to an execution of a right arm hit (RTR) and of a left arm hit (RTL); the number of hits on 8 seconds (H8); the number of hits on 20 seconds (H20).

In the end a Special Judo Fitness Test modified in boxing techniques was submitted to evaluate the fatigue condition of the athletes. To calculate the index (IND) the heart rate at the end of the test (HRE), the heart rate at 1 minute after the end of the test (HR1') and the number of three-direct-hits executed in the test (JC) have been recorded.

Data were analyzed by the Student's t test ($p<0.05$).

RESULTS

In the lower limbs no significant differences were found between national and regional boxers (SJ cm 28.34±3.1 vs. 29.70±4.7, p>0.05; CMJ cm 29.96±3.6 vs. 32.62±5.6, p>0.05).

Also in the upper limbs no differences were found (RTR ms 281.0±24.9 vs. 303.2±27.8, p>0.05; RTL ms 270.6±27.3 vs. 294.4±23.8, p>0.05; H8 54.0±7.5 vs. 48.6±7.1, p>0.05; H20 133.2±17.1 vs. 115.2±19.8, p>0.05).

In the evaluation of the fatigue condition of the athletes neither differences appear in the index calculated by Special Judo Fitness Test modified (IND 9.10±0.6 vs. 9.67±0.4, p>0.05) nor in the heart rate (HRE ppm176.6±3.0 vs. 176.2±4.8, p>0.05; HR1' ppm 146.4±5.5 vs. 140.8±10.1, p>0.05).

On the contrary the national athletes performed a higher number of three-direct-hits during the test than the regional level boxers (JC 35.6±1.9 vs. 32.8±1.3, p<0.05).

DISCUSSION

From the results it seems that national and regional boxers achieve a similar physical performance, even if the first ones practiced and matched more than the others (27±5.2 vs. 7.7±2.5 training hours per week, p<0.05; 66.8±32.5 vs. 17.2±14.9 matches nr made, p<0.05).

REFERENCES

1.Sterkowicz S (1995) Test specjalnej sprawnosci ruchowej w judo. Antropomotoryka. 12-13: 29-44.

PERFORMANCE EFFICIENCY IN KARATE: A SPECIFIC TEST TO EVALUATE IT IN THE KUMITE

Michielon, G., Scurati, R., Roione, G.C., Longo, S., Invernizzi, P.L.

Faculty of Exercise Sciences, University of Milan, Italy

INTRODUCTION

According to several studies in the karate's kumite the anaerobic metabolism is the main energetic source (Dzurenkova 2000), while according to others it is the aerobic one (Beneke 2004). In the karate's exercises the VO2max, the heart rate and the [La] are moderates (Imamura 2003) and the training induces a little increase of the VO2max (Imamura 1999).

A specific test (SJFT - Special Judo Fitness Test) was proposed by Stercowicz (1995) to evaluate the performance efficiency in Judo.

The aim of this study is to apply and verify a SJFT modified with karate techniques (SKFT) in the evaluation of the athletes.

METHODS

The study involved 20 male subjects practicing karate: 10 black belt and brown belt athletes (age 23.4¬±14.1, height cm 165±9, weight kg 67.2±16.8) and 10 white belt to blue belt athletes (age 21.3±13.0, height cm 165±8, weight kg 67.8±18.2).

The SKFT was conducted following the original protocol of the Stercowicz SJFT, but adapted to karate: the subject has to shuttle and to perform a SanBon Tzuki technique against each of the two athletes placed 3mt to him. Three trials with pauses of 10 sec had to be executed: the first one of 15 sec, the second and the third of 30 sec in length. The heart rate at the end (HRE) and at 1 minute after the end (HR1') were recorded by a Polar T31 heart rate monitor and the total number of combinations (TC) was taken. The SKFT index was then calculated: SKTF index = (HRE+HR1')•TC-1.

Subsequently the heart rate of the athletes in a simulated competition of 3 min of length was recorded (HR3L).

The data analysis has been carried out by the Student's t test (p<0.05).

RESULTS

In the Special Karate Fitness Test, a significant difference between the group of the black and the brown belt athletes and the group of the white to blue belt athletes was found (SKTF index 11.36±0.73 vs. 13.06±1.15, p<0.001).

No significant differences were found between the heart rate at the end of the SKFT and the heart rate after a 3 min long kumite in either group of the athletes.

DISCUSSION

The lower SKFT index in the black and the brown belt athletes shows that the results of the test agree with the level of the athletes and with their performance efficiency.

As no differences between the test and the competition simulation were found regarding the heart rate, we can also state that between the SKFT and the kumite there isn't any difference about the overall workout intensity.

Therefore the SJFT could be employed into karate and the SKFT could be considered as a valid tool to evaluate the performance efficiency in the kumite.

REFERENCES

1.Sterkowicz S (1995) Test specjalnej sprawnosci ruchowej w judo. Antropomotoryka. 12-13: 29-44

2.Michielon G, Invernizzi PL, Roione GC, Scurati R, Hernán-Gómez B (2005). Special Judo Fitness Test: incidencia de la tipología de proyección sobre el rendimiento específico en judokas italianos de diferente nivel profesional. II Congreso Internacional. Tenerife. 216-219.

DIFFERENT CONTRIBUTION OF STEP RATE AND STEP LENGTH TO 40M-SPRINT RUNNING PERFORMANCE IN SWISS JUNIOR NATIONAL TEAM SOCCER PLAYERS

Tschopp, M., Hübner, K., Zürcher, S.

Swiss Federal Institute of Sports Magglingen, Switzerland

Sprint running plays an essential role in the performance of soccer1. High sprint running speed is achieved by both a high step rate and long step length2. Little evidence exists to which extent each of these two factors influence running speed over the acceleration phase (0-40m) of sprint running. This may be of particular interest in soccer since most sprint bouts during a soccer game are shorter than 40m. The aim of the study was to determine to what extent step rate and step length differentiate between junior elite soccer players with different sprint abilities in the acceleration phase.

Methods 39 junior elite soccer players (age:17.4±0.8 y) , all members of a Swiss junior national team, participated in the study. A maximal-effort 40m-sprint was performed. Step rate, step length, contact time and flight time were measured with the Optojump Microgate measuring system (Bolzano, Italy). According to their 40m sprint running time, the subjects were divided into quartiles. For data analysis, the fastest group (FG: n=11; 40m sprint time: 5.31±0.12sec; 16.9±0.6y; height: 177.5±4.5cm; body weight: 72.4±5.2kg) was compared with the slowest group (SG: n=10; 5.68±0.07sec; 17.3±0.6y; 183.1±10.0cm; 75.7±11.0kg). Multivariate approach to repeated measures ANOVA with the kinematic variables (average values of every 10m) as dependent variables and group as the independent variable was used for statistical analysis. * p<0.01; **p<0.001

Results Significant effects of group membership were found in step rate (SR)*, contact time** and - trivially - speed**, with the FG having higher speed (highest values: FG 9.05±0.27 vs. SG 8.33±0.10ms-1) and SR (4.82±0.15 vs. 4.53±0.31Hz) and lower contact time (112±4 vs. 125±7ms) values respectively. No differences between FG and SG were found in step length (SL) and flight time. In both groups, speed**, SL** and flight time** increased over the course of 40m. SR** and contact time** decreased significantly. However, there was no change in SR between the first and the second 10m, whereas contact time did not further decrease in the forth 10m-segment. Interaction between kinematic variables and group membership was found in SR and SL. The highest SR in the SG group was found between 0-10m, whereas for the FG it was 10-20m. The FG had a higher increase in SL between the third and the forth 10m-segment. Conclusion Better sprint time in the FG was achieved predominantly by higher step rate over the whole 40m. Higher step rate was linked with shorter contact time. Sprint training should therefore include aspects that generate short contact times and high step rates. Yet, it should be considered that improvement in sprint running by increasing step rate occurs only if step length does not decrease concomitantly at the same rate, since different sources of negative interaction between step rate and step length do exist2.

1 T. Stolen et al.; Sports Med; 2005. 2 J. Hunter et al.; Med Sci Sports Exerc.; 2004.

ANALYSIS OF THE TEMPORAL AND THE TECHNICAL STRUCTURES EMPLOYED IN JUDO COMBAT BY YOUNG ATHLETES AT REGIONAL AND NATIONAL LEVEL

Scurati, R., Michielon, G., Roione, G.C., Longo, S., Invernizzi, P.L.

Faculty of Exercise Sciences, University of Milan, Italy

INTRODUCTION

In literature several studies have analyzed the techniques and the tactics in fighting sports and in judo (Rossi, Nougier 1996; Sterkowicz, Maslej 1996; Mauro, Invernizzi et al. 2001, Invernizzi, Roione et al. 2005).

The aim of this study is to compare the temporal and the tactical conducts employed during the judo combat by young athletes in competitions at regional and at national level.

METHODS

10 national-level and 15 regional-level competitions of young Cadets athletes (weight 66 kg.) have been video-recorded by camcorders located according to the Sterkovicz protocol (1996). The video-recordings of the competitions have been subsequently analyzed and the following data were obtained from: some temporal parameters such as Attack Length (AL), Attack Frequency (AF), Rest among Attacks (RA); some technical parameters such as Number of the Standing Techniques (NST) and Number of Techniques on the Ground (NTG).

Surveys have been carried out during an interval of 4 minutes (the whole competition).

The results have been compared by the Student t-test ($p<0.05$).

RESULTS

By comparing the mean results of the temporal structures of the combat we can observe a higher attack length in the regional-level competitions than in the national-level competitions (ALregional = 10.3±0.7 sec vs. ALnational = 6.4±0.4 sec, $p<0.001$).

Also the attack frequency is higher in the regional-level competitions than in the national-level ones (AFregional = 5.1±0.5 vs. AFnational = 4.2±0.4, $p<0.01$).

On the contrary, the rest among attacks is lower in the regional-level than in the national-level competitions (RAregional = 7.6±0.6 sec vs. RAnational = 9.3±0.7 sec, $p<0.001$).

Referring to the technical structures of the combat, the mean number of the standing techniques is higher in the regional-level competitions (NTSregional = 5.6±0.5 vs. NTSnational = 4.6±0.6, $p<0.05$).

No differences were found in the number of the techniques on the ground.

DISCUSSION

The results obtained might be indicative of the inclination for more instinctively of the young regional-level athletes (higher frequency of the attacks, less rests, higher length of the attacks). Moreover from the video analysis, they seems not much schemers and often to perform randomly the technical actions without careful precision and efficiency. Otherwise the data seems to indicate that the national-level athletes have a different approach to the competition. They show to be highly aware of the tactical and strategic components of the competitions and to have a more qualitative combat.

REFERENCES

1.Sterkowicz S, Maslej P. (1996). An evaluation of modern tendencies in solving judo fight. Sport Wyczynowy, 7: 12

2. Invernizzi PL, Roione G, Scurati R, Michielon G (2005). Technical-tactical differences between athletes at regional and national level in judo competitions. Sport Kinetics 2005, 9th International Scientific Conference of IASK, Rimini. 186.

PROFESSIONAL COMPETENCE IN ORIENTEERING

Carvalhinho, L., Bento, P.

Sports Sciences School of Rio Maior - Polytechnic Institute of Santarêm, Portugal

Summary

Introduction and Objective

This study was carried-out, in the field of Outdoor Sports Activities and the objective was to study the opinions of the technicians in Orienteering with respect to their professional competence, their expectations for advancement opportunities and the ongoing development/recycling of their professional knowledge and abilities.

Methods

The sample was made-up of 20 individuals Orienteering activity, according to their experience. To obtain the data we used open-interviews and semi-structured interviews. We used the content analysis method, selecting the information by means of semantic logic. In dealing with the data, we used descriptive statistics as well as comparative statistics to verify the significant differences among the various groups in the sample. In this case, we used the Chi-Square (Fisher's) statistical technique.

Results

In this activity, we verified there are no significant differences among the groups, in relation to the professional competence (0,107«P«0,500). However, in relation to their expectations for advancement opportunities and ongoing development/recycling of their professional knowledge and abilities, there are significant differences (0,001«P«0,050) among the groups in the study.

Conclusion

In general, we can conclude that despite their differences in terms of professional experience, there is no difference in opinion among the sports technicians in the area of Orienteering.

However, in relation to their expectations for advancement opportunities and ongoing professional development/recycling, there is a tendency in the group of the more experienced technicians to give more importance to the recycling and up dating of their knowledge.

References

Carvalhinho, L. (1999) As Competências Profissionais do Orientador de Estágio. Tese de Mestrado não publicada. Ciências do Desporto. FMH – UTL. Lisboa;

Sarmento, P.; Rosado, A & Rodrigues, J. (2000) Formação de Treinadores Desportivos. Edições ESDRM – IPS. Rio Maior;

Rodrigues, J. (2002) A Supervisão Pedagógica na Formação de Treinadores – Expectativas e Constrangimentos. Seminário Internacional "Formação de Treinadores". ESDRM – IPS.

FEEDBACK IN SWIMMING BY MEANS OF A SUBAQUATIC CHRONOMETER

Pérez, P., Llana, S.

University of Valencia., Spain

INTRODUCTION. Coach-swimmer communication during training is a very difficult task if compared with other terrestrial sports such a basketball or volleyball. In these sense, numerous studies indicate the importance to provide real time feedback for technique improvement (Sanderson & Cavanagh, 1990; Mendoza & Schollhorn, 1993). The aim of the present communications is double: first, to present a new sub-aquatic chronometer system that provide real time feedback without interfering with swimmer's execution and applications to swimming training, second, to evaluate if feedback that chronometer provide is better than other manner employed by coach-swimmer. METHODS. A) Its developed a sub-aquatic chronometer system that it consists on a leds screen (water resistant) installed on the bottom of the pool, so that swimmers can see it every time they perform a turn. The chronometer is connected to a PC by means of a telemetry system without cables, which permits register lap times and provide feedback to swimmers easily. All system works with a small battery, installed outside of swimming pool. B) Feedback tests: Six swimmers of national level perform the tests. In this study was compared the feedback provided by the sub-aquatic chronometer with "coach feedback" and "no feedback" condition to control swimmer race pace in aerobic and anaerobic threshold speeds. RESULTS. Results show little dispersion on lap time with chronometer feedback at aerobic race pace. At an anaerobic threshold race pace, dispersion was similar between "coach feedback" and chronometer feedback, and a little more dispersion in "no feedback" condition. DISCUSSION. Results shows the utility of the new training system, since dispersion on lap times with it are little than with traditional feedback or without feedback. In addition, coach-swimmer can have registered all swimmers time automatically to analyse the race pace control. REFERENCES: 1) Mendoza, L. Schoellhorn, W. Training of the sprint start technique with biomechanical feedback. Journal of sports sciences (London) 11(1), Feb 1993, 25-29. 2) Sanderson DJ, Cavanagh PR. Use of augmented feedback for the modification of the pedaling mechanics of cyclists. Can J Sport Sci. 1990 Mar;15(1):38-42.

Poster presentation (PP)

PP1-03 Health and Fitness 1-5 - "Exhibition Hall"

INFLUENCE OF SAMPLING RATE ON THE EVALUATION OF ACCELEROMETRY DATA OF CHILDREN

Ruch, N., Mäder, U., Rumo, M.

Swiss federal Institute of Sports Magglingen, Switzerland

Introduction

The objective measurement of physical activity (PA) in free-living individuals is essential for the estimation of the PA - health outcome relationship. Accelerometry is known as a valid and reliable system to measure PA in adults as well as in children. Although the issue of sampling rate has not been studied in adults, the use of cut-off points based on 1-min sampling mode may be inappropriate in children and may result in underestimation of PA. The aim of this study was to determine the effect of accelerometer sampling rate on PA measures in children.

Method

25 girls and 21 boys (age: 11±1 y, weight: 39,1± 8.1 kg, height: 1.49±0.09 cm) were included in the study. They wore hip-placed accelerometers with a sampling rate of 1 s for seven consecutive days. Activity counts were subsequently reintegrated into 60-s intervals and classified as either low, moderate, vigorous as well as moderate and vigorous (MVPA) using a children MET prediction equation.

Results

Daily accumulated time classified as MVPA was significantly lower in 1-s than 1-min sampling mode (1-s: 126±23 min, 1-min: 137±35 min). Time spent in moderate activity was significantly lower in 1-s than in 1-min sampling mode (1-s: 87±16 min, 1-min: 119±32 min), while time spent in low (1-s: 683±49 min and 1-min: 671±58 min) and vigorous (1-s: 39±12 min and 1-min: 18±12 min) activities was significantly higher in 1-s than 1-min sampling mode.

Discussion

In comparison to the 1-s sampling mode, the integration over 60 s leads to a significant under-representation of high- and low-intensity activities and to a significant over-representation of moderate-intensity activities. Therefore, sampling mode should be chosen accordingly to the questions to be studied. Further studies should quantify the differences in the estimation of PA between sampling modes in adults.

DEVELOPMENT OF HEALTH PROMOTION SYSTEM BY THE COMPUTER ADAPTED TEST

Nanba, H., Nakano, T., Hasebe, K., Nishijima, T., Kuno, S.

University of Tsukuba, Japan

Background: The health promotion is expected for the prevention of metabolic syndrome and bedridden. It is important that many people practice health promotion, and that the health system is developed. The mechanism of our health promotion system is that the assessment of physical fitness level for individual by using CAT (Computer Adapted Test) based on IRT (Item Response Theory), the prescription for the motor program suitable for the individual, and in recurring, the effect of the motor program is confirmed. The purpose of this study is to develop the health promotion system based on the EBH for many middle and aged people. Methods: The questionnaire survey on physical fitness was carried out for general and healthy man and woman of 485 persons (40～88-year-old). The questionnaire content is consistent of 63 items on physical fitness in the daily life. And, physical performance test of 6 items were doing to man and woman of 128 persons (40～79-year-old) of the inside which replied in the questionnaire for the validity of the questionnaire. For analysis of item characteristic curve, we used a two-parameter logistic model. Test characteristic was calculated by Test characteristic curve and Test information function. Results: Sixty-three items of the questionnaire were classified into 4 regions by the factor analysis. They were active physical fitness, body function of daily life, coordination, and, flexibility. Between total physical fitness evaluation according to the questionnaire and physical fitness score of the field physical performance test, there were significant correlation both man and woman, respectively r=0.76 (p<0.001)and r=0.66 (p<0.001). Between coordination according to the questionnaire and 10 m obstruction walking, the correlation coefficient was r=0.65 (p<0.001). Between flexibility according to the questionnaire and performance test of flexibility, the correlation coefficient was r=0.57 (p<0.001). We made the computer adaptive test based on these results. In addition, we were made to develop to system of the health promotion. The physical fitness age was calculated from physical fitness level (θ) by CAT. The 10 stage evaluation was respectively calculated from result of the above-mentioned 4 regions. A risk of the lifestyle habit illness was expressed by body composition measurement by the impedance method and the physical activity quantity by the pedometer. The prescription program is consistent of aerobics and strength training. It is being made from physical fitness evaluation by CAT, body composition, physical activity quantity, age, gender and so on. Conclusion: This study was shown that the physical fitness evaluation based on IRT was moderate appropriate for a wide age group in the 40～79-year-old. We made algorithm for CAT based on IRT and developed health promotion system. The development of this study is to clarify effect and problem of the practical application of the health promotion system made.

2-YEARS FOLLOW-UP DATA OF DIFFERENT WALKING TECHNIQUES TO IMPROVE CARDIOVASCULAR RISK PROFILE IN DYSLIPIDAEMIC POSTMENOPAUSAL WOMEN

Laqué, M.K., Becker, S., Knigge, H., Montiel, G., Predel, H.-G.

Institute of Cardiology and Sports Medicine, Germany

The menopause is associated with the development of cardiovascular (CV) risk factors leading to an increased prevalence of the "postmenopausal metabolic syndrome". Hereby lack of physical activity is at the centre of attention. Therefore, postmenopausal women (PW) turn out to be the largest physically inactive demographic population group (1). Furthermore, exercise capacity constitutes a strong predictor for cardiovascular disease.

This study evaluates the long term effects of different walking techniques (WT) and a combined dietary modification on the plasma lipid-(LP) as well as on the overall CV risk profile and on the exercise capacity of physically inactive PW with dyslipidaemia.

27 PW (age: 56,5±5,6 yrs, weight: 73,1±12,5 kg, BMI: 26±3,8 kg/m2, BP: 130,4±12,3/83,9±8,7 mmHg, T-C: 266,2±53,7, HDL-C: 60,1±15,2, LDL-C: 177,9±40,7, TG: 146,9±67,7 mg/dl) were randomised and divided in one walking-, one power- and one nordic-walking group. A 16 week walking programme was supplemented after the 12th week by a dietary modification. CV risk factors were determined at the beginning (V1), after 12 (V2), 16 (V3), 48 (V4) and 96 (V5) weeks. No lipid lowering medication was taken two weeks before and during the study. A walking test (2) examining the exercise capacity (V1), (V3), (V4), (V5) was applied as well as a bicycle ergometry test (BET) investigating the physical performance (V1), (V2), (V3). Training (4x 90min/week) was set at 2.0 mmol/l lactate level in each group and controlled by the training heart rate. Following the study (V3) the PW were advised to continue the walking training.

The results of the CV risk factors at V1-V5 showed no group differences. Walking time decreased from 3,5x75 (V1-V3) to 2,5x67 min/week after two years (V5). In V2 and V3 weight, BMI, BP, T-C, (p<0,01) as well as LDL (p<0,05) were minimized. Additional, dietary modification had no significant influence.

From V3 to V4 BMI (p<0,05) and BP increased (p<0,01). Also enlarged were weight (p<0,05), BMI, BP and TG (p<0,01) from V3 to V5. By contrast HDL-C improved from V3 to V4 and to V5 (p<0,01). Thus, only LDL-C remained reduced (p<0,05) (V5).

The walking test demonstrated an improved exercise capacity without group differences after the study (V3), after one (V4) and after 2 years (V5) (p<0,01). The relative physical performance at 2.0 mmol/l increased during the BET from V1 to V3 in all groups (p<0,01).

All WT (3,5x75 min/week) effectively improved the LP and reduced the overall CV risk. Walking duration of 2,5x67 min/week proved to be not sufficient enough to normalise the LP as well as the CV risk profile. Nevertheless, exercise capacity remained improved by the various WT applied.

A life-style intervention based on regular aerobic exercise performed by different WT, constitutes an effective non-pharmacological therapeutical option for PW with increased CV risk.

1. Surgeon General´s report addressing physical activity and health. Nutr. Rev 54:280-4,1996

2. Oja, P. et al. Tester´s guide, UKK WALK TEST, Tampere 2001.

LONGITUDINAL ANALYSIS OF WEIGHT TRAINING INJURIES IN DE NEISS DATA BASE

Morencos, E., Benito, P.J., González-Gross, M., Calderón, F.J., Díaz, V., Martín, C., Peinado, A.B.

Politecnical University of Madrid, Spain

INTRODUCTION

It has been estimated that there were 26831 health clubs, with a total of 41.3 millions of members in the USA in 2005 (1). The aim of this study was to analyse the Wt-related injuries rates (IR) and type of Wt equipment that produces the highest (IR).

METHODS

Estimates of injury (I) trends, products related to the I, primary diagnosis, anatomic location, I severity, descriptions of the emergency departments visit and a brief narrative of the I incident between January 1, 2002, and December 31, 2004, were obtained from the National Electronic Injury Surveillance System (NEISS) database (product code 3265) (2). The IR were analyzed per 100000 subjects for Wt by age-group (Ag) and gender.

RESULTS

From 2002 to 2004, the NEISS identified 6007 cases (1279 women and 4728 men). In an attempt to extrapolate these data for all the USA, the total estimated number of Wt-related cases has been set in 218864 (47274 women and 171590 men), only for the year 2004 it accounts for 70379 cases, a 17,2% higher than in 1998 (60039 cases).

Mean IR per 100000 subjects by Ag for males and females, respectively, are: 0-4 years (40.6 and 76.9), 5-14 years (115.6 and 172), 15-24 years (338.4 and 231.3), 25-44 years (330.8. and 279.2), 45-65 years (80 and 122), Ag of +65 (13 and 20.4). In the analysis of the equipment involved in the incident, 87.3% was attributed to an unspecific category called "Wt". The 6.4% of the accidents occurred with barbells, 4.8% with dumbbells, 3.1% with benches, 2.0% are related to machines, 1.3% were due to different elements of free weight equipment.

DISCUSSION

Through the studied period, all the IR increased for all Ag. This could be explained, partly, because of the 8.7% increase in the US population, between 1998 and 2004. We do not have data about the specific Wt population increment in this period, phenomenon that could explain the spectacular IR increment in comparison with the data obtained by Jones et al. (3) in their study. In our data, as in others, the Ag 15-24 years has the highest IR. In contrast to the Jones´ study were there is a decline in the IR in the 25-44 Ag, our data indicate that the rates keep balanced in men and increase in women. This could be due to the continuity in the training of the subjects that in 1998 were part of the 15-24 years Ag.

CONCLUSION

The information presented about the way the I happens is really useful for the professionals of this area. But the fact that an 82.4% of the information is attributed to the unspecific "Wt" does not contribute with substantial information.

REFERENCES

1. IHRSA. Data related to health club industry benchmarks, best practices, and trends. . [URL] 2005 13/02/06 [cited 2005 02/01/06]; Available from: http://cms.ihrsa.org/IHRSA/viewPage.cfm?pageId=796.

2. NEISS. CPSC's National Electronic Injury Surveillance System 2005 13/02/06 [cited 2005 11/11/05]; Available from: http://www.cpsc.gov/library/neiss.html

3. Jones CS, Christensen C, Young M. Weight training injury trends: a 20-year survey. The Physician and sportsmedicine. 2000 July;28(7).

REGULARLY PERFORMED SWIMMING EXERCISE DOES NOT INDUCE INCREASE OF BASAL METABOLIC RATE ASSOCIATED WITH SOFT LEAN TISSUE MASS IN POSTMENOPAUSAL WOMEN

Usui, C., Miyatani, M., Sanada, K., Miyachi, M., Tabata, I., Higuchi, M.

Waseda University School of Human Sciences, Japan

Introduction: Basal metabolic rate (BMR) accounts for 60～80% of daily energy expenditure and is influenced of various morphological and physiological factors. However, it is not known whether regularly performed swimming exercise induces an increase of BMR which is related to fat free mass (FFM) such as internal organs and skeletal muscles in postmenopausal women. Purpose: The purpose of this investigation was to examine the relationship between BMR and body composition in postmenopausal female swimmers using the cross-sectional design. Methods: A total of 52 Japanese women aged 50-75 yr who were either less or well swimming trained were studied. Systemic and regional body compositions were measured by dual-energy x-ray absorptiometry (DXA). Soft lean tissue mass (SLTM) was calculated from FFM and bone mass (BM). Peak oxygen uptake (VO2peak) was determined by using a graded exercise test on a treadmill. BMR was measured after subjects had fasted 12-hr. Upon arrival at the laboratory in an early morning, the subject rested for over 30 min to reduce previous disturbing influences, and BMR was assessed by collecting expired gases in Douglas bags during 20 min (10 min×2 times), and analyzed O2/CO2 by mass spectrometer. The data are presented as the mean ± SD. Statistical analysis was performed using unpaired t-test. And, a stepwise multiple linear regression analysis was used to determine which body constituents were associated with BMR. Statistical significance was defined as $p<0.05$. Results: There were no significant differences in age, height, weight and years since menopause (YSM) between the two groups (Less-trained group (LT): n=24, Age 63.3±5.9yr., Ht 154.3±5.6cm, BW 56.5±4.9kg, %fat 31.6±4.2%, YSM 13.0±7.5yr., Well-trained group (WT): n=28, 61.3±5.9yr., 154.2±5.7cm, 54.2±6.7kg, 28.4±4.6%,12.1±7.0yr.). VO2peak was significantly higher in WT compared with LT (31.0±5.6 vs 26.5±4.7ml/kgBW/min, $p<0.01$). Whole body fat mass (FM) in WT was significantly lower than in LT (15.6±3.8 vs 18.0±3.4kg, $p<0.05$). No difference was observed in FM of head and trunk between the two groups. FM of limbs in WT was significantly lower than in LT (6.9±1.8 vs 8.1±1.3kg, $p<0.01$). However, there were no significant differences in SLTM of whole body and different regions between the groups. No difference was observed in BMR between the two groups (WT vs LT: 1087±94 vs 1082±101kcal/day, 20.3±2.2 vs 19.2±1.7kcal/kgBW/day, 30.7±2.4 vs 30.5±2.5kcal/kgSLTM/day, respectively). In the results of multiple-regression analyses on BMR (dependent variable) with body constituents (independent variables), significant independent variable was only Head & Trunk SLTM (BMR(kcal/day)=30.7×(Head & Trunk SLTM)+440, $R2=0.355$, SEE=78.0, $p<0.001$). Conclusion: The present investigation provided the evidence for suggesting the possibility that long-term regularly performed swimming reduces FM and enhances aerobic capacity in postmenopausal women. However, this study also suggested that regular swimming exercise can not induce a large increase of SLTM highly associated with BMR.

IS COMPETITIVE SWMMING A SUITABLE VEHICLE TO ACHIEVE HEALTH BENEFITS?

Rivero, O., Sarmiento, L.

University of Las Palmas de Gran Canaria, Spain

Introduction.

Swimming has always been perceived as a healthy and complete sport. This is due to both the environment where it is practiced and the whole participation of the body.

Since water is a hipogravitatory means, it is a suitable environment for therapy treatments as it releases both muscular and skeletal structures of tension. A body completely immersed withstands nearly the 3% of their total weight (1).

However, the obtention of positive or negative health results depends on the sort of activity developed in it. When a swimmer is involved in high-milleage and long hours of training required in modern competitive swimming, chronic overuse of the shoulder, neck, back and knees may lead to a troublesome cycle of pain, inflammation, tissue injury, and more pain (2).

Richardson y Miller (3) believe that despite being practiced in a hipogravitatory environment, competitive swimming is a "spine-intensive" activity because it requires the extension and twisting of the neck and lower back.

Therefore, Is the competitive swimming a suitable vehicle to achieve health benefits?

Material and methods.

Participants were young swimmers aged between 11 and 18 (21 female and 19 males). 87.50% of those had been competing for 3 years. Data were collected by means of a multiple-choice questionnaire about the reason that led them to practice swimming, as well as their pathologies.

Results.

Most of the poll's respondents (62.50%) perceived swimming as a complete sport. In fact, 55% believed that swimming is a suitable sport to improve health condition. 40% of the polled swimmers suffer some type of pathology, and the spine problems are represented by a 62.50% in this group.

43.75% of the young with health problems needed medical attention. Swimming was the recommended therapy, specially for those with back problems (71.43%).

Conclusion.

This study shows that parents, swimmers and doctors perceive swimming as a sport which provides health benefits: that is the most important reason for the swimming practice.

However, most people who go to swimming under medical recommendation join competitive swimming teams or unsuitable aquatic programs for their pathologies. Those practices have no benefits in case of the back problems as the on going pain shows.

References.

(1) Mollon, G; Kinesitherapie des scolioses. Enciclopedie Médico-Chirurgicale. Tomo III. pp 26300 A10. París, 1988. In Natación terapéutica. Lloret, M; Colección Medicina deportiva. Ed. Paidotribo. Barcelona, 1995.

(2) Robert G; The spine in Sports. Ed. Mosby-Year Book. St. Louis, 1996.

(3) Richardson AB, Miller JW; Swimming and the older athlete: sport medicine in the older athlete,Clin Sports Med 10:301, 1991. In The spine in sports. Robert G.; Ed. Mosby-Year Book. St. Louis, 1996.

THE RELATIONSHIP OF CARDIORESPIRATORY FITNESS VERSUS SELF-REPORTED PHYSICAL ACTIVITY WITH BLOOD PRESSURE, BODY MASS INDEX AND WAIST CIRCUMFERENCE IN MIDDLE-AGED MEN AT RISK OF METABOLIC SYNDROME

Scott, A.T., Woolf-May, K., Swaine, I.L.

Canterbury Christ Church University, United Kingdom

Introduction: The metabolic syndrome is a cluster of cardiovascular disease risk factors and is characterised by hypertension, insulin resistance and dyslipidaemia in the presence of abdominal obesity (Reaven, 2002). Furthermore, individuals with low levels of physical activity and low cardiorespiratory fitness (CRF) are more at risk of metabolic syndrome. However, whilst CRF can be objectively measured physical activity levels are often self-reported, thus introducing subjective error to the measurements. The purpose of this study was to explore the relationships of both CRF and self reported physical activity (SRPA) with blood pressure (BP), waist circumference (WC), waist hip ratio (W:H) and (BMI) in middle-aged men at risk of metabolic syndrome.

Method: Twenty one men with a mean age 52.33 ± 7.53 yrs, height 1.79 ± 0.05 m, body mass 93.01 ± 13.22 kg and waist 104.07 ± 10.23 cm participated. Height and body mass were measured using a stadiometer and beam balance scales, respectively (both Seca), and BMI was calculated. WC was measured at the level of the umbilicus and hip circumference was measured at the largest circumference of the hips above the gluteal fold to calculate W:H. Blood pressure was measured using an aneroid sphygmomanometer (Accosson) and stethoscope. CRF was predicted from submaximal heart rate and oxygen consumption values using age-predicted maximum heart rate (220-age), which were collected during a modified Stanford protocol on a treadmill (HP Cosmos) by an online gas analyser (Oxycon-Pro). SRPA was assessed using a 7-day recall questionnaire (Sallis et al. , 1985). The relationships between CRF, SRPA and BP, WC, W:H and BMI were explored using Pearson's product moment bivariate correlation.

Results: CRF correlated with SBP (r=-0.493; P=0.023), BMI (r=-0.481; P=0.027), and WC (r=-0.586; P=0.005), whereas no such associations existed for SRPA and SBP (r=0.309; P=0.198), BMI (r=0.296; P=0.218) or WC (r=0.207; P=0.396).

Conclusion: These findings indicate that CRF is significantly associated with BP, BMI and WC in middle-aged men at risk of metabolic syndrome, whereas SRPA is not. This may be because SRPA does not accurately reflect the quantity and/or quality of physical activities that this population performs.

References:

Reaven GM (2002). Metabolic syndrome: pathophysiology and implications for management of cardiovascular disease. Circulation. 106(3): 286-8.

Sallis JF, Haskell WL, Fortmann SP, Rogers T, Blair SN and Paffenbarger RS (1985). Physical activity assessment methodology in the five-city project. Am J Epidemiol. 121(1):91-106.

EFFECTS OF EXERCISE ON FAT OXIDATION RATES IN OBESE CHILDREN

Zunquin, G., Theunynck, D., Sesboue, B., Arhan, P., Bougle, D.

Université du Littoral, CHU de Caen, France

Some of the benefits of performing regular exercise, such as decreased insulin resistance, reduced hypertension, and reduced plasma low-density lipoprotein concentration, are likely to be related to enhance fat oxidation. This effect could be direct by adaptations in fat metabolism pathways or indirect reducing fat mass. So regular exercise training has been included in rehabilitation exercise protocol in obese individuals to improve fat oxidation and diminish the consequences of obesity. Previous studies have shown that during puberty, children utilize less and less fat as substrate oxidation during exercise at similar relative intensities. PURPOSE: We investigate effects of

one year follow up (exercise training 2h/week at 45% of peak of VO2) on substrate oxidation during exercise. METHODS: 15 obese pubescent (6 prepubertal PP: BMI= 24.9±3.1, Z-score=5±2.5; 9 pubertal P: BMI=26.41±3.3, Z-score= 4±1.3) underwent an incremental cycle ergometry test (20 Watts increments, 3,5 min intervals) to exhaustion with measurements of breath by breath gas exchange and heart rate before and after one year follow up. Fat rates were determined from indirect calorimetry during the 30 seconds of each stage as described previously by Achten (2001) and expressed per kilogram lean body mass (LBM). Body composition was assessed by DEXA. RESULT: When the fat oxidation rates are reported to LBM, fat oxidation rates are identical after one year follow up. Maximal fat oxidation rates occured at the same relative intensity than before follow up (PP: 48.7±1.03% vs 48.2±1.2 %; 47.2±1.2% vs 46.9±1.1%) CONCLUSIONS: This exercise protocol is applicable to obese children for examining fat oxidation rates and permits to save fat oxidation rates which are decreasing during pubertal period.

DIFFERENCES IN DAILY ACTIVITY LEVELS, DIETARY INTAKE, AND BODY COMPOSITION IN PRIMARY SCHOOL CHILDREN WHO WALK TO AND FROM SCHOOL COMPARED TO THOSE WHO TRAVEL BY CAR

Ford, P.A., Bailey, R., Coleman, D., Swaine, I.L.

Canterbury Christ Church University, United Kingdom

BACKGROUND: Evidence suggests that walking to school may contribute to increasing activity levels and elicit health benefits in children. Although previous studies have measured effects on activity, no studies have assessed the effects of walking to and from school on body composition and dietary intake. The purpose of this study was to combine these variables to measure differences in primary school children who walk to and from school compared to those who travel by car.

METHODS: 239 participants (125 boys and 114 girls) took part in this cross-sectional study. Mean age (±SD) was 8.0 (2.0) years. Body mass and statue were 30.0 (8.6) kg and 1.31 (0.1) m respectively. Two groups were studied: children who travel to and from school by car (C), and children who walk to and from school for periods >10mins more than 3 times a week (W). Activity levels were measured using MTI accelerometers. Participants wore the monitors from 7am to 9pm for 5 consecutive days. Dietary Intake was assessed with a 3-Day Recall Sheet, where participants noted food and drink consumed with their parents' supervision. Calorific intake was calculated using DietMaster Pro v6.0 Software. Body composition was measured using the BodPod Self-Test. Data was analysed using SPSS v13.0, with both parametric and non-parametric differences tests. Significance accepted at $p<0.05$.

RESULTS: Total daily activity levels did not differ between W and C (607.2 ± 169.7 vs. 604.8 ± 169.9 activitycounts.min-1 respectively). W were significantly more active between 8-9am and 3-4pm (917.9 ± 368.7 and 1048.5 ± 346.2 activitycounts.min-1 respectively) compared to C (685.7 ± 222.4 and 839.6 ± 245.5 activitycounts.min-1 respectively). Male W were significantly less active than male C during school hours (596.0 ± 162.3 vs. 685.2 ± 222.1 activitycounts.min-1 respectively). Similarly, junior W were significantly¬ less active than junior C during school hours (569.7 ± 158.1 vs. 634.4 ± 190.6 activitycounts.min-1 respectively). There was no significant difference in dietary intake between W and C (1622.9 ± 410.6 vs. 1705.2 ± 428.1 kcal respectively). There was no significant difference in % body fat and fat mass (kg) between W (16.4 ± 0.7 % and 5.4 ± 0.4 kg respectively) and C (16.2 ± 0.8 % and 5.4 ± 0.4 kg respectively).

DISCUSSION: Our study identifies that although activity levels going to and from school were increased for W, there was no significant difference in total daily activity levels between W and C. Our findings suggest that male C are significantly more active during school hours than male W. Similarly, junior C are significantly more active during school hours than junior W. According to our study, whether primary school children walk to and from school or travel by car, it seems to have little influence upon body fatness and dietary intake.

STANDARDIZATION OF THE WC, WHR, WSR, AND PERCENT BODY FAT AND THE INVESTIGATION OF RELATIONSHIP BETWEEN THEM, AND PHYSICAL ACTIVITY AMONG 30-55 YEAR OLD WOMEN IN TEHRAN

Fathi, R., Gharakhanlou, R., Agha Alinejad, H.

Tarbiat Modares University, Iran

Standardization of the WC, WHR, WSR, and percent Body fat and the investigation of relationship between them, and physical activity among 30-55 year old women in Tehran

Introduction: The prevalence of obesity among societies is the outcome of lack physical activities. Obesity lays the ground for mortality in many facts and it is always remembered as a heath risk factor. Most of researchers recommend the measurement of anthropometric indexes as the easiest method to measure obesity and hence, the risk of cardiovascular and diabetes diseases. The anthropometric indexes of WHR, WC, BMI, WSR and percent body fat are the important and more practical anthropometric indexes .the given anthropometric indexes are influenced by age , gender ,ethnicity , race and culture. The present study aimed at the standardization of the WC, WHR, BMI, WSR and percent body fat and the investigation of relationship between them, and physical activity among 30-55 year old women of Tehran.

Material and Methods: this study was completed over 443 women of 30-55.in order to tally the cut-off points of the anthropometric indexes for subject's descriptive statistics (especially mean, medium , percentile) were implemented parsons correlation analysis was used to look at the relationship between the the given indexes.

Results: And in order to investigatigate the relationship between the given indexes and physical activities, Pearson correlation analysis were run. The results of analysis are as follows. Significant relations were observed between physical activities and WHR, WSR, WC, BMI and percent body fat.

Discussion: The cut-off points of WHR, WC, BMI, WSR and percent body fat were noticeably high among the 30-55 year old women in Tehran.

Conclusions: as a result significant relation and opposite between them and physical activity , this relation with BMI as compared with other anthropometric factors were stronger than this relation with WHR either.

WALKING AND BODY COMPOSITION: HOW MANY DAYS NEED TO CHANGE BODY COMPOSITION?

Jafari, A., Moradi, M., Salimi, A.

Azad University, Iran

PURPOSE: Scientific literature suggests at least 60 min of moderate-intensity physical activity may be necessary to maximize weight loss and prevent significant weight regain (John M Jakicic & Amy D Otto, 2005). For individuals constrained by a busy lifestyle, an exercise prescription that delivers benefits with the minimum investment of days is attractive. The purpose of the present study, therefore, was to

comparing the effect of one, two and three days of brisk walking on some of the body composition factors in over weight sedentary females.

METHODS: Thirty six sedentary Iranian females, aged 38.2± 4.4 yr (M±SD) were randomly assigned to three groups, 12 each, with following walking days per week: One day in the first group, two days in the second group and three days in the third group. Participants took 60 minutes of brisk walking with 50-70% VO2max for 12 week in the walking days. The walking was completed on a treadmill (T 9700 HRT, USA Fitness), which is capable for monitoring heart rates, so that the intensity of the walking can be controlled (e.g., if a participant was trained with at 140 beats/min heart rate (HR), we could adjust treadmill speed and elevation to keep HR at the targeted zone). Body weight, BMI, percent body fat, and waist and hip circumferences were measured before and after the intervention. All participants were asked not to change their eating habits during the intervention period, and food diaries were kept and monitored weekly.

RESULTS: All participants completed the12-week program of exercise. Means (±SD) of pre-test weight, body fat, WHR, BMI in all groups were 69.15±9.7 kg, 32.71±4.6 percent, 0.82±0.065, 26.99±3.4 kg/m2, respectively. ANOVA test showed that there was significant difference among mean variables among three groups after the 12-week intervention. Tukey post-hoc tests showed that it was the third group differing from others. Follow-up paired t-test for the third group indicates the pre- and post-test means were statistically significant ($p<0.05$): Weight, body fat, WHR, and BMI (M±SD) 72/41±10.75kg, 33.10±4.2 percent, .80±.043, 26.73±3.35kg/m2 changed to 68.81±9.86 kg, 30.36±5.3 percent, .78±5.7, and 25.72±3.16 kg/m2) after the intervention. Only third group significantly reduced body weight, body mass index, and percentage body fat and waist circumference ($p < 0.05$).

CONCLUSIONS: Brisk walking for 60 min one or two days a week for 12 weeks could not improve body composition of overweight females. This finding suggests that at least 3 days a week with 60 min of moderate-intensity physical activity is necessary to improve body composition. Many health benefits from physical activity can be achieved if duration and days of training is increased appropriately.

PHYSICAL ACTIVITY AND PREGNANCY OUTCOME. AN OBSERVATIONAL STUDY

Barakat Carballo, R., Rojo González, J.J., Rodriguez Cabrero, M.

School of Sciences of the Physical Activity and the Sport, Polythecnic University of Madrid, Spain

INTRODUCTION

The influence of physical activity and its effects on pregnancy outcome remains uncertain.

Throughout history, recommendations for physical activity during pregnancy have been based more on cultural and social mores than on scientific evidence. (2)

Theoretic concerns arise regarding the effects of physical activity on pregnant women. Objective data on the impact of exercise on women, the foetus and the course of gestation are limited, and results of the few studies in humans are often contradictory. Consequently, the pregnant woman and her physician may be uncertain about the safety of exercise during pregnancy. (3)

There is an urgent need for a scientific information on pregnancy outcomes (maternal and foetal) to both physical and occupational activity. (1)

The aim of this investigation is to know the influence of the physical exercise during gestation in some maternal and foetal pregnancy outcome.

METHODS:

Study desing: a retrospective observational study was used. An extensive questionnaire collected information on different variables.

177 participants provided information about the type, intensity, frequency, and duration of physical activity performed before and during pregnancy.

Pregnancy outcome were collect by perinatal inform:

 Gestational age.

 Maternal weight gain.

 Birth weight.

A structured questionnaire, administered during the participants' postpartum period was used to collect information about medical, occupational, and lifestyle characteristics.

Written informed consent was obtained in the same questionnaire.

For the construction of variables, women were divided in groups related with the developed physical activity, for example:

- Physical activity before pregnancy: 0= Sedentary, 1= Some active, 2= Active, 3= Very Active
- Physical activity during pregnancy (PADP): 0= Sedentary, 1= Active
- Occupational activity (OA): 0= Housewives, 1= Active job, 2= Sedentary job

RESULTS:

We find smaller birthweight and smaller maternal weight gain in pregnant that carried out exercise during the pregnancy that in those that didn't make it.

BIRTHWEIGHT (grs.)

– PADP (Mean):

– Sedentary (N= 87): 3267,30

– Active (N= 84): 3146,96

MATERNAL WEIGHT GAIN (grs.)

– PADP (Mean):

– Sedentary (N= 87): 12101.15

– Active (N= 84): 11544.64

CONCLUSION:

Our results show that the physical exercise during the pregnancy can cause a small reduction of birthweight and maternal weight gain, although these differences are not statistically significant. In relation to the occupational activity and the exercise developed before the pregnancy, seemingly these variables don't have influence in pregnancy outcome.

REFERENCES:

1. MOTTOLA M and WOLFE L. (2000): The pregnant athlete. In: "Woman in Sport". Edited by Drinkwater B. Ed. Blackwell Science.

2. STERNFELD B. (1997): Physical activity and pregnancy outcome (rev and rec): Sport Med; Jan 23(1): 33-47.

3. WANG T & APGAR B. (1998): Exercise during pregnancy. Am Fam Phys; April, 15, 57(8): 1846-52.

PELVIC FLOOR IN ATHLETES. A PROPOSAL OF WORK

Rojo González, J.J., Rodriguez Cabrero, M., Barakat Carballo, R.

School of Sciences of Physical Activity and Sport, Spain

INTRODUCTION:

Some of the most important causes in the weakness of the pelvic floor are the impact exercises (jumps, pliometric exercises, etc.) and weight training. This weakness of the pelvic floor has as direct consequence different incontinence types (urinal, fecal).(1)

In that sense, the training of an elite athlete has great quantity of exercises of this type during practically all its sport life.

The aim of this investigation work is to present a program for the invigoration of the pelvic floor in athletes of elite that serves as prevention of future complications.

METHODS:

Our program proposes two phases: one of identification and understanding of the different muscular groups of the pelvic floor and another phase in which series of slow and quick contractions of the musculature of the pelvic floor are included in the athlete's weekly training.

The Kegel exercises are an excellent option for the invigoration of the pelvic musculature. (2, 3)

DISCUSION:

The situation of the elite athletes in relation to the complications of the pelvic floor can be very complex, because to a weak muscular tone of the pelvic area it should unite the invigoration of the other walls that serve as lodging of the organs and viscera, increasing but even the intra-abdominal pressure.

CONCLUSION:

It is necessary to prepare the athlete's body so that during and at the end of their sport life she doesn't suffer the complications of the pelvic floor.

REFERENCES:

1. Espuña Pons M. (1999) Actualización sobre la reeducación del suelo pélvico en la mujer. Papel de los conos vaginales. Barcelona: Ed. Mayo.

2. Kielb SJ. (2005) Stress incontinence: alternatives to surgery. Int J Fertil Womens Med. Jan-Feb;50(1):24-9.

3. Melville JL, Newton K, Fan MY, Katon W. (2006) Health care discussions and treatment for urinary incontinence in U.S. women. Mar;194(3):729-37.

EXERCISE DURING TWIN PREGNANCY. IS IT POSSIBLE?

Rodriguez Cabrero, M., Barakat Carballo, R., Rojo González, J.J.

School of Sciences of the Physical Activity and the Sports, Spain

INTRODUCTION:

Pregnancy is a time of significant changes in the maternal body and systems. From a biological viewpoint, pregnancy is a unique process in which the function of virtually of the body's control systems is modified to maintain both maternal and foetal homeostasis. (3)

Those modifications are duplicated when it is a twin pregnancy.

In that sense, the twin pregnancy has been a cause for no realization of physical exercise. (1)

Nevertheless, some investigation works show that it is possible to develop a program of physical exercise during the twin pregnancy if there are not obstetric complications and the pregnant has practiced physical activity before the pregnancy. (2)

OBJECTIVE:

To value the influence of the moderate and aerobic physical exercise developed during twin pregnancy without obstetrics complications.

METHODS:

A program of moderate and aerobic exercise has been designed, it has been carried out from the week 12 until the week 34 of gestation.

Exercise program consisted on 3 sessions (weekly) of 25 minutes of aerobic and moderate exercise, during the second and third trimesters.

A moderate criteria was observed taking into account a Borg Scale: 10-12, and heart rate no more than 140 lat/min.

All exercise sessions consisted in 7-8 minutes of warm up, 10 minutes of aerobic conditioning and 7-8 minutes of could dawn.

Each session include specific exercises that avoided overextension and exercises performed on the back, avoided hard surfaces when exercising, limit repetitious movements to 10.

Ballistic movements, jumps, extreme stretching, heavy weight lifting were not performed; also warm up and could down were gradually.

RESULTS:

Maternal and foetal pregnancy outcome have been normal in both cases and between normal medical parameters.

MATERNAL

Gestational age: 263 (days)

Weight gain: 14.200 (grs.)

Type of delivery: Normal

FOETAL

Birth weight (grs.):

Boy: 2815

Girl: 2140

Size (cm.):

Boy: 51

Girl: 45

APGAR Test 1 min.:

Boy: 10
Girl: 9
APGAR Test 1 min.:
Boy: 10
Girl: 10
CONCLUSION:
The realization of 3 weekly classes of 25 minutes of moderate aerobic exercise seems not to present a risk for maternal and foetal pregnancy outcome in twin pregnancy.
REFERENCES:
1. ACOG (2002): American College of Obstetricians and Gynecologists. Exercise during pregnancy and the postpartum period. Committe Opinion Nº 267. Washington, DC. January 2002. Obstet Gynecol; 99:171-3.
2. DAVIES B, BAILEY D, BUDGETT R, SANDERSON D and GRIFFIN D.(1999): Intensive training during a twin pregnancy. A case report. Int J Sports Med; 20: 415-418.
3. WOLFE L, BRENNER I and MOTTOLA M. (1994): Maternal exercise, fetal well- being and pregnancy outcome. Exerc Sport Sci Rev; 22: 145-94.

ISOKINETIC STRENGTH EFFECTS OF WATER-BASED VS. LAND-BASED FITNESS PROGRAMS IN OLDER ADULTS

Carvalho, J. 1, Fontes, S. 1, Soares, J. 2, Mota, J. 1

1Research Center in Physical Activity, Health and Leisure, Faculty of Sport Sciences, University of Porto, 2 Laboratory of Physiology, Faculty of Sport Sciences, University of Porto, Portugal

The aim of the present study was to evaluate the effectiveness of a generalized water-based exercise program (WP) compared to a land-based (LP) on improving knee extensor and flexor isokinetic peak torque of elderly. Thirty-four subjects aged 60 -83 were randomly assigned to control group (C - n= 12, mean age= 69.0±4.9 yrs.; mean height= 1.58±0.1m; mean weight= 70.1±11.5 Kg), WP (n= 10, mean age = 66.0±2.8 yrs.; mean height= 1.60±0.1m; mean weight= 76.9±13.8 Kg and LP (n= 12, mean age= 68.0±5.4 yrs.; mean height= 1.66±0.1m; mean weight= 74.1±10.5 Kg). The training period was 5 months, within 2 sessions per week of 50 min. All subjects were tested for maximal strength of quadriceps and hamstrings on an isokinetic dynamometer (Biodex system 2, USA) at 60º/sec. and 180º/sec. before and after the training period. After an initial exploratory analysis, comparison between groups was performed by an analysis of covariance (ANCOVA). The main results showed significant differences after training on knee flexion of the non-dominant leg at 60º/sec. (50.2±19.2 vs 59.0±18.2 Nm) and knee extension of the dominant leg at 60º/sec. in group WB (96.9±26.4 vs 109.8±30.10 Nm). Further, only in those movements was possible to find a significant difference between group WB and C after training (60ED - 109.8±30.1 (W) vs 92.8±31.8 Nm (C); 60FND - 59.0 ±18.2 (W) vs 44.9±14.5 (C) Nm). No other parameter presented significant alterations after training. The findings of the present study seems to hypothesize that five months, twice a week of generalised training regardless being water-based or land-based was not sufficient to induced marked changes in muscle strength of healthy and active community-dwelling older adults. The lack of significant improvements can be due to different reasons: (i) low workloads; (ii) lack of specificity of the stimulus and (iii) the relative high strength values before the start of the training period or even (iv) the training's frequency.
However, the results of this study should be confirmed by others investigations using more subjects to make possible a more strong analysis between exercise and isokinetic strength relationship in elderly.

PHYSICAL ACTIVITY, BALANCE AND FEAR OF FALLING ON INSTITUTIONALIZED ELDERLY SUBJECTS

Carvalho, J., Pinto, J., Mota, J.

Faculty of Sports, Portugal

Falls are one of the major health problems affecting the quality of life among older adults. Many elderly people experience poor balance and fear of falling. This is sometimes associated with activity limitation; witch has potential adverse health implications. The main aim of this study was to explore the relationship between fear of falling, balance and physical activity in institutionalized older adults. Fifty eight subjects aged 65 or older living in nursing homes participated in the study and was divided according to physical activity (participants' vs non-participants of physical activity programs) and gender. Balance (Performed-Oriented Mobility Assessment - POMA I) and fear of falling (Falls Efficacy Scale – FES) were assessed as risk factors for falls. The occurrence of falls during the 12 months prior to the study was self-reported by participants. After an initial exploratory analysis, comparison between physical activity and gender was performed by respectively, an unpaired student's t-test and Mann-Whitney test. Spearman correlation was used to analyze the association between physical activity patterns and fear of falling and balance. The level of significance was set at $p<0.05$.
The results showed: (i) no significant differences in balance according to gender; (ii) Men reported less fear of falling than women (68.8±15.9 vs. 51.7±23.2; p=0.01); (iii) Active elderly subjects showed significantly higher values of balance (25.7±2.8 vs.18.4±5.7; $p<0.001$) and less fear of falling (69.1±16.5 vs. 48.9±22.4; $p<0.001$) compared to non-participated in organized exercise programs; (iv) a moderate positive correlation was observed between fear of falling and physical activity ($r=0.47$, $p<0.01$); (v) a strong positive association was found between balance and physical activity ($r=0.67$, $p<0.01$); (vi) there was no significant differences between older subjects according to history of recent falls.
We concluded that gender did not influence balance but affects negatively fear of falling. On the other hand, participation in physical activity programs seems to be associated and to have positive effects on balance and fear of falling. Finally, the occurrence of recent falls didn't have great impact on fear of falling.
With regard falls, physical activity programs should be considered as a strategy designed to reduce falling and fear of falling and improve balance in institutionalized older adults.

FLOW VISUALIZATION AROUND A HIGH-LEVEL SWIMMER:COMPREHENSION OF DRAG INFLUENCE

Taiar, R., Zaidi, H., Polidori, G., Houel, N., Valois, Y., Laville, M.

Laboratoire d'Analyse des Contraintes Mécaniques LRC CEA EA3304, Université Reims, France, France

INTRODUCTION: Decrease drag during swimming movement in the aim to improve performance (Taiar and al, 2000) appear like a good research way to discriminate the high level parameters. Our approach was to understand out-flows around a high-level swimmers in order to determine the current lines applied to a swimmer during curling movement.

METHOD

To permit this visualization, the method chosen in this study was the parietal thread, "Surface Tuft Method"(G. Polidori, 1994). We have put threads (10cm length) on the swimsuit each 3 cm. The positions of these flexible threads was between shoulders and knees area and represent the interesting out-flows visualization of the body during movement.

Nine international swimmer's levels took part to the experimentation. The task that they have done was to make some dynamics thrusts to the wall, follow-up of curlings. For the data acquisition, we have used a submarine camcorder and camera. For the data treatment, we used the image software and analyzed frame by frame the swimmers movement. We visualized the current lines around the bodies and we determined three characteristics positions during curling (the highest hips, the hips in the alignment of the body and the lowest hips). Finally, with these pictures, we lied the threads directions to found the parietal out-flows, and the boundary layers' separation.

RESULTS AND DISCUSSION

In the three positions chosen, our results showed that the current lines goes from shoulders to the inside of thighs passing by the hip contour. We observed that the boundary layers' separation was located mainly downstream the hip as well as in the middle of the back and downstream the head. These zones are more or less pronounced according to the swimmer's position. For example, in the position where hips are highest, the boundary layer separation was situated downstream the hips and appear more important than when the hips is lowest. The boundary layer separation had a direct effect on the drag, and therefore on the swimmer's performance. To decrease this drag, it's possible to discriminate the positions where the separation of the boundary layer is late. Swimmer's must assure the perfect dorsal alignment fixation from the neck until knees in order to decrease drag.

REFERENCES

Polidori G. (1994). Survey by three-D wake visualization. Application to an oblong help profile.

Taïar, R, Sagnes P, Henry C, and Rouard AH. (2000). Hydrodynamics optimization in butterfly swimming. Journal of Biomechanics, 33:4:509-510.

DIFFERENTIATION OF THE RISK FACTORS IN AGREEMENT WITH THE LEVEL OF PHYSICAL ACTIVITY

Lima, W.A., Glaner, M.F.

Catholic University of Brasília, Brazil

Several risk factors are associated to the development of cardiovascular diseases as the excess of relative body fat (%F), the accumulated fat in the trunk (%F trunk), arterial hypertension, dyslipidemia, physical inactivity, among others (Grundy, 1998). However, the objective of this study was to verify the risk factors if they differentiate in agreement with the level of physical activity (LPA). The sample for this study was 80 male individuals. The LPA was estimated by the questionnaire of habitual physical activities, developed by Pate (1995), being the individuals classified in four categories: Group 1 (G1)= inactive, Group 2 (G2)= irregularly active, Group 3 (G3)= moderately active, Group 4 (G4)= very active. The other risk factors measured were: systolic blood pressure (SBP), diastolic blood pressure (DBP), abdomen perimeter (AP), enzymatic glucose (EG), total cholesterol (TC), high density lipoprotein (HDL), low density lipoprotein (LDL), triglycerides (TG), %F and %F trunk. These last two were estimated for the dual energy X-ray absorptiometry. The blood was taken after fasting for 12 h and the sanguine analysis was made by the enzymatic method. The groups, by LPA were compared through analysis of variance between groups and Scheffé's test (ap<.05). The results obtained for G1, G2, G3 and G4 were: SBP= 133.0 +/- 12.7; 133.0 +/- 19.3; 130.9 +/- 18.2 and 128.5 +/- 19.6 mmHg; DBP = 90.0 +/- 10.5; 86.5 +/- 14.0; 83.3 +/- 14.0 and 84.1 +/- 17.1 mmHg; APa= 94.0a +/- 3.8; 89.3ab +/- 9.3; 87.9ab +/- 9.1 and 82.9b +/- 10.7 cm; %F= 25.6 +/- 3.7; 21.9 +/- 7.2; 19.7 +/- 7.8 and 17.8 +/- 9.2%; %F trunk= 29.7 +/- 4.9; 23.1 +/- 9.0; 22.5 +/- 9.4 and 19.9 +/- 10.6%; EG= 97.7 +/- 10.7; 93.6 +/- 15.7; 95.2 +/- 9.3 and 95.1 +/- 27.3 mg/dL; TC= 179.5 +/- 27.7; 159.8 +/- 39.0; 161.3 +/- 36.9 and 149.2 +/- 32.2 mg/dL; HDLa= 36.4 +/- 7.5; 41.5 +/- 11.7; 38.1 +/- 9.9 and 46.0 +/- 13.7 mg/dL; LDLa= 114.7 +/- 27.7; 92.5 +/- 35.4; 100.2 +/- 29.7 and 82.2 +/- 29.5 mg/dL; TG= 143 +/- 62.8; 134.1 +/- 59.6; 116.8 +/- 70.1 and 107.9 +/- 64.3 mg/dL, respectively. The individuals from the moderately and very active group apparently presented less expressive mean values for the factors of cardiovascular risk in all the variables, but, this difference was only shown significant for AP, HDL and LDL. However Scheffé's test evidenced differences between inactive and very active individuals in AP. In spite of limited questionnaires to estimate LPA, the obtained results are good indicators as how the physical activity can be beneficial to reduce and/or to control the risk factors for the cardiovascular diseases.

Grundy, SM (1998). Am J Clin Nutr. v.67(suppl):p.563S-72S.

Pate (1995). Quest. v. 47, p.304-310.

RISK FACTORS BETWEEN MEN WITH POSITIVE OR NEGATIVE FAMILY REPORTS FOR CARDIOVASCULAR DISEASES

Lima, W.A., Glaner, M.F.

Catholic University of Brasília, Brazil

Several risk factors are associated to the development of cardiovascular diseases (CVD), above all, in the individuals that already possess a positive family report (Navas-Nacher, 2001). Therefore, the objective of this study was to verify if there are differences, in the risk factors, among subject with positive family reports (FR+) and negative (FR-) for CVD. The sample of this study was 78 males from which 24 presented FR+ and 54 presented FR- for CVD. The mean body mass and stature were: FR+ = 74.6 +/- 8.8 kg and 169.5 +/- 7.5 cm; FR- = 70.5 +/- 9.2 kg and 167.7 +/- 6.3 cm, respectively. The risk factors measured were: systolic blood pressure (SBP) and diastolic blood pressure (DBP), abdomen perimeter (AP), % body fat (%F), % trunk fat (%F trunk), enzymatic glucose (EG), total cholesterol (TC), high density lipoproteins (HDL), low density lipoproteins (LDL) and, triglycerides (TG). The %F and %F trunk were estimate for the dual energy X-ray absorptiometry. The blood was taken after fasting for 12 h and the analysis was made by the enzymatic method. The groups were compared by Fischer's statistics F (*p<.05). The results obtained for FR+ and FR- were: age 38.0 +/- 10.6 and 34.2 +/- 9.7 years old; SBP*= 138.5 +/- 20.4 and 127.5 +/- 15.9 mmHg; DBP= 88.1 +/- 16.7 and 84.1 +/- 13.1 mmHg; AP*= 92.2 +/- 8.5 and 85.4 +/- 9.6 cm; %F*= 25.3 +/- 7.6 and 18.3 +/- 7.3; %F trunk*= 28.8 +/- 9.0 and 20.1 +/- 8.6; EG= 95.3 +/- 11.4 and 95.3 +/- 19.3 mg/dL; TC*= 181.3 +/- 36.7 and

151.6 +/- 31.4 mg/dL; HDL= 40.4 +/- 10.2 and 41.0 +/- 12.2 mg/dL; LDL*= 112.8 +/- 33.4 and 88.6 +/- 28.5 mg/dL; TG= 139.9 +/- 57.3 and 113.4 +/- 68.6 mg/dL, respectively. The results found indicate that individuals with FR+ should receive larger attention in the primary analysis and in the follow up of these factors that presented significant difference. The age did not explain the differences between the groups once these did not differ statistically. The results demonstrated agreement obtained by Nicklas et al. (2004), which emphasizes that the development of CVD is associated with the genetics as well for bad incorporate habits of the social environment.

Navas-Nacher, EL. et al. (2001). Ann Intern Med. v. 134: p.433-39.

Nicklas, JB et al. (2004). Am J Epidemiol; v.160(8): p.741-49.

PHYSICAL EVIDENCES OF DISEASE RISK FACTORS IN FEMALE EMPLOYEES

Oliveira, F.P., Vigário, P.S., Terra, B., Vieira, R.S., Jotta, B., Rodrigues, C.

Health Promotion Center (HPC) , Brazil

Introduction:Nowadays, obesity is considered one of the most important public health problems being associated with chronic diseases. The World Health Organization (WHO) estimates that there are 300 millions of obese people in the world. In Brazil, according to Health Ministery's data, 32.9% of the population is obese. Besides others projects, Petrobras has created, in 2004, the Health Promotion Center (HPC) for its employees. The project includes all employees that present risk factors and/or chronic diseases, detected on the annual medical evaluation. All employees selected to participate of HPC, are submitted to functional and nutritional evaluations and, from those information, individual fitness training programs are developed.

Objective:The aim of this work was to analyze biochemical's data and body composition of female HPC participants.

Methods:A total of 316 Petrobras' female employees (41±9 years) participated of this sectional investigation. Biochemical's data were obtained from the Medical Service of the company (data available for only 184 participants of this study). The anthropometric method was adopted and Height (cm), Body weight (kg), Skinfolds thickness (mm), Bone diameters (cm), Perimeters (cm), Circumferences (cm) were measured and Abdominal perimeters; Body Fat Percentage (%BF) - obtained from Body Density estimated according to the equation developed by Jackson et al. (1980); Body Mass Index (BMI= weight/Heigth2,kg/m2); and Waist/Hip ratio were studied. Theses parameters were analyzed considering risks of obesity and others diseases.The calculation and descriptive statistics of the variables were performed with the software "Excel" (2002).

Results/Discussion:A high frequency of women presented alterated biochemical's results. An expressive number of women presented high levels of Total Cholesterol (> 200 mg.dl, 64.5%) and high levels of Low-Density Lipoprotein Cholesterol (LDL-C >160 mg.dl, 57.4%). Results of HDL-C, Serum Triglyceride and Glucose were in the normal pattern. It was also verified that 14% of the women presented Metabolic Syndrome (Brazilian Society of Cardiology, 2005 –three or more risk factors). The anthropometric analysis showed that 56.0% (n= 177) of the female have high %BF and 46.5% (n=147) have high BMI (32.6% classified as overweight; 10.5% classified as obesity I and 2.5% classified as obesity II). The other two anthropometric indexes, important for health, analyzed in this study, pointed out for serious alterations: 87% of the woman has abdominal perimeters higher than the expected value for genre and 71.2% presented Waist/Hip ratio pointing to high or very high risk of disease.

Conclusions:The expressive presence of women with alterated biochemical's results and classified as obese is preoccupying because these indexes express potential cardiovascular morbidity and mortality. With the enrollment of these women, in the HPC, these results will certainly improve. Physical activity added to dietary intervention is effective in weight loss and in the improvement of cardiovascular system.

IS PHYSICAL ACTIVITY LEVEL REDUCED IN CHILDREN WITH CHRONIC DISEASES ?

Farpour-Lambert, N.J., Martin, X., Keller-Marchand, L., Trigona, B., Oehrli, M., Schwitzgebel, V., Aggoun, Y., Hofer, M., Beghetti, M.

University Hospitals of Geneva and Lausanne, Switzerland

BACKGROUND: Physical activity may be reduced in children with chronic diseases due to overprotection, social exclusion, low physical fitness, lack of information or pain. However, there is little information about physical activity in this population. OBJECTIVE: To compare the physical activity level of children with type 1 diabetes, obesity, or juvenile idiopathic arthritis with that of healthy children. METHODS: This was a cross-sectional study including 30 children with type 1 diabetes (DIAB, 10.5 +/- 2.3 yr), 32 obese children (OB, 9.5 +/- 1.1 yr), 26 children with juvenile idiopathic arthritis (JIA, 10.0 +/- 2.5 yr) and 122 healthy controls (CON, 9.9 +/- 2.8 yr). We measured the physical activity count and the time spent in light, moderate, hard and very hard activities using an uniaxial accelerometer (MTI Actigraph 7064) worn at the waist during 7 days (24 hours /day), except during aquatic activities. We also assessed past 12-month leisure-time physical activity by the Modifiable physical activity questionnaire for Adolescents, and anthropometrics. RESULTS: Groups were matched for age and height. Obese children had higher body weight (52.6 +/- 14.0 kg) and body mass index (25.2 +/- 5.4 U) compared to other groups. Physical activity count was decreased in DIAB (303.9 +/- 104.2 cpm, p=0.011), OB (308.2 +/- 53.5, p=0.016) and JIA children (316.4 +/- 82.2, p=0.048) compared to controls (361.3 +/- 125.2). There were no significant differences among the three groups with chronic diseases. Time spent in moderate physical activity was significantly decreased in DIAB and OB compared to JIA and CON groups, and time spent in hard activities was reduced in OB compared to CON. Past 12-month leisure-time physical activity was significantly reduced in OB (0.6 +/- 1.1, hours/week, p=0.001) compared to DIAB (4.0 +/- 4.1), JIA (4.3 +/- 3.2) and CON groups (4.2 +/- 4.6). CONCLUSION: Our study demonstrates that children with type 1 diabetes, obesity and juvenile idiopathic arthritis have reduced physical activity levels compared to healthy children. As physical activity is an important determinant of health and quality of life during growth, these children should be encouraged to be more active.

EFFECT OF AN INPATIENT INTERVENTION ON AEROBIC FITNESS IN PATIENTS WITH JUVENILE OBESITY

Knöpfli, B.H., Schätzle, B., Lehmann, M., Radtke, T.

Alpine Children's Hospital Davos, Switzerland, Switzerland

Background: In most patients with juvenile obesity limitations in aerobic fitness occur, especially if the overweight exceeds the age related 98th percentile. Such deconditioning leads to restrictions in the career prospect or even to physical disability. Specific therapeutic exercise is needed to treat those patients. The present study evaluates a 14-month follow-up of an inpatient intervention on aerobic fitness. Methods: 17 obese girls (n=9) and boys (n=8) were tested at the beginning (IN), at the end of an inpatient program lasting 8 weeks (8W), after 6 month post-hospitalization program (6MFU = 6-month follow-up) and again 8 month later (14MFU = 14-month follow-up). They were

13.4±1.8 years old with a body weight of 87.5±19.2 kg and a body mass index of 32.6±4.8 kg/m2 (for all subjects age related percentile >98). The inpatient program was based on a multicomponent treatment and education focusing on nutritional changes, behavioral modifications and physical activity (at least 45 min/day; 50-75% of maximal heart rate; in swimming, walking, hiking, jogging, skiing, and ball games), in which the participants took part in daily organized activities. In addition, patients were encouraged to use active pursuits as part of their daily life in the hospital. A major effort was done in planning for, and monitoring each patient's post-hospitalization program including the identification of a team of health professionals located close to the patient's home. This was done in coordination with the referring health professional. Maximal aerobic power tests were performed on a cycle ergometer. The study was analyzed, using a one-way ANOVA with repeated measurements. Results: VO2max per body weight significantly increased throughout the inpatient program from 26.8±5.2 to 33.1±4.3 ml/min/kg (pIN-8W<0.001). This increase lasted for the whole outpatient period: at 6MFU 33.1±6.5 and at 14MFU 32.0±5.7 ml/min/kg; pIN-6MFU<0.001 and pIN-14MFU<0.001; p8W-6MFU=ns(1.00), p8W-14MFU=ns(0.61). A similar pattern occurred in VO2max percent predicted (IN 58.1±12.3, 8W 71.5±10.1, 6MFU 71.6±13.5, 14MFU 69.7±12.8 %predicted; pIN-8W<0.001, pIN-6MFU<0.001, pIN-14MFU<0.001; p8W-6MFU=ns(1.00), p8W-14MFU=ns(0.76)) as well as relative peak me-chanical power (IN 2.03±0.39, 8W 2.72±0.43, 6MFU 2.82±0.54, 14MFU 2.74±0.56 Watt/kg; pIN-8W<0.001, pIN-6MFU<0.001, pIN-14MFU<0.001; p8W-6MFU=ns(0.64), p8W-14MFU=ns(1.00)). Absolute VO2max as well as absolute peak mechanical power significantly increased throughout the in- and outpatient periods (IN 2333±581, 8W 2470±461, 6MFU 2470±543, 14MFU 2631±440 l/min; pIN-8W=ns(0.34), pIN-6MFU=ns(0.34), pIN-14MFU=0.003; p8W-6MFU=ns(1.00), p8W-14MFU=ns(0.21). IN 173±35, 8W 203±41, 6MFU 213±39, 14MFU 225±45 Watt; pIN-8W<0.001, pIN-6MFU<0.001, pIN-14MFU<0.001; p8W-6MFU=ns(0.40), p8W-14MFU=0.002). Conclusion: A specific therapeutic exercise as a component of a multidisciplinary inpatient program and a comprehensive follow-up outpatient program is a successful method to improve a clinically relevant aerobic deconditioning to an almost normal fitness.

ECCENTRIC ERGOMETRY AS STRENGTH TRAINING FOR ELDERLY SUBJECTS

Havas, E., Purtsi, J., Heiskanen, J., Selanne, H., Vihko, V.

LIKES-Research Center, Jyväskylä, Finland

Purpose: Eccentric exercise has recently been proposed as a feasible and effective method for strength training especially for the elderly. This experiment compared the effectiveness of endurance type eccentric ergometer and traditional strength training emphasized on knee extensor muscles in improving knee extensor strength and functional capacity of the subjects.

Methods: Altogether 72 voluntary subjects (42 females and 30 males, mean age 64 (range 55-78) yrs) completed the study. The subjects were randomized into three experimental groups, traditional strength training (GYM), eccentric ergometer training (ECC) and non-training control (CRTL). The training regimen of the GYM group consisted of 3 sets of 8-12 repetitions (60-80% of 1RM) at four different leg and knee extensor exercises, totalling on the average of 130 repetitions during a single training session. The ECC group trained at motor driven eccentric ergometer by resisting the movement of the ergometer´s pedals. Typically the number of contractions per ECC training session exceeded 1000. Both groups trained 4 first weeks twice a week, and next 6 weeks three times a week. The intensity of each training session was individually adjusted and progressed targeting at RPE values 14-15 in both groups. The CTRL group continued their normal habitual activity. The functional capacity of the subjects was assessed using TUG-test, stair ascending and descending tests, and the main outcome measure of the training intervention was isometric force production of the knee extensor muscles. The measurements were carried out before, after 4 weeks and after 10 weeks of training.

Results: The average number of training sessions completed was 20 (sd 2) in both training groups. The mean RPE value was 14.5 in the ECC and 14.0 in the GYM. The mean duration of the training session in the ECC was 24 min and 58 min in the GYM. There were no significant differences in results any of the functional capacity measurements between the groups, ie. all groups improved the results by 13-17 % during the intervention period. However, the maximal isometric knee extension force remained unchanged (+5%) in the CRTL group, but was equally improved in the GYM group (+15%) and ECC group (+16%).

Conclusion: Eccentric ergometry was as effective as focused strength training program in improving maximal isometric knee extensor muscle force at same perceived exercise intensity. However, the time required per training session for the improved results was less than half using eccentric exercise than it was using traditional (concentric) strength training program. This supports the concept of using eccentric exercise as a feasible and effective training modality in improving muscle strength.

SELF-REPORTED WAKING AND SLEEPING PERIODS VERSUS VALUES ESTIMATED FROM ACCELEROMETRY DATA

Rumo, M., Ruch, N., Mäder, U.

Swiss Federal Institute of Sport, Switzerland

INTRO: Accelerometers are widely used in the objective measurement of physical activity. In order to adequately interpret behavioural pattern concerning physical activity, it is crucial to determine waking and sleeping periods. Globally fixed points of time for getting up and going to bed do not take individual differences into account, so one can rely on diaries or try to estimate sleeping and waking periods from the accelerometry data. Differences between estimated and self-reported time points for rising and sleeping were investigated.

METHOD: Accelerometry data was recorded from 50 individuals (26 males, 24 females; age: 39 ± 11 years) wearing an Actigraph (Manufacturing Technology Inc. (MTI), Fort Walton Beach, FL, USA) for 4 to 7 consecutive days. All subjects had to indicate for each day the time of getting up and the time of going to bed in a diary. 332 valid days were used for the analysis. Counts were recorded minute-by-minute. For each day the longest time period, during which the mean counts over 10 minutes do not exceed 180 were considered to be the sleeping period. The time points estimated in this way were compared to the indications from the diary.

RESULTS: The mean of the time that was reported by the subjects for rising in the morning was 7h58 ± 1h38 and for the time of going to bed 23h07 ± 3h19, the means of the algorithms estimation were 8h14 ± 1h57 and 23h52 ± 12h07 respectively. The differences between the two methods did reach statistical significance.

CONCLUSION: The automated estimation tends to assign later time points to the start and the end of the waking period. The gap between the estimated time of rising and the self-reported one can be explained by the fact that the subject put on the accelerometer short after he / she actually got up. The estimation of the times for going to bed seems to be a harder problem to automate.

METABOLIC SYNDROME AND PHYSICAL ACTIVITY LEVEL IN PREPUBERTAL OBESE CHILDREN

Farpour-Lambert, N.J., Keller-Marchand, L., Martin, X., Trigona, B., Schwitzgebel, V., Aggoun, Y., Beghetti, M.

Pediatric Cardiology Unit, Switzerland

BACKGROUND: Obesity is a major public health problem that is associated with the Metabolic Syndrome, defined by body fatness, dyslipidemia, hyperinsulinemia, hypertension, and low aerobic fitness. Foundation of cardiovascular diseases may appear early in life in this population. OBJECTIVE: To assess the main components of the metabolic syndrome and physical activity level in prepubertal obese children. METHODS: Cross-sectional study including 47 prepubertal obese children and 47 matched lean controls (mean age 9.1 +/- 1.5 years). We measured fasting blood lipids, glucose and insulin levels; body fatness by DXA; 24-hour systolic and diastolic systemic blood pressure; maximal aerobic capacity (peakVO2) by a treadmill test, 7-day physical activity count by uniaxial accelerometer (MTI Actigraph), and anthropometrics. RESULTS: Age, height and pubertal stage (Tanner 1) were similar among groups, however obese children had higher body weight (48.4 +/- 13.6 vs 31.8 +/- 7.0 kg), BMI (25.1 +/- 4.7 vs 16.4 +/- 1.9 U) and body fatness (41.4 +/- 9.2 vs 21.1 +/- 7.4 %). Obese children had lower cholesterol-HDL (1.11 ± 0.26 vs 1.42 +/- 0.32 mmol/l, p=0.001), and higher cholesterol total/HDL ratio (4.12 +/- 1.31 vs 3.21 ± 0.72, p=0.001) and cholesterol-LDL/HDL ratio (2.83 +/- 1.17 vs 2.00 +/- 0.64, p=0.001) compared to controls. Insulin levels (12.0 +/- 6.3 mU/l vs 4.6 +/- 3.2, p=0.001), mean 24-hour systolic (124.7 +/- 14.0 vs 101.8 +/- 18.3 mmHg, p=0.001) and diastolic blood pressure (72.9 +/- 7.1 vs 63.8 +/- 5.4 mmHg, p=0.001) were augmented. Seven day physical activity count (317.6 +/- 57.2 vs 376.5 +/- 119.0 cpm) and VO2peak (35.9 +/- 6.6 vs 44.2 +/- 7.8 ml/kg/min, p=0.001) were reduced in obese children. CONCLUSIONS: Our study demonstrates that main components of the metabolic syndrome appear before puberty in obese children. Therefore, there is an urgent need to develop prevention strategies early in life. The treatment of obese children should include adapted physical activity, to prevent the development of cardiovascular diseases and type 2 diabetes risk factors.

THE RELATIONSHIP BETWEEN THE RESPIRATORY FUNCTION AND MOTOR ABILITIES OF THE ELDERLY

Rozek, K., Ignasiak, Z., Piechura, J., Slawinska, T.

University School of Physical Education, Poland

Because of the growth of life expectancy in all the industrialized countries, the number of elderly people increases. The society of our country is also getting older. Physical ability, which is one of the indexes of human development and health, is not only a popular subject but also one of the main topics of researches on physical culture. The importance of the researches grows while the human physical activity declines and the number of "civilization diseases" rises.

The aim of the research was to present the level of physical fitness of elderly people and to characterize the relationship between motor abilities and some of the chosen functional parameters of lungs.

The research group consist of 72 randomly chosen "students" of the University of the Third Age in Wroclaw – 45 women and 26 men. Among them, 73,1% of the men and 68,2% of the women declared to do some exercises every day.

The following measurements have been analysed: height and weight of a body, BMI, waist to hip ratio (WHR) and results of tests measured with some chosen European Personal Fitness Tests "Eurofit": plate tapping, shuttle run, hand grip, sit and reach, and ball threw. Additionally, the activity of lungs was examined and the following parameters were chosen for analysis: FVC, FEV1, MEF50, and MVV.

The analysis was conducted on the base of basic descriptive statistics and path analysis.

The relationships presented above show that the level of physical fitness has a great influence on basic respiratory parameters, in which the strength of muscles is of a great importance. Therefore the coefficients describing strength abilities are more visible and the values of the anatomic ones are smaller (MEF50).

The initial results of the analysis show that the most significant factors determining breathing parameters are strength abilities and flexibility

Conclusions

1. It was observed that more men than women were physically fit and had more favorable level of activity parameters of the respiratory system.

2. Among all analysed motor abilities, the strongest influence on breathing parameters of lungs had: static strength of hands' muscles and explosive strength of upper limb.

References:

Szopa J. (1988) Mater.Pr.Antropol., 109: 73-103.

Walla G. i wsp. (2000) Ann.Acad.Siles., 44-45: 83-90.

Wolański N., Siniarska A. (1986) Wychowanie Fizyczne i Sport, 3: 15-38.

RELATION OF BODY MASS INDEX TO FAT AND FAT-FREE MASS AMONG GREEK CHILDREN

Christodoulos, A., Tokmakidis, S.P., Douda, H.

Democritus University of Thrace, Greece

Introduction

The Body Mass Index (BMI, kg/m²) is widely used as a proxy measure of adiposity. However, it is rather a measure of excess weight relative to height, than excess body fat. Moreover, the interpretation of BMI among children is further complicated by the occurring changes in weight, height and body composition during growth (Horlick 2001). The relatively weak correlations (r<0.6) reported between BMI and body fat among children (Widhalm et al. 2001, Kerruish et al. 2002) underline the need for further research, especially in different subgroups. Thus, the purpose of the current study was to examine the relation of BMI to levels of fat mass and fat-free mass among healthy Greek children.

Methods

128 randomly selected 11-year old children from the greater area of North Attica, Greece, were examined. BMI was calculated for all subjects. Percentage body fat, calculated from two skinfolds (i.e., triceps and medial calf, average of two measurements) (Lohman 1992), was used to measure fat and fat-free mass. These measures were standardized for height by calculating the fat mass index (FMI, fat mass/ht²) and the fat-free mass index (FFMI, fat-free mass/ht²). Pearson correlation coefficients were used to examine the relation of BMI to FMI and FFMI. Stratified analyses examined whether the relation of BMI to FMI and FFMI varied across categories of BMI.

Results

BMI levels were more strongly associated with FMI (r=0.95-0.96) than with FFMI (r=0.58-0.88). Stratified analyses indicated that these associations varied across the BMI-for-age categories. Among children with a BMI <50th percentile (P), BMI levels showed stronger association with FFMI (r=0.73-0.87) than with FMI (r=0.51-0.58). In contrast, among relatively heavy children (BMI ≥85th P), BMI was more strongly associated with FMI (r=0.86-0.89) than with FFMI (r=0.31-0.64).

Discussion/ Conclusions

Our results show that BMI performs well among relatively heavy children, but not among thinner children, indicating that BMI levels should be interpreted with caution. Although a high BMI-for-age is a good indicator of excess fat mass, BMI comparisons among non-overweight children need to be interpreted carefully, as they may be largely due to differences in fat-free mass.

References

Horlick M (2001) J Clin Endocrinol Metab 86: 4059-4060

Kerruish KP et al. (2002) Am J Clin Nutr 75 : 31-37

Lohman, T.G. (1992) Human Kinetics Publishers

Widhalm K et al. (2001) Int J Obes Relat Metab Disord 25: 279-285.

THE EFFECT OF PHYSICAL ACTIVITY ON POSTURAL STABILITY IN OLDER WOMEN

Ostrowska, B.

Academy of Physical Education in Wroclaw, Poland

One of main problems connected with the process of ageing is balance disturbance and higher susceptibility to falls. Therefore, it is vital to identify the risk factors of falls and to control the implementation of intervention programs.

To investigate the role of physical exercise program on postural performance in postmenopausal women we measured postural sway (COP) in 60 physically active and 31 sedentary subjects using a force plate. The recorded data were used for computing measures of the COP dispersion (range, mean velocity and mean radius) and the frequency of the "COP minus center-of-mass" difference (corrective signal) [1]. Physically active subjects have participated in general fitness program for at least 6 months prior to the study with intensity of 2 to 3 one-hour workouts a week.

Lower values of the mean velocity and mean radius in the exercising group ($p<0.05$) indicate their better balance. In the sedentary group we found high correlations between age and measures of the COP: mean velocity ($p<0.001$) and other parameters ($p<0.05$). It means that the sedentary group represents a model of aging characterized by an inevitable decline in neuronal function, while active persons a model of stable optimal neuronal function with age [2]. The combined comparison of measures of the COP dispersion with the frequency of the corrective signal lets us infer that physically active subjects have stabilized their postural performance at an acceptable level, while the sedentary persons cannot effectively overcome the challenge of their deteriorating balance.

To conclude, the results of this study provide evidence that participation in a systematic general fitness program may significantly improve balance and decrease prevalence of falls and subsequent fractures in postmenopausal women.

Kuczyski M., Ostrowska B. Understanding falls in osteoporosis: The viscoelastic modeling perspective. Gait&Posture 2006, 23, 51-57.

Shumway-Cook A., Woollacott MH. Motor Control: Theory and Practical Applications. Philadelphia: Lippincott Williams & Wilkins 2001.

6-YEAR EVOLUTION OF PHYSICAL ACTIVITY LEVEL OF ADULTS OVER 50 YEARS-OLD

Matsudo, S.M., Araújo, T.L., Matsudo, V.K.

Physical Fitness Research Center from São Caetano do Sul CELAFISCS & Agita São Paulo Program, Brazil

Introduction: physical activity promotion in the community has been the main focus of the Agita São Paulo Program in the State of São Paulo Brazil since 1996. A regular evaluation of the PA level of the population has been performed since the beginning of the program.and has showed that after 5 years of intervention there was an increase of about 2%/yr in the walking involvement. Purpose: to analyze the evolution of physical activity (PA) level in males and females, over 50 years old from a community with a PA program intervention since 1996. Methods: sample comprised 1235 subjects, over 50 years old, men and women, 50 to 88 years-old (62.3+9.10 years-old). Subjects were selected from a randomized sample of population stratified by age, gender, and educational and socioeconomic status from the metropolitan region of São Paulo in the State of São Paulo, Brazil. They were interviewed each year from 1999 to 2005 at home by a trained professional using the IPAQ, 8th, short version. Subjects were classified as: Active: vigorous PA (VPA) performed at least 3d.wk-1,20 min per day; or moderate activity: 5d.wk-1; 30 min per day; or walking 150 min.wk-1; or an accumulation of 150 min.wk-1, 5 times per week of VPA, moderate PA (MPA) and/or walking; Very Active: those who performed VPA >5d.wk-1 and >30 or vigorous 3d.wk-1, 20 min per day plus moderate/walking: 5d.wk-1 30 min per day or 150 min.wk-1. Subjects below that recommendation were considered as Irregularly Active, and those who reported no PA at all were classified as Inactive. Statistical analysis used was Chi square test (X2) and the level of significance adopted was $p<.05$. Results: sample distribution (%) according to PA level from 1999 to 2005 was: a- Sedentary: 20.5 (1999); 25.2 (2002); 17.1 (2003); 14.2 (2004); 19.2 (2005); b-Irregularly Active: 30.0 (1999); 27.0 (2002); 28.2 (2003); 27.2 (2004); 30.6 (2005); c-Active: 42.3 (1999); 44.2 (2002); 50.0 (2003); 52.9 (2004); 45.9 (2005); d-Very Active: 7.3 (1999); 3.5 (2002); 4.7 (2003); 5.5 (2004); 4.3 (2005). Rates of inactive (sedentary) people varied from 14.2% to 25.2%. Considering the groups of active and very active as those who reached the PA recommendation for health, at least 47.7% to 58.4% of the sample through this period got the adequate PA level. Similar distribution was found according to gender. Statistical analysis showed no differences in the distribution of the PA level through the period of 6 years. Conclusion: although an increase in total PA level of the population (specially walking) has been found in this population as a result of the intervention done by Agita São Paulo Program, this increase seems not to be dependent of the population over 50 years-old. The PA profile of people over 50 remained stable during the 6-year period of community intervention.

CNPq Support: 309481/2003-1.

BASELINE DATA FROM A 2 YEAR SCHOOL-BASED INTERVENTION IN RURAL NORWAY

Resaland, G.K., Mamen, A., Anderssen, S.A., Andersen, L.B.

Sogn & Fjordane University College, Norway

Introduction

256 nine - year - old children (4th grade) (age 9.3±0.3) will participate in a 2-year intervention study of 60 minutes daily physical activity in a rural school in Norway. The reported data are baseline data. According to the Norwegian Directorate for Health and Social Affairs the

fitness and physical activity levels of children in Norway are decreasing. Surveys that have been conducted on 9–15 year old Norwegian children have shown that the body weight has increased 3-4 kg in only 25 years (SEF, 2000). A decline in daily physical activity levels may be a factor contributing to the current obesity epidemic in the world (Saris et al, 2003). Since it is generally accepted that the onset of many chronic diseases lies in early childhood, preventive strategies should start as early as possible (Twisk, 2001). The natural institution where this could be done in Norway is the schools, where all children spend most of their day. The daily physical activity in the intervention will be activities that are fun, exciting, varied and full of play. The purpose of this abstract is to give baseline data and the association between fitness and HOMA score.

Methods

VO2peak was measured directly where the children ran on a treadmill until voluntary fatigue. After an overnight fast, intravenous blood samples were taken to analyse insulin, glucose, triglyceride, total cholesterol and HDL- cholesterol. Body weight was measured to the nearest 0.1 kg using a calibrated electronic scale with the children wearing light indoor clothing. 0.2 kg was subtracted from the result. Body height was measured to the nearest 0.1 cm, with the children standing in an upright position and the face fronted forward. Body mass index (BMI) was calculated as weight per squared height (kg•m-2). BMI were analyzed using the internationally accepted cut-points published by Cole et al (2000).

Results and conclusions

The main conclusions from the baseline data are that boys have significantly higher VO2peak than girls regardless of how it was expressed. The mean values (SD) for fitness were 55.7±7.0 for boys and 49.3±7.8 (ml (kg-1 min-1)) for girls. When using Cole et al's (2000) classification, 15 % of the boys and 25 % of the girls had a BMI score that is classified as overweight or obese. These differences may be due to genetic, behavioural or a combination of factors. Cardio-vascular fitness is recognised as an independent risk factor for CVD. Those belonging to the lowest (worst) quintile of fitness had a significant higher risk of belonging to the highest (worst) quintile of HOMA score ($p<0.05$) compared to the more fit children.

Literature

Cole et al (2000). MBJ. Vol 320 (7244). 1240-1243.

Norwegian Directorate for Health and Social Affairs (SEF) (2000). Report nr. 2/2000.

Saris et al (2003). Obesity Reviews. Vol 4 (2). 110-114.

Twisk (2001). Sports Medicine, 31(8), 617–627.

BODY COMPOSITION AS PREDICTOR OF MUSCLE STRENGHT. THE AVENA STUDY

Urzanqui, A. 1+2, González-Gross, M. 1+2, Barrios, L. 3, Ortega, F.B. 2, Valtueña, J. 1+2, Moreno, L.A. 4, García-Fuentes, M. 5, Benito, P.J. 1, Gutiérrez, A. 2

1 Univ. Politécnica Madrid, 2 Univ. Granada, 3 CSIC, 4 Univ. Zaragoza, 5 Univ. Cantabria, Spain, Spain

Introduction

Adolescence is a decisive period in human life in which important body composition changes occur. Increase of total body mass and its relative distribution are mainly related to physical fitness (strength, speed, flexibility and endurance among others), as well as to gender and pubertal development. The aim of this study was to assess the influence of body composition on physical strength in adolescents. The final aim is to obtain a formula to predict this quality in adolescents, together with the setting of standard values which would allow its interpretation.

Methods

A sample of 2477 adolescents (1194 females), aged 13 to 18.5 from the AVENA study was analysed on the left side of the body for the following anthropometric measurements: skinfold thickness (biceps, triceps, thigh and calf muscles, mm), circumferences (arm relaxed, arm flexed & tensed, thigh, and calf, cm), diameters (elbow, wrist and knee cm); also weight (kg) and height (m). The following parameters were calculated: BMI, arm and thigh muscle area and arm and thigh fat mass. Strength was assessed (for both hands and feet) by using three tests included in the Eurofit test battery: standing broad jump test (lower-limb maximal explosive strength), hand-grip test (maximal isometric handgrip strength), bent arm hang test (upper-limb endurance strength). The relationships between strength and body composition have been studied separately for arms and legs. Statistical analysis has been done with SPSS 13.01 for Windows by means of Principal Components based upon Pearson's Correlations and Categorical Principal Components by Optimal Scaling and Stepwise Linear Regression.

Results and Conclusions

Strength increases with age in both genders. There is a negative correlation between fat mass and body strength in all cases. Those parameters inversely related to lower-limb strength are thigh and calf skinfolds and leg fat area, and directly related are height, weight and knee diameter. Handgrip strength measured on the left side is highly related to strength in the right hand ($r= 0.92$; $p<0.01$). It is positively influenced by height, muscular arm area, wrist and elbow diameter, and negatively by biceps and triceps skinfolds and arm fat area. Upper-limb body strength is inversely related to biceps and triceps skinfolds and arm fat area, and directly related to arm muscle area, height, wrist and elbow diameter. In both sexes the difference between flexed-tensed and relaxed upper arm circumference is the best mark of strength. The levels of studied variables (strength and body composition measurements) vary significantly between age and gender groups, but the observed relationships between dependent and independent variables are maintained.

FUNDING

This study was funded by the Spanish Ministry of Health FIS nº 00/0015, CSD grants 05/UPB32/0, 109/UPB31/03 and 13/UPB20/04, the Spanish Ministry of Education (AP2003-2128), and grants from Panrico S.A., Madaus S.A. and Procter and Gamble S.A.

REVIEW OF SCIENTIFIC LITERATURE IN ADAPTED PHYSICAL ACTIVITY AND DISABILITY SPORT

Trost, T., Ciliga, D., Petrinovic- Zekan, L.

Faculty of Kinesiology, Croatia

INTRODUCTION

The term "disability sport" has become common in the last decade (DePauw et al, 1995). Disability sport is «meant to give equal weight to each word and disability is not meant as an adjective to Sport» (Doll-Tepper et al, 1997). On the other hand, the term "adapted physical activity" (APA) defines "a cross-disciplinary body of knowledge directed towards the identification and solution of individual differences in

physical activity". The aim of this study was to assess progress achieved in the study of disability sport and APA over five years and to find out and analyze the most common issues in the field of APA and Disability Sport research.

METHODS

Electronic search of journals was used. The databases used were: Academic Search Premier, Medline, ERIC, and MasterFILE Premier. Key words used in this search were adapted physical activity, disability, disability sport, sport for disabled, Special Olympics and Paralympics. Years of publications were constrained to 2000-2004. Only journal publications were included. Only articles published in english were processed. The found articles were divided into original scientific papers and reviews.

RESULTS

Electronic search of journals from 2000-2004 produced 225 publications. Original scientific papers made 83,74%, of the sample, the rest were review papers (16,26%). Among all electronically found publications, 34,66% investigated seven disability categories (amputations, spinal cord palsy, Down syndrome, mental retardation, visual impairments, development coordination disorders and deafness), 11,11% treated problems regarding APA education, while 43,11% were about disability sport. When no disabilities were specifically studied, or when the subjects in the study were not included in any kind of sport, papers were categorized as «other» (11,11%).

DISCUSSION/CONCLUSION

The majority of the papers classified as «APA education» were about supporting and limiting factors for the inclusion of children with physical disabilities in a regular full-time school program. A total of 25 papers in 5 years indicate the researchers' interest to improve the environment in which people with disability lives and to develop the teaching methods used in special schools. The Paralympics sports studied were wheelchair basketball, w. shot-putting, w. racing, w. volleyball, w. hand biking, swimming, running, discus throw and sailing, wile no paper about archery, bocce, equestrian, football 5-a-side, football 7-a-side, power lifting, table tennis, w. fencing, w. tennis or w. rugby were found. The need to increase the researchers' interest for the rest of the Paralympics sport is obvious, because the obtained results appear to be insufficient productivity to advance the field of disability sport significantly.

REFERENCES

1. DePauw, KP et al. (1995). Disability and Sport. Ch. IL: Human Kinetics.

2. Doll-Tepper, G et al. (1997). Database for Disability sport organisations. Berlin: IPCSSC.

3. EBSCO HOST Research Databases (2005).

MUSCLE QUALITY: EFFECTS OF THREE DIFFERENT TRAINING PROGRAMS IN OVERWEIGHT WOMEN

Valamatos, M.J., Pinto, R., Carnero, E., Sardinha, L., Santos, P.

Faculty of Human Kinetics, Technical University of Lisbon, Portugal; Physical Education School, Federal University of Rio Grande do Sul (UFRGS), Brazil, Portugal

Introduction

Nowadays obesity is a worldwide problem. It is an epidemic, which grows quickly in the contemporary society, affecting children, youths and adults of both genders. Several factors can be associated with the development of obesity, such as the hipper-caloric diet and a less active lifestyle.

The regular practice of physical activity and the development of a more active lifestyle have been associated to efficient strategies of body weight loss. On this issue, doubts have been mentioned on the literature, namely related with the type, intensity and duration of the exercise (Volek, J.S. et al., 2005). Strength training has been accepted as a useful tool in body weight loss programs, when the main purpose is the increase of lean body mass and the resting metabolic rate (RMR) (Kraemer et al., 1999). Thus, the aim of this study was to compare the changes in the muscular quality of the thigh muscles of prê-menopause overweight women, submitted to three different training programs.

Methods

51 overweight women (40±7 years old, 1.61±0.05 m; 74.5 ±10.5 Kg; 28.8±3.7Kg/m2) were randomized distributed by 3 groups of training (Aerobic (AT), Strength (ST), Concurrent Training (aerobic and strength associated - CT) and Control Group(CG)). The training process lasted 24 weeks, twice a week. Intake habits were controlled before and after the study. All the subjects were evaluated for isometric maximal strength in a "leg press" equipment. Body composition was evaluated using a dual-energy x-ray absorptiometry (DXA). The statistical analysis included descriptive statistics and paired-samples T-test.

Results

The Table 1 presents the parameters of muscular strength and body composition before and after the training process,in Aerobic (AT), Strength (ST), Concurrent Training (CT) and Control Groups (CG)(**p<0.01)

Discussion/Conclusion

Body weight did not change significantly after the training process, suggesting that physical exercise without appropriate diet, probably, is not enough to have a positive impact on weight loss. Despite this fact, when we analysed body composition we could observe relevant changes. The results showed a significant increase of the fat free Mass (FFM) and a reduction of the fat mass (FM) in the different training groups. Additionally, we have observed an increase on muscle strength, in absolute and relative terms, in the ST and CT groups, without a significant increase of the thighs FFM.Together, these results can be seen as improvement of the muscular quality, and CT seams to be a good tool to achieve that purpose.

References

Tracy,B.L.; et al., (1999). Muscle quality. II. Effects of strength training in 65- to 75-yr-old men and women. J. Appl. Physiol. 86(1), pp. 195-201

Volek, J.S. et al., (2005). Diet and Exercise for Weight Loss: a Review of Current Issues. Sports Medicine, 35 (1):1-9

Kraemer,W.J. et al., (1999). Influence of exercise training on physiological and performance changes with weight loss in men. Medicine and Science in Sports and Exercise, 31 (9): 1320-1329.

BONE MASS IS POSITIVELY ASSOCIATED WITH PHYSICAL ACTIVITY, MUSCLE STRENGTH, FITNESS AND LEAN BODY MASS IN SWISS SCHOOL CHILDREN [ISRCTN15360785]

Kriemler, S., Zahner, L., Puder, J.J., Roth, R., Schmid, M., Guldimann, R., Knöpfli, M., Rizzoli, R.

Institute of Sports and Sport Sciences, Switzerland

Background: More than every 3rd woman over 50 years suffers from osteoporosis. The impact of preventive measures on bone accretion is most pronounced during growth. We therefore looked for factors associated with higher bone mass in children and analysed the relationship between measures of physical activity (PA) and bone mineral density (BMD). Methods: Among 540 7-13 y old children (males and females) from randomly selected socio-ethnic diverse urban and rural public schools in Switzerland studied, 389 children had BMD and body composition measurements by dual energy x-ray absorptiometry (DXA). In 374 children physical activity was assessed by accelerometer. Vigorous PA was defined as the daily amount of time above 3000 counts/min. The independent association between BMD, PA, lower extremity strength (jump and reach), and aerobic fitness (20 m shuttle run) was assessed using partial correlation analyses. The association between low age- and gender adjusted BMD (Z-Score less than -1) with age, sex and pubertal stage, family history of osteoporosis, calcium intake, lean body mass (LBM), daily media use and all measures of PA was assessed using stepwise multiple logistic regression analyses. The amount of PA in children with low vs. high age- and gender adjusted BMD (Z-Score less than -1 and over +1, respectively) was compared by t-test. Results: The children were 9.2±2.2 yrs old (x±SD) with a LBM of 25.2 ± 6.7 kg and 23.5±6.0% body fat. BMD of the hip was 0.699±0.099 g*cm-2 and calcium intake 971±384 mg*d-1. Their daily PA was 599'390±167'322 counts*d-1 with 44.7±21.9 min spent in vigorous PA, in the jump and reach test they achieved 24.1±6.9 cm and in the shuttle run test they performed 5.7±2.2 laps. Independently of age, weight, height, sex, pubertal stage, calcium intake and family history of osteoporosis, total hip BMD was positively associated with more time spent in total and in vigorous PA (r=0.19 and 0.2, both p<0.01), strength (r=0.26, p<0.0001) and aerobic fitness (r=0.29, p<0.0001). On multiple logistic regression analyses, a low BMD of the hip was associated with male sex, older age and decreased LBM, strength and less vigorous PA (p<0.0001, n=274). Children with a high BMD spent 17% more time in daily PA compared to children with a low BMD (p<0.01). Conclusion: In Swiss children, higher BMD of the hip is independently associated with higher physical activity, muscle strength and fitness as well as LBM. Bone health improving interventions should therefore focus on increasing PA which also positively affects LBM, muscle strength and aerobic fitness.

This study was supported by the Federal council of Sports, Magglingen, Switzerland.

ANTHROPOMETRIC AND FUNCTIONAL CHARACTERISTICS IN SCHOOL CHILDREN FROM BOLOGNA (ITALY)

Brasili, P., Merni, F., Ceciliani, A., Ventrella, A., Semprini, G., Toselli, S.

University of Bologna, Italy

Anthropometric and Functional Characteristics in School Children from Bologna (Italy)

Brasili P.1,Merni F.2,Ceciliani A. 3,Ventrella A.1,Semprini G. 2,Toselli S. 1

1Dep. Evolut. Experim Biology –Unit of Anthropology–University of Bologna, Italy;

2Dep.Histology, Embryology and Applied Biology-University of Bologna, Italy;

3 Dep. Education- University of Bologna, Italy

Middle childhood appears fundamental in the development of strength and motor performance, with differences among specific skills. The purpose of this study is to evaluate the characteristics of Italian children in the context of growth, body composition and functional characteristics. The sample included 163 school children (97m,66f), from Bologna(Italy) aged 6-11y. This study is the first phase of a broader longitudinal project dealing with modifications in somatic and motor characteristics. The anthropometric dimensions included weight, height, sitting height, breadths, circumferences and skinfold thicknesses. Percentage fat was estimated with the procedures of Slaughter et al.(1988); fat-free mass(FFM) and fat mass(FM) were derived. Functional characteristics included lower back/upper thigh flexibility (sit and reach) and strength tests: hand grip, standing board jump, pinches and ball throwing. In addition, tests were performed in order to evaluate the dominant side of the body and the degree of "coordination" (eye-hand coordination with a tennis ball throw test and kinaesthetic differentiation trough weight estimation test).The growth status of children from Bologna is congruent with Italian standards (Cacciari et al., 2002). Males are fatter than females, but they generally show better motor performance. Only flexibility is higher in females. The results of stepwise multiple regression analysis for motor characteristics show that a substantial portion of the variance can be explained by somatic characteristics. Multivariate statistic allows to identify different cluster variables: one for anthropometric and one other for motor performance data. Height is the most correlated to motor tests variable and represent a link with both variable groups. The ball throwing test is the most correlated (test) with anthropometric data. Our results confirm the importance of the relationships between anthropometric characters and performance during growth.

References:

Cacciari E., Milani S., Balsamo A. , Dammanno F., De Luca F.,Chiarelli F, Pasquino AM, Tonini G., Vanelli M., 2002- "Italian cross-sectional growth charts for height, weight and BMI(6-20 y)" Europ. J. of Clinical Nut., 56: 171-180.

Slaughter M.H., Lohman T.G., Boileau R.A., Horswill C.A., Stillman R.J. Van Loan M.D., Bemben D.A. 1988. "Skinfold equations for estimation of body fatness in children and youth." Hum. Biol., 60 (5): 709-723.

HIGHER BMI IS ASSOCIATED WITH LOWER PHYSICAL FITNESS AND LONGER SICK LEAVES

Kyröläinen, H., Häkkinen, A., Kautiainen, H., Santtila, M., Pihlainen, K., Häkkinen, K.

University of Jyväskylä, Finland

It has been suggested that the changes in physical fitness and anthropometry can be explained by the western life style including reductions in physical activity and / or increased energy intake. Decreased muscle fitness, aerobic capacity and obesity have been shown to increase the risk factors for musculoskeletal injuries, coronary artery disease, hypertension, osteoporosis, certain cancers, type-2 diabetes and metabolic syndrome. These diseases cause sick leaves and, therefore, lost of many working hours. The purpose of the present study was to investigate changes in physical fitness and body mass index (BMI) over the years of 2001-2004, and their association with sick leaves.

7617 male workers participated in the present study. Their mean (±SD) age was 37±8 years (range 18-59 yr.), body height 1.80±0.06m and body mass 83.9±12.0 kg. The endurance performance was measured by 12-min running test or by bicycle ergometer test (estimated maximal oxygen uptake, VO2max). Muscle fitness tests consisted of push-ups, sit-ups, and repeated squats in 60 s, as well as maximal

grip strength. According to these physical fitness tests, the workers were divided to the five fitness index categories: scale from 1 (poor) to 5 (excellent). Body height and mass were measured to calculate BMI, and the relative amount of sick leave to working days and the duration of sick leaves were defined.

The mean (± SD) running distance during 12-min decreased from 2702 ± 330 m to 2656 ± 342 m ($p<0.001$) as compared to the years of 2001 and 2004. Respectively, VO2max decreased from 45.0 ± 8.1 ml/kg/min to 43.9 ± 8.0 ml/kg/min ($p<0.001$). The changes in muscle fitness was, however, minor: push-ups were averaged 31-32 repetitions (reps), sit-ups 34-35 reps and repeated squats 50-51 reps in 60 s. The mean hang grip results varied between 58 – 59 kg, while BMI increased from 24.3 ± 6.3 to 26.1 ± 3.3 ($p<0.001$). The mean fitness index was 3.8 (range 1.0-5.9). Lower fitness index in the year of 2004 was associated with higher BMI ($p<0.001$) and longer sick leaves ($p<0.001$). From those workers who belonged to the excellent fitness category, only 40 % had sick leaves lasting average 3 days, while from those workers who belonged to the poor category 60 % had sick leaves lasting 5 days.

The decreasing aerobic capacity together with increasing BMI values during the follow-up period of three years suggests that physical activity is low as compared to energy intake among the present workers. Furthermore, the number of sick leave days is higher among those workers with poor physical fitness. These results confirm earlier findings that sedentary persons with good fitness seem to show fewer diseases. Therefore, occupational health care system should concentrate to early prevention of life style health problems.

NET CALORIC COST IN THREE DIFFERENT PROTOCOLS – AEROBIC, STRENGTH, AND CONCURRENT TRAINING IN PRE MENOPAUSE OVERWEIGHT WOMEN

Pinto, R., Valamatos, M.J., Carnero, E., Santos, P., Sardinha, L., Rasoilo, J.

Faculty of Human Kinetics, Technical University of Lisbon, Portugal; Physical Education School, Federal University of Rio Grande do Sul (UFRGS), Brazil, Portugal

Introduction

Obesity and overweight have been focused as significant public health problems in some industrialized countries. Physical activity practice has an important role in the control of these epidemics. The caloric cost of some physical activities can affect significantly the daily energy expenditure and, consequently, knowledge of such costs may help in the management of weight loss program. The aim of our study was to compare the net caloric cost (kcal) of three training protocols in overweight women.

Methods

Thirteen overweight females (35±8 years old; body mass index-BMI 29.27 ± 3.59 kg/m2; fat free mass-FFM 44.84 ± 4.69 kg) performed three training protocols – aerobic (A), strength (S) and aerobic and strength associated (AS) in three different days. All the protocols were designed to have similar duration. The resting metabolic rate and exercise energy cost were assessed before and during each protocol, respectively, using an indirect calorimetry system (Cosmed K4b2). The gross caloric cost was estimated using a constant value of 5.05 kcal per liter of oxygen consumed (1). To relative analysis, the FFM was calculated using dual-energy x-ray absorptiometry (DXA). The statistical analysis included descriptive statistics and one-way Anova analyses of variance.

Results

The absolute and relative net caloric cost showed to be similar in A and AS protocols, but smaller ($p<0.001$) in the S protocol (Table 1).

Table1. Exercise time, absolute and relative to FFM net caloric cost of the three protocols.

Discussion/Conclusion

Based on the similitude of the metabolic impact induced by the A and the AS protocols, we can suggest that both strategies are effective for weight loss. However, taking into consideration that an AS type protocol can also have a positive impact on muscle strength and aerobic capacity it should be seen as a good choice.

In other words, the association of aerobic and strength, the so-called concurrent training, showed to be very effective to increment the energy expenditure during exercise sessions and can be an important training strategy to increase strength and muscular quality at the same time, both essentials qualities of the physical fitness.

References:

1. Wilmore, J.H.; Parr, R.B.; Ward, P.; Vodak, P.A.; Barstow, T.J.; Pipes, T.V.; Grimditch, G. and Leslie, P. (1978). Energy cost of circuit weight training. Medicine and Science in Sports and Exercise, 10:75-78.

2. Phillips, W.T. and Ziuraitis, J.R. (2004). Energy cost of single-set resistance training in older adults. Journal of Strength and Conditioning Research, 18 (3):606-609.

3. Haddock, B.L. and Wilkin, L.D. (2006). Resistance training volume and post exercise energy expenditure. International Journal of Sports Medicine, 27:143-148.

LEISURE TIME PHYSICAL ACTIVITY AMONG NORWEGIAN YOUTH

Mamen, A., Aaberge, K.

Sogn og Fjordane University College, Norway

Introduction

There is increasing concern about the level of physical activity among children and adolescents today. Sport organisations report fewer youths as members, and recruitment to traditional organised sport activities are often difficult.

Methods

To quantify the degree of leisure time physical activity among Norwegian youth, we questioned 1272 boys and girls age 15 from Sogn og Fjordane County in western Norway (82% of the population) for their activity preferences and level of activity.

Results

Eighty three percent reported to be physical active in their leisure time and 49% are members of one or more sports clubs. Having fun was the most important reason for being active (82%), about 10% considered competitions to be an important reason for this. The most important reasons for not being active in their leisure time were injuries/illness, other activities and sport taking too much time. Unorganised activity was much more common among the respondents than organised sport, even for those who were members of sport clubs. Totally 8178 activity ticks were made, and 86% of these belonged to the unorganised type. The most popular unorganised activities were cycling, snowboard, cross-country skiing and football for the boys and cycling, swimming, cross-country skiing and snowboard for the girls. The most popular organised activities were football, volleyball, rifle shooting and handball (European type) for the boys. The girls had football, handball, dancing and volleyball as their most popular organised activities.

Conclusion

The unorganised leisure time activity among 15 yr old boys and girls in western Norway is substantial and mirrors partly the offers from organised sport. It seems that the youth wants both, so an important task for the society could be to try to fulfil these wishes, by giving the youth appropriate areas to activate them selves, and to give the sport clubs the means to improve their activity offers.

RIGID FOOT ORTHOSES AND POSTURAL STABILITY

Berger, L., Blanc, S.

Université de Savoie and Centre de podologie du Sport, France

Rigid foot orthoses and postural stability

L Berger*, S Blanc**

* Laboratoire de modélisation des activités sportives, Université de Savoie, Campus scientifique, 73376 Le Bourget du Lac Cedex

**Centre de Podologie du Sport, ZA Le parvis , 38500 Voiron, France

Introduction: Rigid foot orthoses are generally used by skiing racers. Indeed, the use of thermoudled orthoses allow a greater repartition of foot pressure. The aim of this study was to evaluate the impact of a thermoudled rigid orthoses on the body balance in expert and non expert subjects, respectively.

Methods : 10 international skiing racers (18 to 25 years) and 14 non expert subjects, never users orthose (22 to 36 years) participate to this experiment. Subjects had to realize a postural task, eyes closed, before (REF) and after the insert of the orthoses directly under the feet (O). The orthoses were in Podiafix® base Podialène® density 160 covers.

Undisturbed posture was quantified by using a force platform, through which the centre of pressure (CP) trajectories as a function of time an be measured. These trajectories are decomposed into antero-posterior (AP) and medio-lateral (ML) directions. The CP movments were then dissociated in two elementary superimposed components: the horizontal motions of the Centre of Gravity (CG) and the differences between the CP and the vertical projection of the CG (CP-CG).

Results :

Results showed a modification for ML parameters with orthoses.

A decrease of the median frequency of CG motions ($p < .05$) was observed for the non expert subjects, suggesting a change in body sway process.

In contrast, the amplitude of the CP-CG motions increase for the athletes ($p<.05$) corresponding to an increased acceleration communicated to the CG, and consequently, an increase of the neuro-muscular means. Moreover, an increased of the CP-CG median frequency suggested a change in the muscular stiffness and/or the muscular activity.

No significant difference were recorded in the AP direction for all motions and for the two populations.

Discussion conclusion

The better repartition of foot pressure allowed by thermoform orthoses seems to be differently used by the expert and non expert people. The expert group increase the neuro-muscular means used to control the posture whereas the non expert group probably do not take into account the increased tactile information.

WALKING AND BODY COMPOSITION: HOW MANY DAYS NEED TO CHANGE BODY COMPOSITION?

Jafari, A., Moradi, M., Salimi, A.

Islamic Azad University Research and Science Branch, Iran

PURPOSE: Scientific literature suggests at least 60 min of moderate-intensity physical activity may be necessary to maximize weight loss and prevent significant weight regain (John M Jakicic & Amy D Otto, 2005). For individuals constrained by a busy lifestyle, an exercise prescription that delivers benefits with the minimum investment of days is attractive. The purpose of the present study, therefore, was to comparing the effect of one, two and three days of brisk walking on some of the body composition factors in over weight sedentary females. METHODS: Thirty six sedentary Iranian females, aged 38.2± 4.4 yr (M±SD) were randomly assigned to three groups, 12 each, with following walking days per week: One day in the first group, two days in the second group and three days in the third group. Participants took 60 minutes of brisk walking with 50-70% VO2max for 12 week in the walking days. The walking was completed on a treadmill (T 9700 HRT, USA Fitness), which is capable for monitoring heart rates, so that the intensity of the walking can be controlled (e.g., if a participant was trained with at 140 beats/min heart rate (HR), we could adjust treadmill speed and elevation to keep HR at the targeted zone). Body weight, BMI, percent body fat, and waist and hip circumferences were measured before and after the intervention. All participants were asked not to change their eating habits during the intervention period, and food diaries were kept and monitored weekly. RESULTS: All participants completed the12-week program of exercise. Means (±SD) of pre-test weight, body fat, WHR, BMI in all groups were 69.15±9.7 kg, 32.71±4.6 percent, 0.82±0.065, 26.99±3.4 kg/m2, respectively. ANOVA test showed that there was significant difference among mean variables among three groups after the 12-week intervention. Tukey post-hoc tests showed that it was the third group differing from others. Follow-up paired t-test for the third group indicates the pre- and post-test means were statistically significant ($p<0.05$): Weight, body fat, WHR, and BMI (M±SD) 72/41±10.75kg, 33.10±4.2 percent, .80±.043, 26.73±3.35kg/m2 changed to 68.81±9.86 kg, 30.36±5.3 percent, .78±5.7, and 25.72±3.16 kg/m2) after the intervention. Only third group significantly reduced body weight, body mass index, and percentage body fat and waist circumference ($p < 0.05$). CONCLUSIONS: Brisk walking for 60 min one or two days a week for 12 weeks could not improve body composition of overweight females. This finding suggests that at least 3 days a week with 60 min of moderate-intensity physical activity is necessary to improve body composition. Many health benefits from physical activity can be achieved if duration and days of training is increased appropriately.

STUDY ON THE FACTORS AFFECTING IN ADOLESCENTS THE PEAK BONE MASS

Michiko, M., Noriko, M., Haruo, S.

Nara Women's University, Japan

There are two prophylactics to prevent osteoporosis, i.e. restraint of a bone mass and increase of the peak bone mass. The decrease of bone mass depend on the ageing process, but it is difficult prevented complement. Recently, the increase of peak bone mass is assumed to be important as an effective prophylactic. However, few studies have completed to be clear the lifestyle condition, including

nutrition and exercise, which influenced peak bone mass clearly. The purpose of this study was to identify the factors which influenced bone mass in adolescents.

Methods

The subjects who were followed up for three years in this research, were 128 junior high school students (67 boys and 61 girls, 11-14 years). Bone states of the os calicis were measure with quantitative ultrasound, using the Achilles ultrasonometer. Bone states were 'Stiffness' Index (SI) was used as a measure of bone states. %SI was used as index of an increase of SI for three years. Height(cm), body weight(kg), percent body fat(%) and grip strength were measured as indexes of physical fitness. The checklists of the daily lifestyle were composed of frequency about meal and exercise, and of histories of fracture and menarche. SPSS was used as statistical analysis.

Results and discussion

1) %SI was statistically increased in both boys and girls (paired-t-test: $p<0.001$).

The difference on the structure of factors was found between boys and girls by factor analysis. For the boys, the first factor was composed of 3 variables, i.e. fishes, meats, soybeans and vegetables. Also in the second factor, 3 variables, i.e. eggs, oils and fats, and in the third factor, 2 variables, history of fracture and exercise were included. Similarly, for the girls, in the first factor was composed of 3 variables, i.e. percent body fat, SI and appearance menarche. Also in the second factor, 1 variable, exercise, and in the third factor, 2 variables, soybeans and vegetables were included.

It was subjected that calcium and protein were important materials for bone, and exercise was important factor to increase bone mass by recruiting effective nutrition1). In addition, it was an interesting result that the soybeans variables was main Japanese food.

2) For the girls, it was suggested that SI was important factor to influenced %SI and the appearance menarche. Therefore, this result showed influence for female sex hormone secretion2).

Reference

1）Seino Y, Koyama T(1999)：Calcium It is clinical nutrition the basics. Association of national milk spread.

2）Hayashi Y(2000 September)：Tokyo health science society magazine (pp79-87).

THE ISSUE OF ALCOHOL AS A DOPING DRUG: DOSE-RESPONSE STUDIES USING A MOTORIC TEST BATTERY

Schulz, T., Pullmann, T., Bühlmeyer, K., Kornmayer, A., Spitzenpfeil, P., Michna, H.

Technical University Munich, Germany

Introduction

Alcohol is not only the most frequently consumed drug in the world, it is also the most common used drug among athletes. Some studies report in this connection that high consumption of alcohol is also strongly related to use of doping agents. The 2006 prohibited list of the WADA includes a passus to alcohol consumption: in competition it is illegal in certain sports but it exists no longer for (alpine) skiing. Nevertheless, in competition sports severe accidents are most common in alpine skiing. It is therefore that we checked the influence of different doses of alcohol in an appropriate motoric test battery in volunteers.

Methods

25 male students took part in the study, they were randomised in a control non-alcohol beer group (CG, n=12) and a normal beer (vol% 5,4%) group (AG, n=13). Beer was administered in a volume of 15x100ml/5 min for two times. Blood alcohol and breath alcohol levels were measured four times: pre-test (PRE), post first drinking (P1), post the second drinking (P2) and at the next morning after 8 hours (P3). Right after P1, P2 and P3 the probands performed a computer aided motoric test battery including: a 10m "grid-run" (rhythmic performance), a "tapping-test" (frequency abilities), a "shuttle-run" (agility), a "flashjump" and a "hand reaction test" (visuell reaction tests), a "match 6 test" (complex reaction and coordination), and a "MFT balance test" (balance). In addition, at each time-point of blood alcohol testing, the probands filled in a questionnaire regarding mood.

Results

At P1 average blood alcohol level of the AG was 0.55 promille, at P2 1.14 promille and at P3 0.14 promille. In regard to the rhythmic performance the grid-run showed differences between the groups after P1 and P2. The agility in the 26m shuttle-run showed no differences at P1 between groups. Instead, the AG improved the efficiency from PRE to P1. Tapping frequency revealed no differences between groups at P1 but between P2. In the AG frequency showed no differences between PRE and P1. Nevertheless, ground contact time of the left and right foot was enhanced in the AG and therefore showed an impaired tapping coefficient. The visuell reaction tests showed no differences between groups at P1 and P3; in the AG we found an improved reaction in the match 6 test from PRE to P3. Regarding the balance, we found no differences between PRE and P1 in AG but an enhancement of the balance ability from PRE to P3.

Discussion/Conclusion

In contrast to the ACSM position statement that consuming a large amount of alcohol limits skills that require reaction time, balance, accuracy or hand-eye coordination, we could only confirm this for blood alcohol levels of about 1.0 promille but not for 0.5 promille. Since alcohol may benefit performance psychologically by decreasing sensitivity to pain, increasing self-confidence, or removing psychological barriers to performance from our point of view alcohol must be on the prohibited list at least for alpine skiing.

PHYSICAL FITNESS AND QUALITY OF LIFE IN ELDERLY WOMEN – STUDENTS OF THE UNIVERSITY OF THE THIRD AGE AT WROCLAW UNIVERSITY IN POLAND

Dabrowska, G., Ignasiak, Z., Woźniewski, M., Żurek, G., Wnuk, W.

University School of Physical Education, U3A at Wroclaw University, Poland

Introduction. The society ageing occurs also considerable problem in Poland. Changes occurring in different of an ageing organism inevitably lead to involution of motor function Poland actively participates in European projects on geriatric care.

Geriatric prophylaxis in the University of the Third Age (U3A) at Wroclaw University aims at intellectual, mental and physical stimulation of the elderly students. U3A is active for 30 years.

The aim. The aim of this study is to present the organization of physical activity program in the U3A at the Wroclaw University in Poland and evaluation of physical fitness and quality of life in the elderly women – students.

Material and methods. 147 women, aged 60 – 86, students of the were included in the study. All tests were carried out at the Scientific Research Laboratory of the Dept. of Physiotherapy at the University School of Physical Education in Wroclaw. Physical fitness test according to K. Means modified to our purposes and suitable for measuring physical fitness and balance in the elderly. Life quality evaluation (Easy – Care). The average quality results in the Means test was 32,8 points (max 36).

Results. Our results point to a high level of fitness of students from U3A in Wroclaw comparing to average of their age. Physical activity of the elderly women – students U3A determined their health and life quality.

EFFECT OF VISUAL FEEDBACK ON MAINTENANCE OF HRTARGET DURING INDOOR CYCLING

Piacentini, M.F., Carminucci, R., Quinci, M.L., Capranica, L.

IUSM of Rome, Italy

Introduction

Indoor cycling is a popular fitness activity aiming at improving cardiovascular efficiency. Usually, experts and novices join the same lesson and no feedback is provided regarding their actual intensity. Previously it has been shown that during Spinning® participants remained on average 15% above the HR suggested by the instructor (HRtarget)(Piacentini et al., 2005). Recently, a new indoor cycling bike that includes a display on the handlebar has been developed. Participants can therefore visualize if their HR remains within HRtarget set by the instructor prior the lesson and eventually adjust their workload in order to remain in target. Thus, the aims of the present study were: 1) to study the effects of the visual feedback on the participant's ability to remain within the HRtarget; and 2) to evaluate the effect of indoor cycling experience in maintaining the HRtarget based only upon the rate of perceived exertion (RPE).

Methods

11 participants (age: 23.6±2.5 yrs; body mass: 70.7±14.3 kg; height: 175±8.1 cm) with different indoor cycling experience volunteered in the present study. They randomly performed the lesson with the new bike (Panatta Sport, Italy) with (F) and without (NF) visual feedback of their HR data on the display. During the F class they were able to adjust their workload in order to meet the displayed HRtarget, while during the NF class they tried to follow the indications of the instructor relying only on their RPE. Chi square test was used to evaluate differences ($p<0.05$) between cycling conditions in the participants' HR and RPE.

Results

A significant difference was found between F and NF lessons for the time spent exercising at HRtarget. Participants remained for 80% of the F lesson within their HRtarget, and were above only for 6% of the lesson. In the NF lesson participants spent only 34% of time within the suggested range and the majority (51%) of the class above their HRtarget. In particular during the F and NF lessons, novel practitioners exercised at their HRtarget for 86% and 41% of the total time, respectively, with the remaining time spent above the suggested HR. No difference was found for RPE between F and NF conditions relatively to levels of experience.

Discussion/Conclusions

The results of the present study show that during indoor cycling practitioners strongly rely on visual feedback to maintain their HRtarget. In agreement to the literature (Piacentini et al., 2005), during the NF class (i.e., condition similar to most indoor cycling classes administered in fitness centers), most of the time was spent at HR above the ranges suggested by the instructor, independently of level of expertise and RPE. Instead, visual feedback prevented participants, especially novel ones from exercising at intensities higher than suggested, thus meeting the training program and avoiding undue risks.

References

Piacentini MF et al. (2005) Proceedings of the 10th ECSS congress.

EVOLUTION OF THE SOMATOTYPE AND BODY COMPOSITION OF ADOLESCENT CLASSIC BALLET DANCERS

Sillero Quintana, M., García, A., Refoyo, I., Garrido, G.

Universidad Politécnica de Madrid, Spain

Classic ballet practice is compared, in terms of volume and intensity of training, with other sport disciplines as gymnastics. Furthermore, dancing requires keeping a strict body weight control, which could have a negative incidence in the normal growth and development of the young female dancers.

Our study tries to assess the longitudinal evolution of the somatotype and body composition on a group of dancers from the Public Dance School of Madrid aged between 11 and 14 years. The sample started with 23 female dancers aged 11.4 years (Ã± 0.9) and it finished, three years later, with 18 female dancers aged 13.5 years (Ã± 0.9). The half-yearly anthropometry allowed us to obtain the Heath-Carter somatotype and to estimate the percentage of body fat (%BF), besides providing us with the sum of 6 (S6) and sum of 4 (S4) skin-folds. Bone mineral density (BMD), bone mineral content (BMC) and %BF were obtained by DXA.

The height, weight and body mass index (BMI) averaged percentiles for our dancers were always higher than the 25 percentile for the Spanish girls of the same age. Other authors refer higher results in height and weight for older samples (1, 2). Anyway, the evolution along the three-years study forecasts that our dancers will reach these values.

Values of %BF obtained by DXA (19.0%; Ã± 5.1) were similar to others referred in literature (1). The BMD (0.936 gr/mm2 Ã± 0.061) values are still lower than others found for adult dancers (2,3) but they will evolves into these values when the dancers are older.

Pearson correlation coefficients between humeral (HW) and femoral widths (FW) and BMD were r (HW-BMD) = 0.572 (n = 56; $p<0.05$) and r (FW-BMD) = 0.439 (n = 56; $p<0.05$), and for the BMC, r (HW-BMC) = 0.678 (n = 56; $p<0.05$) y r (FW-BMC) = 0.645 (n = 56; $p<0.05$). Correlation between %BF by anthropometry and DXA was significant: r (%BFS6-DXA) = 0.793 (n = 56; $p<0.05$) and r (%BFS4-DXA) = 0.743 (n = 56; $p<0.05$). However, values of %BF obtained by DXA were higher than by anthropometric formulas. We suggest two formulas to estimate the %BF in ballet dancers from the S6 and S4 skinfolds.

It is essential that dance schools emphasises in body change evaluations during adolescence to compare the typology of the dancers with other actives or sedentary populations.

REFERENCES:

(1) Yannakoulia, M., Keramopoulos, A., Tsakalakos, N., & Matalas, A.L. (2000) Body composition in dancers: the bioelectrical impedance method. Medicine & Science in Sports & Exercise. 32(1):228-34.

(2) Young, N., Formica, C., Szmukler, G., & Seeman, E. (1994) Bone density at weight-bearing and nonweight-bearing sites in ballet dancers: the effects of exercise, hypogonadism, and body weight. J Clin Endocrinol Metab. 78(2):449-54.

(3) Van Marken Lichtenbelt, W.D., Fogelholm, M., Ottenheijm, R., & Westerterp, K.R. (1995) Physical activity, body composition and bone density in ballet dancers. Br J Nutr. 74(4):439-51.

PERFORMANCE AND EXERTIONAL VARIATIONS DURING WALKING, RUNNING AND JUMPING ON TERRAINS OF VARYING COMPLIANCE

Davies, S.

Cape Peninsula University of Technology, South Africa

Introduction: This paper reviews three coordinated studies that investigated the effects of terrains of varying compliance (sand and a hard surface) during walking, running and jumping. The compliance of sand for each research objective was not significantly different and was verified by measurements using a rapid cone penetrometer.

Walking on sand: Fourteen adult males participated with a mean age of 34.6 years, who were 72.6 kg in mass, and 172.5 cm in stature. They walked at 3, 4, 5, 6 and 7 km.hr-1 on sand and grass surfaces. Physiological measures included heart rate, O2 uptake, CO2 exhalation, ventilation (VE), and relative oxygen uptake. Results indicated that there was a significant increase ($p<0.01$) in all physiological indices when walking on sand compared to grass at 3 to 7 km.hr-1, with the greatest disparity between the surfaces (ratio=1.63) in relative oxygen uptake at 5 km.hr-1.

Running on sand: Twenty adult male participants with a mean age of 27.7 years, who were 78.3 kg in mass, 179.1 cm in stature and 13.1% body fat. The Multi-Stage Fitness Test (MSFT) was the running protocol used on sand and grass surfaces. Two responses were evaluated namely heart rate and Ratings of Perceived Exertion. There was a significant ($p<0.05$) elevation in heart rate response by approximately 9% and an increased RPE of 17% when running on sand, and this resulted in an overall mean performance decrement of 37.3% in terms of MSFT shuttles (distance) completed.

Jumping on sand: Forty one male participants with a mean age of 20.4 years, who were 79.56 kg in mass, 178.03 in stature and 12.6% body fat. The mean vertical jump performance (VJP) achieved on sand was 49.0 cm, compared to 55.11 cm on a hard surface. The mean VJP on sand was 11.03% less than that achieved on a hard surface, which was significantly ($p<0.01$) less.

Conclusion: Sand appears to have a distinctive and significant effect on human performance during walking, running and jumping when compared to the same action performed on a hard (non-compliant) surface. Walking on sand increases physiological demand by as much as 63%, while running a predictive test of aerobic capacity (MSFT) resulted in a 37.3% decrease in distance-shuttles completed. Jumping on sand resulted in a mean 11.03% loss in performance compared to the same action on a hard surface.

LEVEL OF PHYSICAL FITNESS AMONG YOUNG TURKISH CYPRIOT POPULATION: ASSOCIATION OF PHYSICAL FITNESS WITH OBESITY IN 7425 EUROFIT TEST RESULTS OF JUNIOR SCHOOL CHILDREN

Ahmedov, S., Emiroglu, O., Atamtürk, H., Burgul, N., Tinazci, C.

Near East University, Cyprys

We aimed to assess epidemiology of obesity and its relation to physical fitness in prepubescent children of Cyprus. For this purpose 7425 junior school children (i.e. 78% of mentioned population), aged between 9 – 11 years old, were gathered from all 90 junior schools of North Cyprus and evaluated through application of EUROFIT Test Battery for the period between March – May 2005. The 12 tests, comprising EUROFIT, were height and weight measurements, test for skinfold thickness, flamingo balance test, plate tapping test, sit-and-reach test, standing broad jump test, test for handgrip strength, sit-up test, bend arm hang test, 10m x 5 sprint test and shuttle run test.

Statistical analysis of 7425 results allowed getting the following picture of physical fitness in Cyprus. The average rate of obese (> 95th percentile) children, identified by calculation of children's body mass indexes (BMI), was 13% with some age, gender and regional variations. Rural regions had significantly lower rate of overfats and better shuttle run performance in compare with urban population, which possibly witnessed in favor of better aerobic capacity of former group (t-test, $p < 0.05$).

Overall assessment of all test results for each participant through z-score revealed that in all age groups both boys and girls from rural region had higher overall physical performance in compare with urban areas, like for example Nicosia. Besides, the latter was the only region of North Cyprus, which test results were below the country's level.

BMI and physical performance data changed with age progression in girls. The rate of these group of children with excessive BMI decreased from 12.9% to 11.7% (for 9 & 11 years old girls respectively), whereas this parameter in boys has increased from 12.9% to 14.6%. Moreover, while regional differences of physical fitness level in girls have diminished with age progression, we didn't admit similar changes in boys.

In conclusion, age, gender and regional interrelation of BMI and EUROFIT test results indicated on impact of obesity on physical performance in children. Besides that decrease of obesity rate and positive changes in performance observed with age progression in prepubescent girls characterized them as more fruitful audience for management of childhood obesity in contrast to boys.

Poster presentation (PP)

PP1-04 Sports Medicine 1-3 - "Exhibition Hall"

INFLUENCE OF BEHAVIOUR, LIFESTYLE AND SOCIAL COMPONENTS ON CARDIOVASCULAR DISEASE RISK FACTORS IN PARTICULAR THE METABOLIC SYNDROME (MTS) IN THE PRÄFORD COLLECTIVE

Kosminski, R., Predel, H.-G., Latsch, J.

German Sport University Cologne, Germany

Cardiovascular diseases (CVD) are the main cause of death in the Western developed nations and are often causally linked to lifestyle conditioned, cardiovascular risk factors (1). However, it is not sufficient to merely relate to the classical risk factors which collectively induce the metabolic syndrome (MTS). Increasingly the health influencing social components have to be considered. The objective of the study was to describe the interdependency of MTS, smoking and the social factors (education level) in the Präford study collective.

4.818 valid data records were available for the results of the study. These were collected within the framework of the Präford cohort study 2003-2004 from workers of the Ford factory AG and affiliated companies for the primary prevention of cardiovascular diseases. The data collection took place in accordance with the criteria of the NCEP-ATP-III (MTS1) as well as the criteria of the International Diabetes Federation (MTS2) (2). Smoking was defined by the status (smoker, ex-smoker, non-smoker) and by the number of daily smoked cigarettes as well as the amount of packets smoked per year (pack years). The education level was differentiated into a lower (secondary school),

medium (secondary modern school) and higher (grammar school) level. For comparison of the different components one factor analysis of variance was applied. With significant influences multiple mean value comparisons (according to Student-Newman-Keuls) for determination of differences between the groups were applied.

In terms of frequency of occurrence of MTS1 and MTS2, smokers (0.25±0.43 and 0.33±0.47; n=1609) differed significantly from non-smokers (0.17±0.37 and 0.24±0.43; n=1975) as well as ex-smokers (0.23±0.42 and 0.34±0.47; n=1038) from non-smokers (p=0,01). Subjects with higher education levels showed less inclination to MTS1/MTS2 (0.13±0.33/0.19±0.39; n=1358) than subjects with lower education levels (0.29±0.46/0.39±0.49; n=1605) (p=0,01). There were similar results for subjects with medium (0.19±0.4/0.28±0.45; n=1689) and low education levels and for subjects with medium and high education levels (p=0,01). Additionally subjects with higher education levels smoked significantly less (0.28±0.45; n=1339 vs. 0.38±0.48; n=1554 vs. 0.37±0.48; n=1636) and had fewer pack years (12.08±12.51; n=206 vs. 24.3±27.22; n=432 vs. 15.79±13.8; n=410) compared to subjects with lower education levels.

The results of the study demonstrated that the prevalence of smoking, the MTS1 and MTS2 as well as the risk constellation decreased with higher education level. Considering the respective prevalences the IDF criteria seem to be more progressive than the ATP-III criteria of the NCEP.

(1) WIRTH, A.: Lifestyle modification for the prevention and therapy of atherosclerotic diseases. Deutsches Ärzteblatt 2004; 101 (24): A 1745 – A 1752.

(2) INTERNATIONAL DIABETES FEDERATION: The IDF consensus worldwide definition of the metabolic syndrome. Belgium 2005: 2 – 7.

ANALYSIS OF THE MOST FREQUENT INJURIES IN KARATE ACCORDING TO THE RISK FACTORS AND THE LOCALIZATION

Gogl, A., Hilda, T., Dekany, M., Gyore, I., Pucsok, J.M , Nánai, F.

Semmelweis University, Hungary

In order to prevent sport injuries the knowledge of the risk factors and the mechanism of the injuries is essentially.

The aim of our studies was to clear up the prevalence and the risk factors of the karate injuries in a Hungarian karate population with a two years survey method.

The incidence of the injuries was analysed according to the risk factors (age, gender, BMI, training time, and skill level) and to the localization.

The data got in 201 athletes have been elaborated. The male/female rate was 145/56, the rate of injured/not injured athletes was 69/132. The greater part of the injuries (65.9%) occurred in training and 34.1% during competition.

The occurrence of injuries progressively increased with the age, skill level and training time. The most commonly injured regions were the lower extremity (38%), upper extremity (19%) and cranial region (19%). The cranially injured athletes had significantly higher BMI ($p<0.01$), body weight ($p<0.02$), skill level ($p<0.01$) and weekly training time ($p<0.01$).

The mouthguard was judged as an efficient protector of the teeth. The tibia padding should be modified to be effective.

The lesions caused by kicks in the cranial region were without exception fractures or other serious damages. The injuries of the attacker, independently of the region, were without exception the consequences of the inadequate techniques or failure of concentration.

AIRWAY SECRETION DURING EXERCISE IS IMPAIRED IN EXERCISE INDUCED ASTHMA AND IN CYSTIC FIBROSIS

Schmitt, L., Dehnert, C., Frese, F., Bärtsch, P., Mairbäurl, H.

University of Heidelberg, Germany

Airway lining fluid, mucus and the movement of cilia are important defense systems to trap particles contained in inspiratory air. The lining fluid also humidifies the air which is a requirement for alveolar gas exchange. Fluid secretion into the airways is driven by the secretion of Cl, whereas an increased reabsorption of Na would decrease the layer of the lining fluid and support its drying. A delicate balance between Cl-secretion and Na-reabsorption determines the ionic content of the lining fluid, modulates the osmolarity of the interstitial fluid and cell volume of surrounding cells. During exercise ventilation increases dramatically, which might cause drying of the airway surface, cell shrinkage, activation of mast cells and broncho-constriction. In susceptible individuals this can cause exercise induced asthma (EIA). In patients suffering from cystic fibrosis (CF) fluid secretion into the airways is impaired by a defective Cl-secretion which might enhance problems induced by exercise. The present study was therefore performed to test how airway secretion adjusts to the increased ventilation during exercise.

Healthy controls (CO; n=10), individuals with reported EIA (n=6) and patients with CF (n=10) were subjected to a maximal (50 W, 3 min steps) and sub-maximal ergometer test (basal lactate + 1mM, 30min) in a semi-supine position. Potentials across the nasal mucosa were determined as a measure of airway epithelial ion transport activity. Maximal workloads (W) and heart rates were 239±55 and 187±8 in CO, 196±46 and 178±15 in EIA, and 120±28 and 169±12 in CF; workloads and heart rates in sub-maximal tests were 129±64 and 133±13 in CO, 112±38 and 133±11 in EIA, and 64±9 and 128±8 in CF, respectively. Norepinephrine and epinephrine, which are known stimulators of Na- and Cl-transport in airway epithelium increased about 9- and 15-fold in maximal tests and only about 2-fold in sub-maximal exercise; there were no differences among groups. Nasal potentials (NP) at rest were about -18mV in CO and EIA but -54mV in CF, the amiloride-sensitive components representing Na-transport were about 6mV in CO and EIA but 22mV in CF. Cl-sensitive NP was about 15mV in CO but significantly lower in EIA (10mV) and CF (3mV). During maximal exercise total NP and Na-transport decreased significantly in CO and CF but not in EIA. Whereas in CO Cl-sensitive potentials increased during maximal exercise, no change was found in EIA and CF. No such changes were found in sub-maximal tests.

These results indicate that in healthy individuals fluid secretion is stimulated during intensive exercise. In contrast, in patients with EIA and CF these adjustments in Na- and Cl-transport during exercise are not seen are not seen. Therefore drying of the airways by a defective control of airway secretion might be involved in problems of ventilation at high intensity exercise. Knowledge of the might provide a basis for diagnosis and a more specific treatment.

RELATION OF THE OXIDATIVE DNA DAMAGE TO LYMPHOCYTOPENIA AFTER HIGH INTENSITY EXERCISE

Tanimura, Y., Shimizu, K., Yamauchi, R., Tanabe, K., Otsuki, T., Lemitsu, M., Maeda, S., Ajisaka, R.

Tsukuba University, Japan

Introduction: Post high intensity exercise lymphocytopenia is well documented (2), but the underlying mechanisms have not been fully elucidated. One possible mechanism is reactive oxygen species -induced DNA damage following high intensity exercise(3). Furthermore, lymphocyte apoptosis relating to the DNA damage may contribute to exercise-induced lymphocytopenia(1).

PURPOSE: The purpose of this study was to examine whether oxidative DNA damage can relate to lymphocytopenia after a bout of high intensity exercise, and the DNA damage is associated with apoptosis.

METHODS: Fifteen young healthy sedentary males (age 23.7± 1.5 yr, VO2max 43.1± 4.2ml/kg/min) exercised on a bicycle ergometer for 1h at 75% of their VO2max. Venous blood samples were taken at pre-exercise (Pre), and 0, 1, 2, 3, 4h of post-exercise (P0-P4). Lymphocyte counts, serum lipid peroxides concentration as a marker of acute oxidative stress, and serum cortisol concentration as an apoptosis inducing factor were measured. Single cell gel electrophoresis with the incorporation of the specific endnuclease (hOGG1) is a method to reveal an oxidative purine (8-OHdG)-sensitive sites contributed to most of post-exercise nucleotide oxidation. The oxidative DNA damage in lymphocyte was evaluated by the % DNA in tail whose intensity relative to the head reflects the number of DNA breaks. Moreover, after cell isolation, CD95 (Fas receptor) as a cell-based apoptosis marker was measured by flow cytometry. Data were analyzed using a repeated one way ANOVA.

RESULTS: Lymphocyte counts decreased significantly ($p<0.05$) at P1 (1983± 511 cell/μl), P2 (1785± 630 cell/μl), and P3 (1922± 550 cell/μl) compared to the Pre level (2444± 913 cell/μl). Serum lipid peroxides concentration significantly ($p<0.05$) increased approximately 1.6-fold at P2 (1.23± 4.3 nmol/ml). % DNA in tail as the oxidative DNA damage significantly increased from 42.6±11.1% at Pre to 54.3±12.8% at P3 ($p<0.05$). CD95 expression in lymphocyte significantly ($p<0.05$) increased during P2-P4, P2: 22.2±6.4%, P3: 22.5±7.6%, and P4: 22.2±9.6%, respectively. The serum cortisol concentrations decreased during P2-P4, P2: 15.2±4.5μg/dl, P3: 11.2±4.9μg/dl, and P4: 9.5±7.0μg/dl, respectively.

CONCLUSION: These results suggested that the oxidative DNA damage may in part account for lymphocytopenia after a bout of high intensity exercise. Further investigations are needed to elucidate whether lymphocyte apoptosis contributes to post high intensity exercise lymphocytopenia.

REFERENCE

1. Mars M, et al. High intensity exercise: A cause of lymphocyte apoptosis? Biochem Biophys Res Commun 249: 366, 1998.

2. Pedersen BK, et al. Recovery of the immune system after exercise. Acta Physiol Scand 162: 325, 1998.

3. Quadrilatero J, and Hoffman-Goetz L. N-Acetyl-L-cysteine prevents exercise-induced intestinal lymphocyte apoptosis by maintaining intracellular glutathione levels and reducing mitochondrial membrane depolarization. Biochem Biophys Res Commun 319: 894, 2004.

ANTROPOMETRICAL PREDICTORS OF CARDIAC PARAMETERS, VO2MAX AND MYOCARDIAL OXYGEN UPTAKE IN ELITE MALE BASKETBALL PLAYERS AND SEDENTARY CONTROLS

Popovic, D., Ostojic, M.C., Mazic, S., Stojiljkovic, S., Djordjevic-Dikic, A., Dikic, N., Mitrovic, D.

Medical Faculty Belgrade, Serbia and Montenegro

BACKGROUND: The degree of cardiac changes responsible for better work efficiency, which have been identified as the ¨athletes heart syndrome¨, is highly variable considering different kinds of physical activities. Only hypertrophied and dilated heart, of low heart rate, can perform better during vigorous physical activity. The aim of this study was to find best reasons, and consequently predictors, of morpho – functional changes of the athlete˜s heart.

METHOD: Subjects in this study were 35 elite male basketball players and 34 sedentary controls mached by age, BH, BW and BSA. Standard anthropometrical examination, standard echocardiographic method and ergospirometric maximal test on treadmill were used to assess cardiac parameters at rest; VO2 max and double product at rest and at maximal level of physical activity.

RESULTS: We obtained following parameters: LA, Ao, LA/Ao index, IVSd, PWTd, IVSd/PWTd ratio, LVd, LVs, RWT, LVM, FS, EF, TAFV, TPFV, Et, E, A and E/A index. All parameters were significantly higher in athletes, except LA, TAFV, E, A and E/A (not significantly different between groups), and LA/Ao, IVSd/PWTd, LVs (significantly lower in athletes). When indexed for LBM, the difference between groups in LVM, IVSd, PWTd and LVd was changed, but when indexed for BH, BSA, BMI remained unchanged. VO2max was significantly higher in athletes and its best predictor in both groups was LBM. Double product was lower in athletes at both levels of physical activity and its best predictor looking both groups together was LBM, but looking independently for athletes BW and for sedentary BH.

CONCLUSION: Better work efficiency of the heart in basketball players become from moderate dilatation and hypertrophy of the heart, lower HR and better systolic function of the heart. All examined morpho - functional changes of the heart are predominantly due to changes in LBM.

IMPACT OF CHRONIC ECCENTRIC EXERCISE ON MRF, MYOSTATIN AND MYH3 MRNA EXPRESSION IN HUMAN SKELETAL MUSCLE

Costa, A., Hissam, D., Zsolt, C., Hegyesi, H., Tihanyi, J.

Semmelweis University of Budapest, Faculty of Physical Education and Sport Sciences, Hungary

Existing evidence suggests that repeated-bouts of eccentric exercise on already damaged muscles do not affect or retard the recovery process. However the molecular mechanisms by which the skeletal muscle responds have not been yet investigated. The purpose of the present study was to investigate the expression of those genes responsible for satellite cell activation and therefore muscle fiber regeneration/hypertrophy (MH3, MyoD, myogenin, MYF5) combine with those responsible for satellite cells differentiation (p21) and hypertrophy suppression (myostatin) after a scheduled damage-induced exercise protocol.

Methods: Fourteen subjects, 9males and 5 females were recruited for this study with the following characteristics, standard deviations in parenthesis: age M=24,4years (3.8), weight M= 72,6kg (7.9), height 176cm (6.8). The exercise group (10 subjects randomly assigned) completed successfully the eccentric exercise, which consisted of (6sets of 15 rps) maximum voluntary eccentric contractions for six repeated days using a multicont isokinetic dynamometer. Three muscle biopsy (Bergstrom technique with suction) samples were obtained from each subject 1-week prior exercise, 1-hour post the first training session and at day-6 after the last training. Gene expression levels

were determined using real-time RT-PCR (reverse transcription-polymerase chain reaction) with GAPDH as an internal standard house-keeping gene.

Results: The mRNA expression of all myogenic regulatory factors investigating by this study (MYF5, MyoD, and Myogenin) was elevated one-hour post exercise 42%, 82% and 231% respectively, while after the last training session was increased by 97%, 201% and 174% respectively compare to the pre-exercise level expression. MH3 expression 1-hour post exercise was relatively unaffected while by the last training was increased 146%. In contrast myostatin mRNA expression was decreased 25% at both times measured comparing to pre-exercise level.

Conclusions: Our results suggest that skeletal muscle ability to respond in subsequent damage-induced eccentric bouts and thus avoiding further damage is at least partly mediated by molecular adaptations.

ACUTE EFFECTS OF EXERCISE TRAINING ON BLOOD PRESSURE IN PATIENTS WITH PREHYPERTENSION AND HYPERTENSION STAGE 1

Punter, E.

University of Innsbruck, Austria

Introduction: Hypertension (HTN), one of the most common medical disorders, is associated with an increased incidence of all-cause and cardiovascular disease mortality. Exercise programs that primarily involve endurance activity reduce blood pressure (BP) in adults with normal BP and those with HTN [1]. The aim of the study was to assess the acute effects of cross-country skiing on BP in persons with pre HTN and HTN stage 1.

Design: Subjects were five women (51.8±5.2 years, 164.2±3.7 cm, 74.8±10.9 kg) with pre HTN and HTN stage 1. Twenty-four hour BP was measured by Medi Tech Cardio tens 24-h system. During the awake hours (11am–10pm) the BP was measured each 45 min and during the night hours (10pm–7.30am) each hour. BP were recorded following exercise (Ex=60 min: 70–80% heart rate max) and during a non-Ex control day (C). On the Ex day, the subjects completed 60 minutes of cross-country skiing with a calculated intensity of 70%-80% of their maximal heart rate. On the C day the patients had a normal day with no exercise. The 24-h BP were compared between Ex and C days for magnitude of the BP reduction following cross-country skiing.

Results: In three subjects the BP decreased after the exercise. The mean systolic BP (SBP) at C day was 124.0±14.1 mmHg and the diastolic BP (DBP) 81.7±9.4 mmHg and decreased on E day to SBP 118.9±12.7 and DBP 76.5±9.6 mmHg. During the awake hours the SBP decreased by –5.8 mmHg and the DBP by –4.0 mmHg, in the night hours the SBP decreased by –4.3 mmHg and the DBP by –6.3 mmHg compared with the C day.

Discussion: Three out of five subjects are "Responders" and showed a decrease in BP following exercise. BP decreased in approximately 75% of individuals with HTN [2]. The "non responders" were the oldest and had the highest baseline BP values. Studies showed that the BP lowering effects of exercise are most pronounced in people with HTN with BP decreasing approximately 5–7 mmHg after an acute exercise session and is reduced for up to 22h after an endurance exercise [1]. Other results from a meta-analysis indicated the exercise effect with a decrease in SBP by 2.58 mmHg and DBP by 3.84 mmHg [3]. All these results are also reflected in this study. Not all people with HTN demonstrate postexercise HTN so definitive conclusions cannot be made at this time [1]. These results support and emphasise the recommendation that exercise training is an important initial or adjunctive step in the treatment of HTN.

1. Pescatello LS, Franklin BA, Fagard R, Farquhar WB, Delley GA, Ray CA. American College of Sports Medicine, positon stand: exercise and hypertension. Med Sci Sports Exerc 200, 36:533–553

2. Hagberg JM, Park JJ, Brown MD. The role of exercise training in the treatment of hypertension. An update. Sports Medicine 2000,30 (3): 193–206

3. Whelton SP, Chin A, Xin X, et al. Effect of aerobic exercise on blood pressure: a meta-analysis of randomized controlled trials. Ann Intern Med 2002, 136:493–505.

RELATION BETWEEN ESTIMATES OF BODY FAT BY MEANS OF ANTHROPOMETRY, UNDERWATERWEIGHING AND BIO-ELECTRICAL IMPEDANCE AS MEASURED IN SPORTIVE YOUNG ADULTS

Deriemaeker, P., Clarys, P., Van Acker, A., Duquet, W.

Vrije Universiteit Brussel, Faculty of Physical Education and Physiotherapy, Belgium

Introduction

The underwaterweighing (UWW) as a method to measure the body composition is considered as a golden standard. Two other methods which are often applied in literature are the skinfold (SF) measurements and bioelectrical impedance (IMP). The objective of this study was to examine if the SF and bioelectrical IMP measures are valid to estimate the percentage body fat in sportive young people in comparison to UWW.

Methods

Thirty three (16 boys (20.8±1.2y, 73.1±8.1kg, 180.3±6.1cm and 17 girls (20.4±1.5y, 58.9±7.0kg and 167.6±3.2cm)) physical education or physiotherapy students participated. They participated in at least 10 hours sport per week. In this study bodyweight, body height, 10 SFs, 7 girths and biepicondylar humerus breadth were measured. For the measuring of the bioelectrical IMP a Tanita TBF-410 was used. In the method of the bioelectrical IMP we will examine two formulas, standard formula (IMPST) and a formula for athletes (IMPAT).

Results

For the males a significant difference was found between the IMPAT and the UWW. No difference was found between IMPST and UWW. Low correlations were found between the IMP measurements and the UWW. The correlations between UWW and anthropometric values were higher. By regression a formula was established using two anthropometric variables UWW=27.17+1.31*SF abdomen-0.71*calf girth (r=.82, r2=.67, SE=2.54). We found also a regression formula for our test group by means of the IMPSC in combination with age, length and weight. Low correlations were found between this combination and UWW. For the females higher correlations were found between the IMP measurements and UWW compared to the males. Two regression formulas were established: UWW=4.05+0.73*IMPST (r=.78, r2=.61, SE=3.44) and UWW=2.71+0.93*IMPAT (r=.74, r2=55, SE=3.73). For the prediction of UWW from anthropometric measurements we found a better estimation compared to the males. The hip girth (HIPG), SF thigh frontal (SFTHIGHF) and SF supra-iliac (SFSUPIL) gave the best predictions.

UWW=-39.5+0.51*HIPG+0.41*SFTHIGHF+0.31*SFSUPIL (r=.95, r2=.90, SE=1.87); UWW=-48.69+0.74*HIPG (r=.89, r2=.79, SE=2.51); UWW=-50.1+0.68*HIPG+0.37*SFTHIGHF (r=.93, r2=86, SE=2.12).

Conclusion

For the males we can conclude that UWW measurements corresponds more to anthropometric values then IMP measurements. For the females the correlations between UWW and IMP were higher but anthropometric values deliver still the strongest predictions for body fat as estimated with UWW. For our test group anthropometric measurements, which are cheap and easy in use, are the most accurate to estimates the fat percentage as estimated with the UWW.

THE EFFECT OF ACUTE PHYSICAL EXERCISE ON STEROIDHORMONE PROFILE AND CYCLOOXIGENASE ENZYME MEDIATORS AND OTHER METABOLIC PARAMETERS IN COMBAT SPORTS

Pucsok, J.M., Gyore, I., Hollósi, I., Soós, E., Horváth, I.

National institute for Sports Medicine, National Korányi Institute for Pulmonology and Pathophysiology, Hungary

A heterogenous group of 13 male and 16 female judoists, and 10-10 karate competitor male and female members of the hungarian national team participated in this study. The subjects completed a standardised maximal treadmill (Jaeger LE 580 C) exercise test. Capillary and urine samples were collected at the pre-and post exercise stages. The serum sample of 10-10 karate competitors was analysed using radio-immunoassay technique. The urine steroids were measured at the judo group, using a gas-chromatography, combined with mass-spectrometry (GC-MS) device. At the final stage of our study-design the judo group was measured for cyclooxigenase enyzme mediators from the exhaled breath condensate, while executing the above mentioned maximal exercise test. The purpose of this measurements was to determine the acute exercise induced changes in the concentration of cyclooxigenase enzyme mediators, prostaglandin E2 and tromboxane B2.

The concentration of anabolic hormones in the serum, such as testosterone, DHEA and androstendione have significantly changed. The concentration of the main catabolic hormone, cortisol increased in judo players, but not in the karate group. The results of our study supports, that elite judoists were in excellent physical condition. The hormonal response due to the catabolic/anabolic effects is balanced. The karate players demonstrated no significant increase in plasma cortisol level, the intensity of the treadmill test primarily strengthened the anabolic effects. We experienced no changes in catabolic effects. The changes of serum DHEA concentration is worth to note. We suggest, that the changes in the level of DHEA and the hormonal adaptation are important demonstrators of the improved physical capacity. The change in concentration of adrenal cortex originated DHEA is less known, compared to cortisol and testosterone on the effect of exercise. We found significant increase in both groups (judo, karate), which supports that DHEA has an important effect on the adaptation of physical exercise. The urine steroid profile showed a decrease in the level of inactive metabolites, androsterone and etiocholanolone in elite competitors. Among the analyzed hormones, we measured increase, although not significant, only in the concentration of DHEA and 11-beta-OH androsterone. This increase was negligible, so the level of 11-beta-OH androsterone eventually remained stabile throughout the exercise test. We suggest, that the elevated serum concentration of DHEA and the metabolism in the liver explains the higher concentration. The changes on the level of cyclooxigenase enzyme mediators are inversely related to exercise intensity. The changes in TXB2 are related to exercise intensity. We found, that physical activity has an effect on the level of PGE2 and TXB2 in the airways. We conclude, that these mediators have an important effect on the adaptation of the airways. The examination of biologically active substances - PGE2 and TXB2 - is a useful indicator of execise-induced airway adaptation.

AQUATIC EXERCISE PROGRAM-EFFECTS ON PHYSICAL FUNCTION IN PATIENTS WITH KNEE OSTEOARTHRITIS

Pais, S., Espanha, M., Santos, M., Alves, V., Silva, C.

Faculty of Human Kinetics, Technical University of Lisbon, Portugal, Portugal

Osteoarthritis (OA) is a joint disease which results of the degradation of the articular cartilage. The major symptoms are pain and physical disability1 namely in daily activities such as ascending and descending stairs and getting up from or sitting down on a chair, evolving both concentric an eccentric muscles actions. Non-pharmacological interventions such as exercise are frequent in the treatment of these patients2, although water is an excellent environment for these subjects to exercise there is little evidence of it's efficacy3.

A randomized clinical trail was carried out to compare the effects of a 6, 12 and 24 weeks aquatic exercise program on the physical function of patients with knee OA.Thirty subjects with knee OA were selected and observed by a rheumatologist, and randomly assigned to one of three groups of aquatic exercise: 6 weeks (G6; n=8; 66,7±6,04 yrs; 7F;1M;), 12 weeks (G12; n=11; 66,82±7,4yrs;7F;4M;) and 24 weeks (G24; n=11; 63,8±7,3; 8F;3M;). Physical function was assessed through three functional testes all preformed at subjects fastest speed. Time to ascend (TAS) and descend 12 steps (TDS)4 and time to sit and stand five consecutive times (CT)5 was measured before and after intervention.

The aquatic exercise program was performed, 3x wk. All exercises, specific for lower limb training were previously selected. Each session of 45' was organized with a 10' warm up; 5' of passive and dynamic flexibility exercises; 20' of dynamic and isometric strengthening exercises, in both closed and open kinetic chains and a 5' cool down period.

Although all groups decreased the time needed to perform the functional tests after intervention TAS (G6: -1,5%; G12: -19,3%; G24: -29,3%) TDS (G6: -2,3%; G12: -17,6; G24: -25,7%) and CT (G6: -19,6%: G12-30,8%; G24: -28,4%); in the G6 and G12 it was only significant for the CT ($p<0,01$; $p<0,001$). For G24 all three tests were significant (TAS $p<0,01$; TDS $p<0,001$; CT $p<0,01$). Between subjects differences were significant from 6 to 24 weeks of intervention ($p<0,05$). Aquatic exercise seems to improve physical function in OA patients independently of the duration of the intervention, demonstrating an appropriate selection of exercises, specially the strengthening one's, which were performed in similar condition of the functional tasks. However the magnitude of the results is strongly related to the duration of the program.

1. Ling, S., et al. (2003). J of Rheumatol, 30,114-120.

2. Hurley, M. et al. (2001). Best Pract Res Clin Rheumatol,15(4),569-581.

3. Cochrane, T, et al. (2005). Health Technol Assess, 9(31),1-130.

4. Gür, H., et al (2002). Arch Phy Med Rehab, 83,308-316.

5. Rejeski, W., et al. (1995). Osteoarthr Cartil, 3,157-167.

AGING EFFECTS IN ISOKINETIC STRENGTH IN ELDERLY WOMEN WITH AND WITHOUT KNEE OSTEOARTHRITIS

Espanha, M., Pais, S., Santos, M., Alves, V., Silva, C.

Faculty of Human Kinetics, Technical University of Lisbon, Portugal, Portugal

Osteoarthritis (OA) is the most prevalent joint disease and is a major cause of chronic pain and disability in the older population. Some of the risk factors of knee osteoarthritis in older adults1 are modifiable, such as obesity, muscle weakness and joint laxity. Quadriceps weakness is due not only to arthrogenous muscle inhibition, since findings show that it also occurs in women with no history of joint pain2. The purpose of this study was to compare isokinetic muscle strength in elderly women with knee OA and age matched healthy controls, and observe age influence. Measurements were done with a Biodex System III dynamometer to thirty women with knee osteoarthritis (GO; 64±7,2 yrs) and thirty healthy women (GH; 64±7,2 yrs). Diagnosis was done according to American College of Rheumatology criteria for knee OA3. The isokinetic knee flexion and extension strength (peak torque) and the ratio of hamstrings to quadriceps (H/Q) was assess at 60°/s in a C/C mode.

Knee extension and flexion strength was 40% and 35% lower (p<0.001) in OA subjects than in controls, respectively. Ratios of H/Q muscles did not differ between groups, however they were lower in OA patients (-11%). To analysis the effects of age, both OA and healthy groups were divided in three sub-groups: 50-59 yrs; 60-69 yrs; 70-79 yrs (n≈10). In healthy women significant peak torque differences were found in knee extensors between when comparing the group 50-59 yrs with the others two age groups (p<0.01), but not in the OA group. Ratio H/Q differences were observed only between OA age groups (p<0,05).

Women with knee OA have significantly lower extension and flexion muscle strength than controls, confirming previous findings2. Expected age decline in muscle strength was observed only in healthy controls, seeming to indicate that the muscle weakness observed in these patients is an outcome process of the disease not influenced by age. However the decrease in ratio H/Q observed only in OA age groups indicates a superior decline of the quadriceps strength, probably due to pain inhibition. This imbalance can compromise dynamic stability of the knee joint and contribute for acceleration of the OA process.

1. Loeser, RF (2000). Rheum Dis Clin North Am, 26:547-567.

2. Slemenda, C. et al. (1997). Ann Intern Med, 127:97-104

3. Hochberg, MC et al. (1995). Arthritis & Rheum, 38(11), 1541-1546.

IS QUALITY OF LIFE REDUCED IN OBESE CHILDREN?

Keller-Marchand, L., Farpour-Lambert, N.J., Martin, X., Trigona, B., Schwitzgebel, V., Aggoun, Y., Beghetti, M.

University Hospital of Geneva, Switzerland

Is quality of life reduced in obese children ?

Keller-Marchand L1, Farpour-Lambert NJ1, Martin X1, Trigona B1, Schwitzgebel V2, Aggoun Y1, Beghetti M1.

1Pediatric Cardiology Unit; 2Pediatric Endocrinology and Diabetology Unit; Dept of Pediatrics, University Hospital of Geneva, Switzerland.

BACKGROUND: Childhood obesity is associated with poor quality of life, due to reduced psychosocial health, self-esteem and physical functioning. Physical activity is a major determinant of cardiovascular health and may also improve components of quality of life in this population. OBJECTIVE: To assess quality of life and physical activity in obese children. METHODS: Cross-sectional case control study including 41 obese prepubertal children and 41 lean controls aged 6 to 11 years (mean 9.0 ± 1.5 years). Both groups were matched for age, height and pubertal stage. Health-related quality of life was assessed by the Child Health Questionnaire. Other measures included: 7-day physical activity count by accelerometer; past 12-month physical activity level by questionnaire; body composition by DXA and anthropometrics. RESULTS: Quality of life total score (73.0 ± 10.9 vs 82.4 ± 7.3, p=0.001) was significantly lower in obese children compared to controls, especially psychosocial health, self-esteem, physical functioning, and impact on parental emotional well-being. Obese children had lower physical activity count (309.3 ± 42.4 vs 394.4 ± 99.5 cpm, p=0.04) and past 12-month physical activity (0.8 ± 1.3 vs 3.9 ± 3.2 hours/week, p=0.001) than controls, whereas body mass index (p=0.001) and percentage of body fat (p=0.001) were significantly increased. CONCLUSIONS: Our study demonstrates that quality of life is reduced in prepubertal obese children compared to lean controls, particularly psychosocial health and physical functioning. In addition, obese children are less physically active, suggesting decreased sports participation and physical conditioning. We conclude that obese children may benefit from adapted physical activity interventions to improve their quality of life and social integration.

SHAPE OF THE CORNEA AND VISUAL ACUITY OF ATHLETES

Jendrusch, G., Lingelbach, B., Dennhoven, P., Platen, P.

Ruhr-University Bochum / Institute of Optometry Aalen, Germany

It is well known that on average athletes show higher visual acuity than a representative selection of the whole population. It was proved in former studies that professional athletes (alpine skiing, soccer, table tennis, gliding flight etc.) normally have a visual acuity of more than 2 (= 40/20); in a few cases even visual acuity values higher than 3 (= 60/20) were found.

Every part of the visual system has to be perfect to obtain perfect vision. The cornea, the lens and all distances for the geometrical projection of the outer world onto the retina should be optimized.

PURPOSE: The purpose of the study was to determine the morphological conditions of the cornea which can lead to such a high visual acuity.

METHODS: In our experiments we determined the visual acuity of professional athletes, of students studying sports and of normal people. A total of 166 persons participated in these inquiries (63.3% male, 36.7% female). From overall 332 analyzed eyes 321 eyes could be evaluated.

Simultaneously we used an Oculus-Videokeratograph to get information about the shape of the cornea of each subject. With a software, especially designed for this experiment, we were able to analyze the shape of the cornea. The best fitting ellipsoid was determined and the deviations from this ellipsoid were fit in terms of Zernike-polynomials. These polynomials were used because each Zernike-polynomial correlates to a special aberration of the geometric optical projection.

RESULTS: The higher the visual acuity, the lower the amplitudes of the high-order aberrations. Especially the meridional polynomials like astigmatism or trefoil or four-lobe-aberrations are close to zero. The root mean square error (RMS) of the fit - which is an indicator for the amount of the total aberration of an optical system - was significantly lower with high acuity (correlation between RMS and visual acuity: r

= -0.20, p < 0.001). On an average the shape of the cornea was close to an ellipsoid with a shape-factor of 0.7 which is equivalent to a numerical eccentricity of about 0.55. Absolutely no correlation was found between shape-factor and visual acuity.

CONCLUSION: At first we only found very few people with extreme high acuity. All were professional athletes. Their corneae were nearly free of high-order polynomials and the shape was close to an ellipsoid with an eccentricity of about 0.55. A necessary but not sufficient condition for an excellent visual acuity - which plays a major role in numerous sports and field events - are low amplitudes of the high-order Zernike-polynomials in the shape of the cornea.

Jendrusch, G., Platen, P., Department of Sports Medicine and Sports Nutrition, Ruhr-University Bochum, Germany.
Lingelbach, B., Dennhoven, P., Institute of Optometry Aalen, Germany.

THE EFFECT OF INSPIRATORY MUSCLES TRAINING ON SPORT PERFORMANCE

Vasilescu, M., Rusu, L.

University of Craiova, Romania

Introduction. The results of specialty studies to the influence that training of the respiratory muscles has on the sport performance contradictory results: a part of the scientists indicate the positive influences, meanwhile others contest it. The aim of our study was to investigate the effects of inspiratory muscles training on aerobic performance of athletes.

Methods. Our study has included five aerobe trained athletes, mean age =20,3 years, with equal aerobic performance (VO2max = 50,5ml/Kg/min) and comparable respiratory function, who have been separated into two groups: group A for research (n=5), who undertaken an inspiratory muscles training with resistive loading at 75% of maximum inspiratory pressure, of 15 minutes beside the usual training and group B (n=5) has undertaken only usual training. The inspiratory muscles training session lasted for 6 weeks, four days a week.The ten athletes have made over the eight weeks the same type of aerobic training, at the beginning and the end of the eight week period there has been an evaluation of the aerobic capacity (VO2max) through the Astrand test at the cycloergometer Monark 828

Results and Conclusions. After the six training weeks, it has been noticed that the athletes of group A presented an mean increase of VO2max with 10,2% over the mean value of the B group subjects who did not undertake the muscles insiratory training . These results indicate the fact that the association of inspiratory muscles training with resistive loading to the classic aerobic training brings an outstanding improvement of aerobic performance.

PHYSICAL ACTIVITY LEVEL, RESTING EXPENDITURE ENERGY, FOOD INTAKE AND BMI ACCORDING TO BONE MINERAL DENSITY IN NON-SEDENTARY POS MENOPAUSAL WOMEN

Marin, R., Camargo, L., Matsudo, S.M., Telles, M., Lazzaretti-Castro, M., Matsudo, V.K.

Physical Fitness Research Center From São Caetano do Sul & Centro Universitário UniFMU & Endocrinology-Unifesp, Brazil

PURPOSE: compare and associate the physical activity level (PAL), resting expenditure energy (REE), food intake and body mass index (BMI), according to the bone mineral density status in pos menopausal women involved in a regular physical activity program. METHODOLOGY: sample was composed by 77 women aged 51 to 79 (68.7 ± 6.0 years old) who exercise (low impact aerobics), at least twice a week, 50 minutes per session during 8.1 ± 6.3 years. This sample is part of the Longitudinal Project of Aging and Physical Activity from São Caetano do Sul in São Paulo, Brazil. PAL was determined through International Physical Activity Questionnaire (IPAQ), 8th-short version, by interview. Subjects were classified in 3 groups according to the classification proposed by IPAQ: inactive (22.1%), minimally active (23.4%), and HEPA active (54.5%). PAL was calculated in total METs/week. A questionnaire of food frequency was applied to evaluate: a- calcium intake (dairy products and vegetables); and b- foods that limit calcium bioavailability (coffee, tea, chocolate, soft drinks and alcohol). REE was calculated using the Harrys Benedict´s protocol. BMD was evaluated with DEXA in femoral neck, proximal femur, lumbar spine (L1-L4), and trochanter. Osteopenia and osteoporosis diagnosis followed the WHO criterion. The statistical analysis used was the "t" Student Test for independent samples. Spearman Rho´s correlation was used to measure the association between BMD with PAL, REE, BMI and food intake. The level of significance adopted was p<0.05. RESULTS: the consumption of dairy, vegetables, coffee, tea, soft drink, and alcohol was not different between the normal BMD group and the osteopenia/osteoporosis group. It was noticed a significant difference (p<.05) on BMI and REE between the groups with normal bone density (BMI: 26.3 kg/m2; REE: 1279.6 kcal), and with osteopenia/osteoporosis (BMI: 27.4 kg/m2; REE:1233.6 kcal). However total PAL (2370.5 to 2885.5 METs/week) as well as calcium and limiting foods on calcium intake did not show any significant difference between both groups. Correlation values (r) between BMD and food intake (-0.01 to 0.33), PAL (0.01), BMI (-0.07), and REE (-0.06 to 0.08) were weak and no significant in both groups. CONCLUSION: patterns of physical activity, resting energy expenditure, body mass index and nutritional intake are very similar in non-sedentary pos menopausal women regardless their status of bone mineral density.

Supported CNPq 309481/2003-1.

BIOMECHANICAL COMPARISON OF THE TRACK START AND THE MODIFIED ONE-HANDED TRACK START IN COMPETITIVE SWIMMING: AN INTERVENTION STUDY

Galbraith, H., Scurr, J.

University of Portsmouth, United Kingdom

In competitive swimming, the fundamental goal is to cover a set distance in the least amount of time. The start is an area where small, yet significant gains can be made; some researchers have found that through consistent dive practice an elite swimmer can reduce their total race time by a minimum of 0.10 s. 1 At the elite and Olympic level this improvement could represent the time difference between a first and third place in a sprint event. 2,3 The purpose of this study was to modify the conventional track start diving technique and assess dive performance. Kinematic and kinetic effects of a swimming dive start intervention programme were examined using the conventional track start and the new one-handed track starting method in elite-level swimmers. Five male and seven female GB national qualifiers participated (mean age 16.7 ± 1.9 years, stretched stature 176.1 ± 8.8 cm, body mass 67.4 ± 7.9 kg) were assigned to a control group (n=6) or an intervention group (n=6) that learned the new one-handed dive technique. Swimmers underwent a 4-week intervention comprising 12 ± 3 thirty-minute training sessions led by the same coach to ensure consistency in coaching techniques, video feedback and training. Video cameras synchronised with an audible signal and timing suite captured temporal and kinematic data, and a portable force plate and load cell handrail mounted to a swim starting block collected force data over 3 trials of each technique. The performance criterion measure was time to 10 m [4.51s ± 0.45 track start (TS), 4.59s ± 0.41 one-handed track start (OHTS)], no significant differences

were found between the dive starts demonstrating the absence of a superior and preferred technique bias. A MANCOVA revealed that the type of dive conducted (F=7.682, 8, p = 0.000) affected several kinetic and kinematic variables including: vertical lower limb force (TS= 1.55 % BW, OHTS = 1.19% BW), flight distance (TS = 3.01 m, OHTS = 3.11 m), flight time (TS = 0.31 s, OHTS = 0.33 s) total time (TS = 0.97 s, OHTS = 1.03 s) and horizontal impulse (TS = 119.1 N•s-1, OHTS = 107.8 N•s-1). Although alterations in upper body technique had little effect on overall track start performance to 10 m, coaches should focus on the statistically significant dive performance variables including horizontal force and velocity at take-off, and time to 10 m during dive training sessions and they should guide athletes to choose the style that makes the best use of their respective strengths.

1.Maglishcho, E. (2003). Swimming Fastest. (revised ed. of Swimming Even Faster). Champaign, IL: Human Kinetics.

2.Breed, R., & McElroy, G. (2000). A biomechanical comparison of the grab, swing and track starts in swimming. Journal of Human Movement Studies, 39, 277-293.

3. Lyttle, A., Benjanuvatra, N. (2005). Start right – a biomechanical review of dive start performance [Electronic version]. Retrieved May 11, 2005, from Coaches Information Website: http://www.coachesinfo.com/category/swimming/321.

RED BLOOD CELL PARAMETERS IN PRE-PUBESCENT, PUBESCENT AND MATURE HIGHLY TRAINED FOOTBALL PLAYERS

Boyadjiev, N., Taralov, Z.

Medical University of Plovdiv, Bulgaria

Background - A suboptimal values of the haematological variables has often been recorded in young athletes involved in intense physical activity. There have even been reports of 'sports anemia' associated with intensive physical training(1,2). Our previous studies demonstrated lower values of red blood cell count (RBC), packed cell volume (HCT), haemoglobin concentration (HGB) in highly trained football players than in untrained controls of the same pubescent age(3).

The aim - To evaluate the haematological status of 2314 football players (15.11±2.89 yrs old) and to compare the results for pre-pubescent, pubescent and mature boys recruited in the study and also to relate the values obtained to the individulal aerobic functional capacity.

Methods - 2314 highly trained football players were included in the study. Their mean±SD age, weight, and BMI were: 15.11±2.89 yrs, 56.33±13.28 kg, and 19.62±2.58 kg/m2. The sportsmen were divided into three groups in accordance with their age: pre-pubescent group A (n=1178) - 13.22±1.05 yrs; pubescent group B (n=1029) – 16.57±1.04 yrs; and mature group C (n=107) – 24.30±3.78 yrs old. Venous blood samples were drawn from the cubital vein in standard conditions, and the RBC, HCT, HGB, mean corpuscular volume (MCV), white blood cell count (WBC) and platelet count (PLT) were measured. Each football player passed PWC 170-test.

Results – All haemathological variables in the groups were found in normal ranges, but the RBC was highest in group B (5.17±0.27 x 1012/l vs. 5.03±0.28 x 1012/l for group A, and 5.08±0.41 x 1012/l for group C). Group A demonstrated not only lowest values for the RBC, but also for the HGB (144.69±6.39 g/l vs. 149.06±6.02 g/l for group B, and 151.75±7.54 g/l for group C, P<0.001), and for HCT (0.437±0.02 vs. 0.451±0.02 for group B, and 0.451±0.03 for group C, P<0.001). The pre-pubescent football players (group A) had lower MCV (87.10±2.81 fl), than the players of group B (87.50±2.86 fl) and than the players from group C (88.06±2.95 fl). There was not difference in the WBC and PLT between pre-pubescent, pubescent and mature footballers. The mature players (C-group) demonstrated higher PWC/kg than pre-pubescent (20.64±2.34 vs. 19.25±2.36 kgm/min/kg), and than pubescent boys (19.76±2.69 kgm/min/kg). Significant correlations were obtained between the age and HGB, and between the age and HCT in groups A (0.19 and 0.19 respectively) and B (0.24 and 0.15 respectively). Good correlations were found between RBC and PWC/kg in all groups investigated.

Conclusions – Pre-pubescent highly trained football players have lower values of the red blood cell variables than pubescent and mature footballers, which correlates with lower aerobic working capacity.

1. Biancotti PP, Capopreso A, Di Vicenzo GC, et al., J Sports Med Phys Fitness 1992; 32:70-5.

2. Radomski MW, Sabiston BH, Isoard P. Aviat Space Environ Med 1980; 51:41-5.

3. Boyadjiev N, Taralov Z. Br J Sports Med; 34:200-4.

THE INFLUENCE OF DIET EFFECT ON FREQUENCY, STRENGTH, AND PERIOD OF DIET IN KOREAN COLLEGE STUDENT'S

Hoseong, L., Youngho, S.

Dankook University, Korea, South

Although the exercise and dietetic treatment in the obesity are being clarified, in fact, a lot of problems exist in the diet action. Especially, frequency, strength, and period of exercise play an important role for diet effect. The objective of this study was to investigate the influence of diet effect on frequency, strength, and period of diet in male and female korean college student's. Data collection were surveyed by targeting in male and female college student's in the community, no disability in basic or instrumental activities of daily living and no cognitive impairment, and date used in this study recruited about 306 subjects including 65 males and 241 females. The collected data was analyzed with multiple regression analysis, and the result is as follows. First, the diet effect to the physical strength improvement was higher at practice period and practice frequency of diet, but not in the diet practice intensity. Second, the diet effect to the figure improvement was higher at practice period and practice frequency of diet, but not in the diet practice intensity. Third, the diet effect to the obesity improvement was higher at practice period and practice frequency of diet, but not in the diet practice intensity. Fourth, the diet effect to the well-balanced was higher at practice period and practice frequency of diet, but not in the diet practice intensity. Fifth, the diet effect to the confidence was higher at practice period and practice frequency of diet, but not in the diet practice intensity. These results suggest that diet practice contributed to the period and frequency than exercise intensity. Our results support the notion that constant and continued effort need to achieve the effect of diet.

FREQUENCY OF MUSCULOSKELETAL INJURIES IN TURKISH ROWERS

Koz, M., Ozkaya, C., Arslan, C., Yildiz, N.

Ankara University, Turkey

Rowing is increasingly popular in Turkey. There is a lack of information dealing with the profile of common injuries in Turkish rowers.The purpose of this study was to analyze all injuries occuring in a population of elite Turkish rowers to determine their frequency and location of injury.

A total 135 elite rowers (106 male, 29 female) participated in the study. Data were collected with a questionnaire named nordic questionnaire for the analysis of musculoskeletal symptoms during 2002-2003 race season. The injuries were classified according to the anatomical location of the injury, the mean time lost from employment or training due to injury, and the age of the rower. Correlations between incidence of injury and age, rowing experience, sex, weekly training hour, and boat type were determined by Chi-square test.

This study shows that the commonest site of injury in male are lumbar spine (54.7 %) knee (32.1 %), wrist/hands (26.4 %), shoulder (24.5 %) and ankle/foot (16.0 %). The commonest site of injury in female are lumbar spine (48.3 %), knee (37.9 %), wrist/hands (31.0 %), shoulder (24.1 %) and ankle/foot (10.3 %). The most frequent time lost from employment or training due to low back pain was 1-7 days (for male 20.8 % and for female 27.6 %). It has been determined that as long as chronological and training age increased, injury frequency had decreased significantly on all over regions ($p < 0,01$), and injury frequency of men has been detected as higher than that of women on the shoulder, wrist/hand, knee and ankle/foot areas($p < 0,01$). It has been found that there was a positive correlation between the boat type and the injury frequency($p < 0,01$). The highest frequency of injury has been observed in teh 4X class type rowers in all areas. It has also been found that there was a positive correlation between the weekly training hour and the frequency of injury. The more advanced training hour, the higher frequency of injury has been detected.

The present study suggests that there is a high incidence of injury in Turkish rowers, and that most injuries are low back pain and discomfort. This study also confirmed that low back injuries are a significant problem in rowers.

CUMULATIVE APPEARANCE OF DENGUE FEVER IN GERMAN PARTICIPANTS IN THE YOUTH TRACK AND FIELD WOLD CHAMPIONSHIPS IN JAMAICA 2002

Furian, T., Pfaff, G., Kimmig, P., Striegel, H., Niess, A.

Medical Clinic, Department of Sports Medicine, University of Tuebingen AND Baden-Wuerttemberg State Health Office, Epidemiology and Health Reporting, Stuttgart, Germany

The increasing international nature of sports, including youth athletics, results in more competitions in subtropical and tropical regions, with the corresponding health risks. After individual cases of Dengue Fever (DF) were diagnosed, all members of the German junior national team (n = 98) were asked to fill out a questionnaire regarding health problems and to send in a blood sample to be examined for DF-serology (quantitative IgM-titer). 76 persons completed the questionnaire (response rate 77.6%), 73 provided a blood sample, one who did not provide a serum specimen sent a written proof of respective laboratory results obtained from other laboratories (response rate 74.5%).

Most participants had used personal insect protection measures, such as mosquito nets and long clothing, or insect repellents. 27 participants reported having felt ill during the trip. After return, 25 persons experienced various symptoms.

Serologic evidence of DF was found in 10 participants (13.5 %), 6 females and 4 males. The prevalence of seropositive diagnoses did not differ significantly between athletes (5 out of 55 = 9.1%) and coaches (5 / 21 = 26.3%; p=0.2). Only in four cases was there at least a preliminary diagnosis of DF. Neither age, gender nor training volume influenced the risk of infection. DF led to a significant decrease in subjective athletic performance in the following 3 to 4 months.

The data of these follow-up examinations demonstrate that both good medical preparation and comprehensive care during competitions in countries with a high risk of tropical infectious diseases are very important. If international competitions take place in such regions, organizers and delegations should take measures to maintain the health of all participants including mosquito control programs.

EFFECTS OF SPONTANEOUS RUNNING ON SATELLITE CELLS IN RAT SKELETAL MUSCLE

Kurosaka, M., Naito, H., Ogura, Y., Kojima, A., Goto, K., Katamoto, S.

Juntendo University, Japan

Skeletal muscle satellite cells play an important role for muscle fiber regeneration and hypertrophy. It is well known that resistance training can increase the number of satellite cells with muscle hypertrophy. Recently, it has been reported that endurance training or an increased level of physical activity cause proliferation of satellite cells without muscle fiber hypertrophy. Therefore, the purpose of the present study was to examine the effects of the spontaneous running training on satellite cells in the skeletal muscle of rats.

Seventeen male Wistar rats (6 weeks old) were assigned to a control (CON) group (n = 5) or a training (TR) group (n = 12). Each rat in TR group was kept in a cage with a running wheel for eight weeks. All animals were fed standard rat chow and water ad libitum and maintained on a 12:12 h light-dark photoperiod in an environment-controlled room (22.0 ± 0.5?C, 55.0 ± 5.0% relative humidity). The daily running distance in TR group was recorded, and body weights in both groups were measured every week. After the training period, the right plantaris muscles in both groups were quickly removed under anesthesia, weighted and frozen with liquid nitrogen and stored at –85°C. Serial transverse sections (8μm thick) were made using a microtome at –20°C. Satellite cells were immunohistochemically stained, visualized and identified by using anti-Pax7 and anti-laminin antibody and DAPI. The number of muscle fibers, mean fiber area, myonuclei and satellite cells were measured. To determine the effects of endurance training, citrate synthase (CS) activity of the plantaris muscle was also measured as the oxidative capacity.

The mean running distance during the training period was 6570 ± 1773 m/day in TR group. Body weight was significantly lower in TR group than CON group (CON: 303.9 ± 16.1 g vs. TR: 259.5 ± 15.0 g). There was no difference in the muscle weight and mean muscle fiber area between CON and TR groups. CS activity (CON: 0.25 ± 0.01 μmol·min-1·mg protein-1 vs. TR: 0.30 ± 0.03 μmol·min-1·mg protein-1), the number of satellite cells (CON: 0.021 ± 0.004 vs. TR: 0.032 ± 0.007) and number of myonuclei (CON: 2.03 ± 0.14 vs. TR: 2.48 ± 0.40) per muscle fiber and the relative number of satellite cells (CON: 1.03 ± 0.17% vs. TR: 1.27 ± 0.15%) were significantly higher in TR group than CON group ($P < 0.05$). Furthermore, the relative number of satellite cells was positively correlated with running distance ($r = 0.61$, $P < 0.05$) as well as CS activity ($r = 0.49$, $P < 0.05$) in TR group.

It was concluded that the increased level of physical activity by spontaneous running induced proliferation of satellite cells without muscle fiber hypertrophy in the plantaris muscle of rat.

ACTIVATION PATTERN DIFFERS BETWEEN MONO- AND BI-ARTICULAR MUSCLES DURING A SUSTAINED CONTRACTION WITH EMG BIOFEEDBACK

Place, N., Martin, A., Duclay, J., Lepers, R.

INSERM ERM 207 Motricité-Plasticité, France

INTRODUCTION

Previous studies reported a different activation pattern for the bi-articular rectus femoris (RF) muscle compared to the mono-articular vastus lateralis (VL) and vastus medialis (VM) muscles during submaximal fatiguing isometric knee extension (Ebenbichler et al., 1998; Rochette et al., 2003). However, the activation strategy of the central nervous system during tasks where EMG is kept constant on different synergistic muscles has never been established.

The aim of the present study was to investigate time course of EMG activity for VL, VM and RF muscles during two tasks performed with an original EMG biofeedback either i) on vasti muscles or ii) on RF muscle.

METHODS

Thirteen subjects volunteered to participate to two experimental sessions. The protocol involved the measurement of 1) a maximal voluntary contraction with the knee extensor muscles (MVC); 2) a submaximal isometric fatiguing knee extension with a visual electromyographic (EMG) biofeedback set at i) 40% maximal EMG of vasti muscles (vasti task) or ii) 40% maximal EMG of RF muscle (RF task). All procedures were conducted on a Biodex isokinetic dynamometer at a knee angle of 75°. Surface EMG activity of VL, VM and RF muscles, torque and time to task failure were measured during the two tasks. EMG activity and torque was then expressed at every 10% of the endurance time. Maximal voluntary torque was measured before and after the fatiguing task.

RESULTS

Time to task failures were comparable for both tasks (173 ± 77 s for vasti task vs. 166 ± 105 s for RF task, $P>0.05$). MVC loss was similar for the two sessions (-27 ± 15% on average, $P<0.001$). Vasti EMG activity remained constant ($P>0.05$) for vasti muscles during the RF task but RF EMG activity decreased significantly ($P<0.001$) from 60% to 100% of endurance time during the vasti task (from 33.9 ± 2.9% maximal EMG at the beginning of the contraction to 23.3 ± 2.2% maximal EMG at task failure). Torque decreased ($P<0.001$) for both tasks (from 40.5 ± 0.7% MVC to 15.7 ± 1.4% MVC for the vasti task vs. from 41.4 ± 0.6% MVC to 23.4 ± 3.7% MVC for the RF task).

CONCLUSION

Present results clearly show a different activation pattern for the bi-articular RF muscle compared to the mono-articular VL and VM muscles during a sustained contraction performed with an EMG biofeedback. It seems that activating the bi-articular RF muscle is more strenuous for the central nervous system than the activation of the mono-articular vasti muscles.

REFERENCES

Ebenbichler G, Kollmitzer J, Quittan M, Uhl F, Kirtley C and Fialka V. EMG fatigue patterns accompanying isometric fatiguing knee-extensions are different in mono- and bi-articular muscles. Electroencephalogr Clin Neurophysiol 109: 256-262, 1998

Rochette L, Hunter SK, Place N and Lepers R. Activation varies among the knee extensor muscles during a submaximal fatiguing contraction in the seated and supine postures. J Appl Physiol 95: 1515-1522, 2003.

NITRIC OXIDE SYNTHASE MEDIATES BONE STRENGTHENING EFFECT OF EXERCISE IN OVARIECTOMIZED RATS

Hung, W., Hsu, J.F., Lee, S.Y., Chang, C.K., Fang, J.L.

National Taiwan College of Physical Education, Taiwan

Bone strengthening effect of exercise on postmemoposal osteoporosis has been well documented, but the underlying mechanism remain controversial. Nitric Oxide synthase (NOS) expressed in bone tissues might be an important modulator in bone metabolism during exercise. The purpose of this study was to investigate whether NOS mediates the strengthening effect of exercise on estrogen deficient bone tissues in rats.

Fifty twelve-week old Spraque-Dawley rats were assigned randomly to one of the following five groups : (1) exercise (EX), (2) NOS inhibitor (NOS-I) + exercise, (3) sedentary control group (OC), (4) normal control group (N), and (5) baseline control group (B). All groups other than the B group were either bilateral ovariectomized or sham-ovariectomized. EX and NOS-I groups ran 4 days per week on a motor-driven treadmill. The intensity of exercise was gradually increased to 24 m/min at 0% grade for 60 min/day till the end of training period. L-NAME was administered to the NOS-I group at the dose of 30 mg each other day by gastrogavage for the entire study period. The rats were sacrificed after 12 weeks. Femurs and tibias were removed for cantilever or three point bending test, X-ray absorption, and NOS expression assays.

After twelve weeks of experiment period, exercise training increased bending moment of femur neck (EX：25.33±2.31, NOS-I：18.56±4.28, OC：20.46±4.89, N：22.93±4.12, B：16.01±4.50 kg-mm), maximal loading and stiffness of tibia (EX：18.72±1.56, NOS-I：15.57±1.93, OC：15.72±1.71, N：16.86±1.57, B：11.17±1.81 kg), and bone mineral density of femur neck (EX：0.70±0.05, NOS-I：0.63±0.02, OC：0.51±0.14, N：0.64±0.07, B：0.55±0.03 unit). The exercise effects were abolished by NOS inhibitor but bone density was not affected. NOS expression was dramatically increased in NOS-I group, possibly due to compensation.

RISK FOR THE HEALTH OF SOME OF THE USED SPEED GLUES FOR THE GLUING OF BLADES AND RUBBERS IN COMPETITIVE TABLE TENNIS

Porcar, C., Escoda, J., Riera, J., Drobnic, F.

Consorci Sanitari de Terrassa-Centre d'Alt Rendiment Esportiu, Spain

Speed glues for the gluing of blades and rubbers in competitive Table Tennis and its risk for health.

The international Federation of Tennis of Table will prohibit the use of speed glues that contain Volatile Organic Compounds (VOC) on 2007.

Such speed glues are being used approximately from 1970, with the purpose of providing greater speed and spin to the ball.

Recommendations and regulations for the use of these substances with the purpose of preventing acute effects and to protect the health of the workers exist in the labour world.

The risks for the health depends on the type of compound and of the exposure time.

In the composition of the three analyzed glues we found: butane, hexane, pentane, ciclopentane, heptane, ciclohexane, octane, and other similars in smaller amount. All of them are absorbed by inhalation and some by contact with the skin. The poisonous effects already mentioned are strictly controlled in labour environments.

Players are exposed to these volatile substances during the gluing, previous to each session of training, and throughout the time that each training session lasts.

The yearly health assessment of the Table Tennis players at CAR has been always correct. No alterations in the physical exploration have been detected, neither in the analyses of blood nor in electrocardiogram.

Nevertheless, we have found alterations in the respiratory functional tests, in form of some diminution of the respiratory volumes registered by spirometric test that correspond to a restrictive pattern. These alterations clinically are not related to pulmonary disease nor to bronchial hyperreactivity or previous clinical pathology history.

We have observed a diminution of the Forced Vital Capacity (FVC) in four of the eight players and the Forced Espiratory Volume in the first second (FEV1) in three of the eight players, comparing the assessments of 2005 with respect to the ones made in 2004. Indicating a worsening of the spirometric data.

We cannot statistically conclude that these alterations are secondary to the irritation of the upper respiratory produced by the VOC's inhalation. Research will continue, since the suspicion level is high.

LOW BACK PAIN IN ELITE AND SEMI-ELITE FOOTBALL: A CROSS-SECTIONAL SURVEY WITH NON-ATHLETIC CONTROLS

Hoskins, W., Pollard, H., Daff, C., Odell, A., Garbutt, P., McHardy, A., Hardy, K., Dragasevic, G.

Macquarie University, Australia

No study has investigated the levels and prevalence of low back pain (LBP) occurring in football players or at different levels of athletic play (elite and semi-elite).

PURPOSE: To document the levels and prevalence of LBP symptoms in Australian male elite and semi-elite level football players and to compare data with an age-matched non-athletic population. METHODS: Subjects were drawn from clubs playing in the national or international competition for elite players (n=271) and the highest level state competition for semi-elite players (n=360). Age matched controls were drawn from a convenience sample of university students and office workers (n=152). Subjects completed the validated and reliable Quadruple Visual Analogue Scale (VAS) and the McGill Pain Questionnaire (short form), along with a series of specific LBP questions regarding frequency and duration of symptoms, age of first onset LBP and aetiology. Group means were compared using descriptive statistics. RESULTS: There was a significant increased difference between controls and semi-elites and between semi-elites and elites for current VAS, VAS average and VAS at worst (all $p<0.01$) (controls 1/10 v semi-elites 2/10 v elites 3/10 for current and average VAS, controls 4/10 v seim-elites 5/10 v elites 6/10 for VAS at worst). The average pain profile was also clinically significant between controls and elites ($p<0.01$). There was a significant difference between controls and combined elite and semi-elites for VAS at best ($p<0.01$) (controls 0/10 v semi-elites and elites 1/10). There was a significant difference between controls and semi-elites combined compared with elites for levels of overall pain, sensory aspect of pain severity and total pain rating (all $p<0.01$). There was no difference between the age of first onset of LBP for any group (average age 17). 85% of elites, 65% of semi-elites and 53% of controls said their first ever episode or attack of LBP was due to athletic activities. The point prevalence of LBP was 69% for elites, 57% for semi-elites and 55% for controls. 93% of elites, 75% of semi-elites and 49% of controls said their current episode of LBP was due to athletic activities. 40% of elites, 31% of semi-elites and 17% of controls experience daily or weekly LBP. CONCLUSION: Footballers in Australia compared with age-matched controls have significantly higher levels and prevalence of LBP and this figure escalates significantly with level of play.

THE EFFECT OF SPORTS CHIROPRACTIC ON THE PREVENTION OF HAMSTRING INJURIES: A RANDOMIZED CONTROLLED TRIAL

Hoskins, W., Pollard, H.

Macquarie University, Australia

Hamstring injuries are the most prevalent and recurrent injury in Australian Rules football resulting in the most missed matches.

PURPOSE: To determine whether sports chiropractic involving manipulation and supporting soft tissue therapies to the spine, pelvis and lower extremity can prevent the occurrence of hamstring injuries in semi-elite Australian Rules footballers. METHODS: 59 male subjects (age range 18-27) were drawn from two semi-elite clubs and randomly allocated to an intervention (n=29) or control group (n=30) matched for age, low back pain, Knee Injury and Osteoarthirits Outcome Score and hamstring injury history. Treatment and scheduling for the intervention group was pragmatically determined. The minimum scheduling adhered to was 1 treatment per week for 6 weeks, 1 treatment per fortnight for 3 months and 1 treatment per month for the remainder of the season. Treatment began 6 weeks prior to round 1. The intervention and control group both continued to receive standard club medical management (including medication, surgery, manipulative physiotherapy, massage, strength and conditioning and rehabilitation) as directed by club staff. All medical staff were employed by the club and had no limitation in the number of treatments or the type of treatment they could render. This was independently administered without restriction or interference from the study authors. Injury was determined and recorded by club medical staff and defined as that which results in a missed match. Clinical parameters were recorded including mechanism of injury. Two-sample t-tests with 95% confidence intervals were used to assess the efficacy of the treatment with respect to the number of injuries and total amount of playing weeks lost. Survival analysis based on Kaplan-Meier curves and the logrank test were used to compare with respect to injury recurrence. RESULTS: At the end of season (24 matches/24 weeks) there was a significant difference between the intervention and control group for hamstring injury incidence (1 v 5 $p<0.05$), weeks missed due to hamstring injury (4 v 14 $p<0.05$), hamstring injury recurrence (0 v 2 $p<0.05$), total lower-limb muscle strain incidence (1 v 8 $p<0.05$), weeks missed due to total lower-limb muscle strain (4 v 21 $p<0.05$), non-contact knee injury incidence (1 v 7 $p<0.05$) and weeks missed due to non-contact knee injury (1 v 24 $p<0.05$). CONCLUSION: This study demonstrated significant prevention of hamstring injuries severe enough to result in loss of competition match play. Significant reduction in lower-limb muscle strains and non-contact knee injury was also observed.

SYNTHESIS OF MYOFIBRILLAR PROTEIN IN SKELETAL MUSCLE AND OF COLLAGEN IN TENDON OF PATIENTS WITH OSTEOARTHRITIS: RESPONSE TO EXERCISE

Petersen, S.G., Miller, B.F., Hansen, M., Holm, L., Kjær, M.

Bispebjerg Hospital, DK-2400 Copenhagen NV, Denmark

Physical activity leads to an increased protein synthesis in both muscle and tendon in healthy people of all ages, and this leads to both stronger skeletal muscle and more resistant connective tissue, which is important for joint-stabilisation. Likewise, in patients with osteoarthritis (OA) of the knee, physical training decreases symptoms and increases function, but the mechanism behind this is unknown, and it remains to be explored whether training leads to an increased synthesis of structural proteins of muscle and tendon in OA. We studied 8 elderly patients (50-70 years) with knee OA (symptoms and x-ray) and compared results with a healthy control group. Each patient performed 60 min of one-leg kicking at 67 % of W-max in a modified Krogh ergometer while the contra lateral resting leg acted as resting control. 24 hours after one-leg kicking, the patients met in the laboratory in a fasting state and had a stable isotope-infusion of 13C-leucine and 15N-proline in a brachial vein. During the infusion we collected blood samples, and after 4 hours of infusion, biopsies were taken bilaterally from both m. vastus lateralis and the patella-tendons. Analysis of 13C-leucine incorporation in the muscle biopsies demonstrated that the mean fractional synthesis rate (FSR) of myofibrillar protein in the resting leg was 0.07% h-1, whereas the mean FSR of the working leg was 1.0% h-1($p>0.05$). In healthy young controls, a similar mean FSR of the resting leg at 0.04% h-1 and a FSR of the working leg at 0.1% h-1 was found ($p>0.05$).

In contrast, in the tendon of OA-patients we found that the mean FSR was similar in the resting (0,09% h-1) and the working leg (0,09% h-1), indicating no response to exercise, whereas in the control group of younger men, mean resting FSR was 0,04% h-1 and working FSR was 0,08% h-1. Interestingly, the resting FSR for tendon collagen in OA was significantly higher than in controls ($p=0,029$). In conclusion, protein synthesis of skeletal muscle myofibrillar structures in elderly people with osteoarthritis seem to respond to exercise in a similar way that muscles of younger individuals do. In contrast to this, tendons of elderly people with osteoarthritis of the knee seem to have a significantly higher resting FSR than that of young people. Furthermore, protein synthesis in tendons of elderly with osteoarthritis does not respond to acute exercise. This study indicates that whereas protein synthesis of skeletal muscle is normal in OA patients, resting collagen synthesis rates of connective tissue (like tendon) is elevated in osteoarthritis patients.

(Reference: Miller,B.F. et al 2005).

EFFECTS OF TAURINE ON BLOOD LACTATE LEVEL WHICH WAS INCREASED BY RUNNING EXERCISE IN RATS

Shumpei, M., Tohru, T., Kazuyoshi, N., Hiroyasu, M., Takahiko, N., Yoshihisa, Y.

University of Tsukuba, Japan

To examine the effects of taurine on fatigue induced by running exercise with a treadmill, blood lactate and muscle lactate were measured.

Concentrations of blood lactate elevated in the twenty-, thirty- and forty-minutes' running groups as the duration of running exercise was prolonged. In the 30- and 40-minutes running groups were higher than the control group with statistical significance ($p<0.05$). Changes in concentrations of muscle lactate were'nt statistical significance in all the groups. However, concentrations of muscle lactate tended to elevate as the duration of running exercise was prolonged. Concentrations of blood lactate decreased in the 03, 1.0 and 3.0% taurine administration(14days) groups with 25minutes running exercise. Blood lactate decreased dose-dependently.

Taurine is considered to decrease blood lactatose and an index to indicate fatigue increased by running exercise.

EFFECTS OF SERIAL FATIGUING TASKS AND ACUTE RECOVERY ON INDICES OF VOLITIONAL AND MAGNETICALLY-EVOKED NEUROMUSCULAR PERFORMANCE OF THE KNEE FLEXORS IN FEMALES

Minshull, C.M., Walters-Edwards, M., Gleeson, N.P., Rees, D., Bailey, A.

Nottingham Trent University, United Kingdom

Optimal functioning of the knee flexors is paramount to the dynamic stabilisation of the knee (Rees, 1994). Team sports frequently require serial episodes of high-intensity fatiguing exercise (McInnes et al., 1995), which may be associated with greater decrements to neuromuscular performance and a prolonged recovery compared to single episodes of fatigue (Zhou, 1996). The effects on the physiologic capacity of the knee flexors to initiate muscle force under these circumstances are yet to be established.

Volitional and magnetically-evoked neuromuscular performance of the knee flexors of the preferred leg (females, n=20; 21.3 ± 2.3 yrs; 1.68 ± 0.06 m; 68.0 ± 6.3 kg [mean ± SD]) was assessed prior to and immediately following two treatment conditions: (i) a fatiguing intervention condition consisting of 4 bouts of 35-seconds maximal static exercise, (ii) a control condition consisting of no exercise. Recovery measures were obtained at 1, 3 and 6-minutes.

The intervention induced cumulative decreases to knee flexor volitional peak force of up to 15.9%; recovering to 96.6% of pre-exercise values following 6-minutes of rest (235.3 ± 54.7 N vs. 198.1 ± 38.4 N; $F[2.4, 44.8 GG] = 3.2$, $p < 0.05$). A 25.6% impairment to volitional electromechanical delay performance (55.3 ± 11.8 ms vs. 69.4 ± 24.5 ms; $F[4, 76] = 2.7$, $p < 0.05$) and a 10.0% improvement in magnetically-evoked electromechanical delay (EMDE) (24.5 ± 4.7 ms vs. 22.1 ± 5.0 ms; $F[2.6, 49.6 GG] = 3.18$, $p < 0.05$) following the first exercise bout were sustained throughout the remainder of the intervention and recovery. Magnetically-evoked peak twitch force was impaired (23.7%) following the fourth episode of fatigue (21.5 ± 13.6 N vs. 16.4 ± 14.7 N; $F[2.3, 44.5 GG] = 3.2$, $p < 0.05$) and did not recover by 6-minutes.

The fatigue-related impairments to the neuromuscular performance of the knee flexors suggest a prolonged decrease in capability to stabilise the knee joint following serial episodes of high-intensity exercise. However, quickened initiation of muscle force (EMDE) may represent a vital neuromuscular compensatory strategy to resist injury.

References:

McInnes, S.E., Carlson, J.S., Jones, C.J. and McKenna, M.J. (1995). The physiological load imposed on basketball players during competition. Journal of Sports Sciences, 13 (5): 387-397.

Rees, D. (1994). Failed ACL reconstructions. Proceedings of the Football Association-Royal College of Surgeons, Edinburgh 6th Joint Conference on Sport Injury, Lilleshall Hall National Sports Centre, July.

Zhou, S, (1996). Acute effect of repeated maximal isometric contraction on electromechanical delay of knee extensor muscle. Journal of Electromyography and Kinesiology, 6 (2): 117-127.

OPTIMISATION OF EXERCIES PERFORMANCE IN WHEELCHAIR RACING ATHLETES

Mueller, G.

Swiss Paraplegic Research, 6207 Nottwil, Switzerland

Wheelchair racing is a paralympic discipline where exercise performance is at the highest level in many categories. To win a medal at the paralympic games, athletes have to exercise and prepare for such competitions as able-bodied olympic athletes do.

However, spinal cord injured (SCI) athletes have additional problems to consider due to their impairment. Such problems may cause special or additional exercise training, supplementation, or other arrangements to be used in order to reach the highest possible exercise performance level.

Some of these additional problems are the absence of the sympathetic nervous system regulation in tetraplegic and high lesion paraplegic athletes, the absence of thermoregulation below the lesion level, the lower amount of active muscle mass which also affects respiratory muscles e.g. abdominals and in tetraplegic athletes even most expiratory muscles. This leads to an altered coenaesthesia which needs special attention throughout the whole training process.

In order to consider all these special needs and to concurrently improve individual exercise performance, we conducted several studies with junior and elite wheelchair racing athletes. Thus we developed and validated a new exercise test in order to improve training quality in junior wheelchair racing athletes. Furthermore, the effects of respiratory muscle endurance training on 10km time-trial performance in elite wheelchair racing athletes was investigated, as well as the influence of creatine supplementation on 800m all-out exercise performance. Results of the study about respiratory muscle endurance training showed significant improvements in respiratory muscle endurance in the training group, but failed to show significance in 10km time-trial performance, even if the training group showed a mean improvement of 3 min. Our current investigations focus on different tests to determine the individual maximal lactate steady state in wheelchair racing athletes in order to improve guidance of exercise training in this special group of athletes.

Outcomes of all these studies revealed that there are big inter-individual differences between athletes due to their varying types and levels of impairment. Lesion level for example plays a major role in exercise performance and due to only small numbers of athletes, large standard deviations occur in the results of scientific studies performed with SCI athletes. In general, due to the limited number and heterogeneity of wheelchair racing athletes, highly scientific studies are difficult to perform. Nevertheless, SCI individuals could benefit from such studies, and based on individual results each athlete would be able to decide which additional intervention may help to further improve personal exercise performance.

Poster presentation (PP)

PP1-05 Biomechanics 1-3 - "Exhibition Hall"

REPETITIVE HOPPING EXERCISE ALTERS THE SKELETAL MUSCLE ARCHITECTURE AND THE FASCICLE AND TENDON INTERACTION

Ishikawa, M., Vincent, M., Kanervo, M., Peltonen, J., Nicol, C., Chavet, P., Komi, P.V.

Neuromuscular Research Center, Finland

In human locomotion, the tendinous tissues (TT), such as tendons and aponeuroses, can play an important role for movement performance with regard to energy storage and its release (e.g. Fukunaga et al 2002). The recent ultrasonographic studies showed that the fascicles contract isometrically or shorten when the muscle-tendon unit (MTU) lengthens during the ground contact phase of walking, for example (e.g. Fukunaga et al 2002). This fascicle behavior, especially during the MTU lengthening phase, suggests that TT plays an important role as a mechanical buffer during human locomotion (Fukunaga et al 2002). On the other hand, it was suggested that repeated isometric contractions could alter the fascicle geometry (Maganaris et al 2002) and tendon properties (Kubo et al 2001). Therefore, it is important to consider how the repeated high intensity movements change the fascicle-TT interaction. This may have implications, especially for utilization of elastic energy during locomotion. Therefore, the purpose of the present study was to examine architectures and interaction between the fascicle and TT of the medial gastrocnemius (MG) and Soleus (SOL) muscles during human hopping exercises.

32 subjects underwent 15 repetitive hopping (two-legged hopping) with maximal efforts on a force plate followed by submaximal repetitive hopping (65% of the peak ground reaction force) until exhaustion. Ground reaction force and kinematics were recorded together with ultrasonographic scanning (96 images/sec) of MG and SOL during exercises. The subjects were asked to stop hopping and remain standing for 3-4 seconds to measure the muscle architectures before the exercise, after 15 maximal hops and during repetitive hopping after 50, 100, 250 and then at 250 hop intervals.

When measured during erect standing, the fascicle lengths of MG and SOL increased significantly and muscle-tendon junction of MG shifted proximally when hopping progressed. During the ground contact, after the rapid fascicle stretching (0-10% of the contact period), the MG fascicles shortened throughout the ground contact in the initial 50 hops. The SOL fascicles were stretched during the MTU lengthening. However, when hopping have advanced further (>500 hops), the stretching of the MG and SOL fascicles during the MTU lengthening increased and the estimated TT stretching decreased significantly.

The observed results demonstrate that the fascicle behavior of MG and SOL muscles and TT properties could vary with repetitive hopping. The increased fascicle stretching during exercise and the longer Achilles tendon at the standing position due to the repetitive hopping can influence the storage of elastic energy.

References

Fukunaga et al (2002) Exerc Sport Sci Rev 30, 106-110.

Kubo et al (2001) J Appl Physiol 91, 277-282.

Maganaris et al (2002) J Appl Physiol 93, 2089-2094.

RELATIONSHIP BETWEEN ENDURANCE CAPACITY AND CHANGES IN SURFACE ELECTROMYOGRAM SPECTRUM ANALYSIS DURING SUSTAINED SUBMAXIMAL ISOMETRIC HIKING ACTIVITY

Boyas, S., Maïsetti, O., Guével, A.

University of Nantes, Nantes Atlantique Universities, France

Introduction

In dinghy sailing, hiking is a technical gesture allowing to reach the optimal speed of the boat. This position solicits several joints and mainly involves the anterior muscles of the trunk and lower limbs in an isometric contraction mode.

Several studies have shown that changes in sEMG parameters during isometric mono-articular submaximal contractions sustained until exhaustion were related to the endurance time (tlim) (1, 3). However, the relationship between tlim and changes in sEMG parameters has not been investigated yet during a sustained pluri-articular submaximal task.

The aim of this study was to examine whether the changes in sEMG parameters were related to the tlim of a submaximal pluri-articular task sustained until exhaustion.

Methods

Nine sailors regularly involved in hiking position (hikers) and 9 physical education students (controls) sustained a hiking position corresponding to 50% of their maximal hiking torque until exhaustion on a specific hiking ergometer reproducing actual hiking position. The electrical activity of main muscles [rectus abdominis (RA), rectus femoris (RF) and vastus lateralis (VL)] acting as synergists to maintain the hiking posture was recorded bilaterally. sEMG amplitude (RMS), MPF and relative power in the 6-30 Hz frequency band (FB1) were calculated.

Changes in sEMG parameters were assessed using the slope of linear regression and a regression-free index called area ratio (1). Changes were computed over the tlim and if significant, over time periods shorter than tlim. Relations between tlim and changes in sEMG were evaluated using Pearson correlations.

Results

Hikers were 45% less fatigable than controls ($p<0,01$). The most fatigable muscle was the RA, whatever the group (2). These results were illustrated by greater changes in RMS area ratio for controls (-1,06±0,80) compared to hikers (-0,34±0,24) and for RA (-1,18±1,37) compared to VL (-0,66±0,78) and RF (-0,31±0,35). Greatest changes in MPF area ratio were also obtained for the RA muscles (0,18±0,13) compared to RF (0,11±0,04) and VL (0,05±0,09). FB1 area ratio changes seemed to indicate that both RA (-0,26±0,38) and RF (-0,27±0,22) muscles were more solicited than VL (-0,04±0,14). No significant relation between tlim and sEMG changes computed over tlim was found whatever the statistical index (slope or area ratio), the muscle, the parameter or the group.

Discussion/Conclusion

These results contradict the literature indicating that relations between tlim and sEMG changes were greater using changes in the most fatigable muscle (3, 1). This may be due to the number of muscles and joints involved in pluri-articular tasks and to modifications in muscular activity patterns that can occur during fatigue (4).

(1) Maïsetti et al. 2002. Eur J Appl Physiol 87: 509-519

(2) Maïsetti et al. 2006. Int J Sports Med: in press

(3) van Diëen et al. 1993. Eur J Appl Physiol 66: 388-396

(4) Rochette et al. 2003. J Appl Physiol 95: 1515-1522.

BACKHANDSPRING PERFORMANCE MODEL BY CLUSTERS ANALYSIS

Penitente, G., Merni, F.

Faculty of exercise and sport sciences; University of Bologna, Italy

The backward handspring(BH) is a basic skill action used in the back tumbling passes on the floor exercise. It's also performed as a great deal on the beam and it represents the fundamental action of the Yurchenko vault elements. It was hypothesized that some BH biomechanical variables were significantly correlated and that they could identify the movement model. The aim of this work is to highlight the most important temporal, spatial (linear and angular), and kinematics relationships for this movement.

5 Italian female gymnasts aged 10 to 14,competing for 2 local clubs, performed several repetition of round-off(RO) and BH. Statistic analysis has been done on data extracted by the 3d trajectories of 46 markers displaced on the gymnast's body recorded by an optoelectronics system(Vicon 3000pixel;100Hz). The center of mass(COM) location was identified according to the Davis-Kadaba proceeding. The variables were selected from the technical evaluation rules and in reference to the specific literature[1-4]. Starting from two correlation matrixes, for the first(1) and second(2) flights(FL) phases' variables respectively, we have applied and then compared both the non-hierarchical and the hierarchical cluster analysis methods.

The results show that the 1FL phase's clusters are stronger than the 2FL ones and, that the clusters individualized with the two analysis methods are very similar.

For the 1FL there are 2 enough complex clusters. In the first the hip(h), knee(k) and ankle(a) ROIMP angles(A) are tightly correlated among them and, with the delta gathering and pushing's kA and, with the vertical velocity(Vz) at the ROIMP. The second cluster includes the aA takeoff(TKO) that is significant correlated to:

– the maximum gathering Ha

– the feet(F) SUPP time, the COM position versus the SUPP base both at the FIMP and TKO

– the ROIMP horizontal velocity(Vx)

– the gathering hA.

The 2 clusters that grouped the next variables are:

1. The COM vertical lift, the 1FL time and, the F TKO kA.

2. The FTKO hA, the FTKO Vz, the vertical COM pushing during the FSUPP phase.

The most important correlations for the 2FL are in the following clusters:

1. The 2FL time, the HTKO Vz; the 2FL space and the 2FL's COM vertical lift.

2. The HIMP hA, the HTKO aA and, the COM's vertical push space during HSUPP phase.

The results show that is possible describe a technical model for the BH through clusters analysis and,how both the biomechanical and technical variables, evaluated by judges, are correlated among them.

REFERENCES
1–DILLMAN C.J.et al"A kinematic analysis of men's Olympic long horse vaulting"IntJouofSpBiomech,Vol 1,1985.
2– DAINIS A"Cinematographic analysis of the handspring vault"ResQuart,Vol50,n.3,1979.
3–TAKEI Y."Comparison of on-horse mechanical variables between two handspring category vaults performed by elite gymnasts"Med&Sc inSports&Exercise Vol34(5) Suppl 1,2002
4–MERNI F.et al"3D biomechanical analysis & artistic gymnastics"XIVthIntConfonMechinMedandBiol. Bologna,Sept2004.

DIFFERENCE IN KINETIC VARIABLES ACCORDING TO SHOE TYPE DURING WALKING

Kwon, B.Y., Yi, K.-O.
Ewha woman's University, Korea, South

Purpose: The purpose of this study was to analyze force and pressure variables according to different shoes types during walking.
Methods: Subjects for this study consisted of three college-aged females who had never experienced pregnancy. Passive force variables were measured utilizing the Kistler Force Platform (9281B), while total pressure and pressure distribution was measured using the Pedar Insole system (V.654R, V.658L, novel, Germany). These variables included: maximum passive force, number of passive force peaks, maximum passive loading rate, maximum passive decay rate, passive impulse. Each subject used standard walking shoes, elevated forefoot walking shoes, round bottom walking shoes, and high heeled dress shoes (7cm). Statistical analysis was performed using SPSS 12.0 program with one-way ANOVA analysis and tukey post-hoc testing.
Results
There were significant differences in the following categories of passive force variables:
1. Maximum passive force between round bottom shoes and high heeled shoes(F=4.957, p<.05).
2. Number of passive force peaks between all shoes types and high heels(F=8.333, p<.01).
3. Maximum passive decay rate elevated forefoot shoes, round bottom shoes, standard walking shoes and high heels respectively (F=9.705, p<.01).
4. Passive impulse between round bottom shoes, standard walking shoes and high heels respectively (F=6.020, p<.05).
There were significant differences for pressure variables in the following categories:
1. Midfoot pressure between elevated forefoot walking shoes, high heels and round bottom walking shoes (F=7.048, p<.05).
2. Forefoot pressure between high heels and all other categories (F=45.869, p<.01).
3. Total mean pressure between elevated forefoot walking shoes and all other categories (F=20.994, p<.01).
Conclusion
Total mean pressure was highest for round bottomed shoes and high heels, while total mean pressure was the lowest for elevated forefoot walking shoes. There were significant differences between the high pressure and low pressure groups.
Elevate forefoot shoes had the lowest levels of decay rate, and total pressure. The structure of elevated forefoot shoes transfers these forces and pressures from the foot into the lower leg and higher. As a result, different muscles become engaged in gait, resulting in lower decay rate and pressure while walking. Future studies should incorporate the use of an EMG in order to quantitatively evaluate the degree to which different muscle groups are enacted according to shoe type.
References
Yi, Kyung-Ok(2005), The Effects of Elevated Forefoot Walking Shoes on Body Composition, Physical Fitness, and Qualitative Health Variables, Journal of Korean Physical Education Association for Girls and Women, Vol.19.No.1.pp.9-26.
Antonio, Pedotti. and Paolo, Crenna. (1990) Individual Strategies of Muscle Recruitment in Complex Natural Movements. Multiple Muscle Systems: Biomechanics and Movements Organization J. M. Winters and S. L-Y. Woo(ed.), Springer-Verlag. 542-549.

SHORTENING-STRETCH CYCLE OF HUMAN PLANTAR FLEXORS IN VIVO: EFFECTS ON MOMENT GENERATION AND MUSCLE ARCHITECTURE

De Monte, G., Arampatzis, A.
German Sport University Cologne, Germany

It is accepted that following active muscle stretching or shortening, phenomena known as force enhancement and force depression can be present (1, 2, 3). In daily activities muscles do not undergo isolate shortening or lengthening contractions but rather shortening-stretch (SH-ST) or stretch-shortening (ST-SH). Reports state that the shortening induced force depression is unaffected by a previous stretch (4, 5). Oppositely, stretch induced force enhancement is affected in a dose dependent manner by a previous shortening (4, 5). However the available studies on force depression or force enhancement after a ST-SH or a SH-ST cycle were conducted on isolated cat muscles. Results on these phenomena in human skeletal muscles are not available in the literature. In addition the influence of the history dependent mechanical properties of the tendon and aponeurosis (i.e. creep) was not examined in these experiments. Therefore the purpose of this study was to examine the moment generation of the human plantar flexors and the architecture of the m. gastrocnemius med. (GM) during and after SH-ST cycles in vivo, and to verify the hypotheses that there is a moment enhancement after SH-ST cycles and that this might be influenced by muscle architectural changes.
Fourteen male volunteers participated in the study (Age: 30.7±5 years, height: 177.4±7 cm, body mass: 79.6±9 kg). The subjects performed a series of isometric-SH-ST-isometric plantar flexion contractions at two electro stimulation frequencies (85Hz, 30Hz), two movement amplitudes (15°, 25°) and three velocities (25°/s, 50°/s, and 100°/s). The corresponding ankle moments, kinematics and changes in muscle architecture were analysed at eight time intervals (B1 to B8). The effects of stimulation frequency, motion amplitude and velocity on torque enhancement were tested by a univariate ANOVA. The main effects were compared using a Bonferroni correction (α = 0.05). The results show an isometric ankle joint moment enhancement at steady state of about 2% after SH-ST cycles. Furthermore the enhancement found was independent of amplitude, velocity and stimulation frequency. Despite an "architectural steady state" after SH-ST cycles, the GM fascicle length was lower and the pennation angle higher (~2%) than in the initial isometric condition. Considering that the GM was tested in the ascending limb of its force-length relationship the results indicate that the moment enhancement found was underestimated. Concluding: We found an enhanced ankle joint moment after SH-ST cycles of similar amplitudes during maximal and submaximal stimulations. Moreover the observed moment enhancement underestimates the actual moment enhancement which has to overcome the adverse architectural changes.

1. Abbott & Aubert, 1952. J Physiol, 117, 77-86
2. Edman et al., 1978. J Physiol, 281, 139-155
3. Maréchal & Plaghki, 1979. J Gen Physiol, 73, 453-467
4. Herzog & Leonard, 2000. J Biomech, 33, 531-542
5. Lee et al., 2001. J Biomech, 34, 979-987.

ALLOMETRICAL ANALYSIS OF THE BALL KICKING PERFORMANCE IN MALE JUNIOR SOCCER PLAYERS

Teshima, T., Yumigeta, R., Tsunoda, N.

Kokushikan University, Japan

The purpose of this study was to clarify relative growth of the ball kicking performance to body height in male junior soccer players.

Eighty-seven male junior soccer players aged from 10 to 17 years were participated as subjects. Subjects were classified by nine body height groups for every 5cm. The anthropometric parameters for body height (BH), body weight (BW) and fat free mass (FFM) were measured in all the subjects. Each subjects were performed a warm-up routine including some stretching and kicking drills. All subjects were performed maximal ball kicking to measure maximal kicked ball distance (BD). Kicked ball velocity (BV) in the distance of 5m with the three ball kicking was measured by Radar Gun (Mizuno, Japan). Maximal swing velocity (SV) on ball kicking movement of the lower limb was obtained using a custom-made movement velocity measurement system of Speed Meter (VINE, Japan). Statistical analysis was used allometrical analysis method to relative development on ball kicking performances due to physical growth. Ball kicking performances (y) corresponding to body height (x) was plotted on double logarithmic graph to obtain allometric equation $y = bx^a$, where "a" is a developmental index and "b" is constant. Partial correlation coefficient between anthropometric data and ball kicking performances were analyzed. The level of significance was set at $p<0.05$.

The relationships between body height and ball kicking performances (BD, BV and SV) showed broken lines which has three phases with two critical points. The body heights corresponding to the first critical point were 150.3cm and 148.8cm for BD and BV, respectively. There is first critical point of body height corresponding to 146.3cm in SV. The index "a" for BD increased from 1.415 to 3.796 at first critical point. In BV, allometly index was changed from 0.777 to 2.1036. There was allometry index of SV increased from 0.199 to 2.251 at the first critical point. Above the second critical point, the index "a" decreased ball kicking performances respectively. And also, BH and FFM as anthropometric parameters were closely related to the ball kicking performances during rapidly developing from first to second critical point of body height.

In this study, Ball kicking performances were rapidly developed from about 150 to 170cm of body height. The age range corresponding to the first critical point was about 12-13 years old with chronological age. Generally, those ages were appeared adolescence growth spurt in almost boys. During this body height range from about 150 to 170cm, there was significant coefficient correlation between BH and FFM and ball kicking performances. And also, ball kicking performances were significantly developed than body height growth during this body height range. From these results, it was considered that ball kicking performance may be develop due to physical growth during adolescent growth spurt in male junior soccer players.

COMPERATIVE KINEMATIC ANALYSIS OF SIMILARITIES AND DIFFERENCES IN SERVE AND GROUNDSTROKES BETWEEN WHEELCHAIR AND STANDING TENNIS PLAYERS

Haudum, J., Wagner, H., Schwameder, H., Haudum, A.

University of Salzburg, Austria

Wheelchair tennis players (WTP) have different playing conditions compared to standing tennis players (TP) due to locomotion and injury. The purpose of this study was to clarify differences in EMG activity and shoulder angles between wheelchair and standing tennis players during tennis groundstrokes and serve.

5 male wheelchair tennis players (mean ITF ranking 41.5), and 3 male and one female able-bodied tennis players (Austrian National League) served as subjects.

Nine muscles (m. bizeps brachii, m. trizeps brachii, m. brachioradialis, m. anterior deltoid, m. posterior deltoid, m. pectoralis, m. trapezius, m. latissimus, m. external oblique) of the dominant side were studied using surface electromyography. The objective was to analyze the mean activation of these muscles engaged in the tennis movements: serve, backhand slice, and forehand topspin. The surface EMG was processed with IKE software.

Kinematic data was collected by eight cameras (Vicon System) keeping track of reflective markers placed on the trunk and arm. Data included shoulder angles of the dominant arm: anteversion, abduction and internal rotation of the humerus with respect to the thorax.

T-test was used for significance testing of the mean differences between WTP and TP (alpha = 0.05).

Results showed that in all movements normalized mean EMG activity of the nine muscles was not significantly different between WTP and TP.

Statistical analysis of kinematic data showed significant differences in the range of abduction ($p<0.001$) and anteversion ($p<0.001$) angles during all three movements, whereas results for the range of internal rotation angle did not show significant differences between WTP and TP ($p>0.05$) apart from the serve. WTP had a significantly greater range of shoulder anteversion, whereas the range of shoulder abduction was significantly lower than that of TP.

The findings of this study suggest several important points about joint motion. Although being in a lower sitting position, WTP have less abduction angles. Range of anteversion angle is, however, increased in WTP. This could be a strategy to find the best combination of anteversion and abduction angle producing the greatest consistency and accuracy in their strokes.

Different shoulder angles might be important findings for shoulder pathology and wheelchair tennis training skills, especially flexibility training.

CREATION OF A FREE COMPUTER SCIENCE INSTRUMENT FOR THE MEASUREMENT OF TEMPORARY EVENTS FROM CONTACT PLATFORMS NAMED CHRONOJUMP, AND ITS APPLICATION IN SPORT SCIENCES

de Blas, X.

FPCEE-Blanquerna, Universitat Ramon Lull, Spain

Time is the most used measure to value sport results. Time measurements must be taken with reliability, accuracy and independence of the observer, specially when the evaluands are very short. For this reason, when sport science universities need measuring tools, they usually buy expensive –unaffordable for students- technological instruments whose source code is not accessible, forcing the users to trust the manufacturing company's quality controls and preventing them from the desirable validation in all scientific scope.

The aim of this project is to provide a free GPL licenced application, which not only is freely downloaded from the Internet, but also facilitates the access to the source code and schemes of all its versions, both in software and hardware. This tool is made up of three parts: a contact platform, which is properly documented so that the user can build it; Chronopic chronometer based on the free microcrontroller Skypic; and Chronojump software, which captures the events in Chronopic, organises them in a database and manages all the information, allowing to analyse, graph and prepare reports.

A technological structure integrating some free softwares has been created. It includes: CVS for revision control, FTP for version distribution, SSH for secure changes submissions, Apache server for web publishing, Sendmail for mail lists, and Create_web_chronojump –designed ad-hoc- for document coordination and web translations; all integrated in the GNOME web development platform under the URL: http://gnome.org/projects/chronojump. In addition, contact has been established with the GNOME Translators Group in order to translate the program into as many languages as possible. As far as the execution environment of Chronojump is concerned, MONO development platform, Sqlite database manager and Nplot library are the main tools helping Chronojump to grow continuously with new features. Each new software module has been included after being gathered in the bibliography and/or requested by biomechanics or trainers, who are close to the development process in the aim of Extreme Programming methodology.

This new tool has been validated in four different ways: using a square waves generator, doing comparisons with an oscilloscope, doing comparisons with more expensive -and already validated- instruments, and through the exploration and study of the source code. The final product is a tool integrating Bosco tests well as any type of simple or repetitive jump, any kind of race and, before long, rhythms. It is a tool already used by training and health professionals, and university teachers, which, moreover, is also accessible to students, who can build the instrument with their own hands, at a very low expense, without violating any ethical or legal norms, with a high educative value and direct application to their professional scope.

SARCOLEMMAL EXCITABILITY AFTER ECCENTRIC EXERCISE IN MAN

Piitulainen, H., Komi, P.V., Avela, J.

Neuromuscular Research Center, University of Jyväskylä, Finland

INTRODUCTION: Intensive eccentric exercise results in a prolonged loss of muscle strength. The cause for this could be partly attributed to disturbances in excitation-contraction coupling (Warren et al. 2001). Any damage in the excitable membrane in muscle cell may be expected to lead to failure in sarcolemmal action potential (AP) propagation. Indeed, the sarcolemma has been found to be damaged after eccentric actions in animals (Komulainen et al. 1998), but not yet in humans (Yu et al. 2002). According to Warren et al. (2001) AP propagation is unaffected in animals after eccentric exercise. Juel et al. (2000) have reported the possibility of modified ion distribution across the sarcolemma after exercise in humans, which could result in reduced sarcolemmal excitability (Sejerstedt & Sjogaard 2000). The purpose of the present experiment was to examine if the sarcolemmal excitability is modified after intensive eccentric elbow flexor exercise in humans.

METHODS: In the exercise, subjects performed two sets of twenty maximal eccentric contractions with elbow flexors of right arm on a dynamometer (Komi et al. 2000). Supramaximal transcutaneous electrical stimulation (20 Hz, 30 sec.) was applied on the biceps brachii muscle of nine male subjects. The surface compound muscle action potential (M-wave) properties were analyzed and followed up to 48 h post exercise.

RESLUTS: The results indicated that the M-wave properties (area, peak to peak amplitude, root mean square and duration) were reduced when measured immediately post-exercise. However, this was not the case two days after the exercise, even though, subjects had clear symptoms of delayed-onset muscle soreness and the maximal voluntary isometric and eccentric torques were still depressed by 12.2 ± 9 % (mean ± SD) and 17.7 ± 9 %, respectively. Plasma concentrations of K+ and Ca2+ showed an acute post-exercise increase of 5.4 ± 5.4 % and 1.7 ± 2.1 %, respectively, suggesting an acute loss of normal ion distribution across the sarcolemma. The ion concentrations were returned to normal one hour after the exercise and remained this level the rest of the experiment.

DISCUSSION: In conclusion, these findings suggest that the eccentric exercise may decrease the sarcolemmal excitability acutely, which seems to be related to increased sarcolemmal permeability. However, the disturbance of sarcolemmal excitability is not the major factor in eccentric exercise induced prolonged loss of muscle strength.

ANALYSIS OF TWO JUMP TESTS AND THEIR LANDING PHASES IN A GROUP OF SCHOOL AGED CHILDREN

Rubio, J.A., Abián, J., Alegre, L.M., Lara, A.J., Sordo, S., Aguado, X.

University of Castilla-La Mancha, Spain

Introduction:

The aim of this study was to analyse ground reaction forces during the landing phases of two jump tests, and their relationships with the values of the push off phase in a group of school-aged children.

Methods:

Fourteen children from the same primary school [7 boys (height 137.5 ± 2.1 cm; weight 35.15 ± 4.33 Kg, age 9 years) and 7 girls (height 135.7 ± 3.9 cm; weight 34.99 ± 4.50 Kg, age 9 years)] volunteered for the study. They performed two jump tests: an Abalakov test (ABK, vertical jump with an arm swing) and a countermovement jump (CMJ) on a force platform. During the push off phase of the jumps the peak power was analysed. There were also analysed the jump height and the following variables during the landing phases: the first and second maximum vertical forces (F1, F2), the time at which these values occurred (T1, T2), the height difference of the centre of gravity between the end of the push off phase and the contact of the feet (HL), the trajectory of the centre of gravity during the landing (Lr) and the

time elapsed from the feet contact until the vertical forces reach the subject's weight for the first time after the landing movement (TBW). Anthropometric variables were measured: height, body mass, percent body fat and fat free mass (FFM).

Results:

The mean values of F2 were 8.47 ± 2.33 BW (range: 6.27 -12.06 BW) and 7.49 ± 2.93 BW (range: 3.27 -13.97 BW) in ABK and CMJ, respectively. In the CMJ test, T2 correlated significantly with F2 (r = -0.70; p< 0.01) and Lr (r = 0.67; p< 0.05), and there were significant correlations between F2 and HL (r = 0.70; p<0.05). In the ABK test, there were significant correlations between T2 and F2 (r = -0.65; p< 0.05), T2 and Lr (r = 0.68; p< 0.05), and F2 and HL (r = 0.70; p<0.05). There were no significant relationships between F2 and jump height or peak power, either in the CMJ or in the ABK test.

Discussion/ conclusion:

The results of the present study show that the participants who were able to delay F2, that is, to increase T2, obtained lower values of F2 during the landing, and, at the same time, lowered more their centre of gravity in the two tests during the landing. These characteristics are compatible with a proper landing technique. The delay of F2 could be achieved with a greater plantarflexion at the moment of the first contact of the feet, combined with greater activation of the plantarflexors. The softest landings, observed in few participants, are not frequent, maybe because few physical education teachers or coaches teach how to perform a landing with proper technique. The lack of relationships between jump heights and F2 values showed that, in the sample studied, F2 did not depend on the landing height; therefore landing technique would be the main factor in decreasing vertical ground reaction forces during landings.

Further studies should focus on the design and application of an intervention programme to teach a proper landing technique among school aged children.

REGIONAL DIFFERENCES OF SEMITENDINOSUS MUSCLE CONTRACTION BEHAVIORS DURING ISOMETRIC KNEE FLEXION

Kubota, J., Torii, S., Fukubayashi, T.

Graduate School of Human Sciences, Japan

The semitendinosus muscle (ST) has a tendinous intersection (TI) within the muscle berry. The TI is a complicated three-dimensional tendinous structure and connects the fibers of the two regions (proximal, distal), which are innervated via two branches from the tibial part of the sciatic nerve: one above and one below the TI. The exact function of the TI is unclear. The purpose of this study was to characterize changes of the TI shape of the ST during isometric knee flexion. Furthermore, we investigated the fascicle and sarcomere length of proximal and distal regions of the TI.

This study examined 16 healthy young male volunteers who performed an isometric knee flexion task. The muscle thickness, the magnitude of displacements of two points (superficial point, apex point) and TI angle (superficial angle, apex angle, deep angle) were determined using real-time B-mode ultrasonography. Moreover, the ST was dissected in two human cadavers. The fascicle and the sarcomere lengths of proximal and distal regions were measured.

The angles between the superficial fascia and short leg of TI (superficial angle) and between the short leg and long leg of TI (apex angle) increased significantly with increasing isometric torque (P<0.05), but no significant change was observed in the angle between the long leg of the TI and deep fascia (deep angle). The superficial angle increased from 27.3±9.0 degrees to 32.6±8.0 degrees and the apex angle from 53.1±13.2 degrees to 59.5±11.1 degrees. The displacement of the superficial point at 100% ramp maximum, 8.2±3.4 mm, was significantly greater than that of the apex point, 5.9±3.1 mm. Difference in fascicle length was observed. The fascicles of the proximal region were longer than that of the distal region. Sarcomere lengths were approximately equal.

This study indicated that the shortening behavior of the muscle fascicles was different at the superficial region and at the mid region of the ST during isometric knee flexion. Although the prime factor which affected the difference in the displacements of the superficial and the mid regions was not clarified, the regional heterogeneity of the fascicle length suggests that muscle contraction behaviors could be regionally different in the ST.

Recent studies demonstrated that the contractile force transmission from the muscle fibers was not solely to the MTJ, but also to the lateral fibers within the muscle. The ending architecture of the muscle fibers near the TI is similar to the architecture of the MTJ. Consequently, it is assumed that the function of TI is to participate in lateral force transmission.

These results indicate that the contraction behaviors in the ST differ near the muscle rim and at the muscle center, and around the superficial layer and deep layer. The TI might have a role in strain sharing behavior.

Wickiewicz et al. (1983) Clin. Orthop. Relat. Res. 179 275-283

Maas et al. (2001) J. Biomech. 34 927-940

Woodley at el. (2005) Cells Tissues Organs. 179(3) 125-141.

KINETIC DIFFERENCES BETWEEN MEN AND WOMEN IN SIX LANDING SITUATIONS

Abián, J., Alegre, L.M., Lara, A.J., Aguado, X.

University of Castilla-La Mancha, Spain

Introduction: Landings have been reported to be the main cause of injury in some sports. Two thirds of the anterior cruciate ligament injuries happen during the landing from a jump, and this fact is particularly important in women, because they have specific characteristics that increase the risk of injury during drop landings. The aim of this study was to analyse and compare the vertical ground reaction forces in six different landing situations between men and women.

Methods: Fifteen young women (age = 18.8 ± 1.0 yr, height = 164.8 ± 7.1 cm, weight = 60.53 ± 5.66 Kg) and men (age 22.1 ± 2.3 yr, height 176.6 ± 6.2 cm, weight 72.11 ± 6.21 kg) all of them physically active and university students, volunteered for the study. The force-time data from six different landing situations were recorded by a piezoelectric force platform: four of them from an elevated surface at 0.75 m from the ground (perform a soft landing with the use of upper extremities, perform a soft landing without upper extremities, just before a drop jump and after a sudden start) and two from the ground level [landing after a counter-movement jump (CMJ) and after a drop jump (DJ)].

Results: There were significant negative correlations between the jump heights in CMJ and DJ, and F2 in the landings from 0.75 m (r = -0.56 and 0.54, respectively, P < 0.001). There were only significant differences in F2 between men and women in the landings from 0.75 m, with greater F2 values in the females (P < 0.05). The contribution of the upper extremities reduced F2 by 13.5% in women and 10.3% in men. When comparing F2 among the six landing tests, there were significant differences in the women's group only (P < 0.05).

Conclusions: The decrease in F2 with the use of the upper extremities during the landing is not always possible during a sport competition, but reduces the impact forces and consequently, the risk of injury. There were no differences in the landings from ground level between men and women. However, the significant differences appeared when the landings were performed from 0.75 m. It seems that the explosive force of our participants would be more important in the landings from 0.75 m, while in the landings after jumps a good technique would be more relevant to achieve lower values of F2. Further studies should analyse kinematics and electromyography synchronised with the ground reaction forces, in order to achieve deeper understanding of these differences.

FATIGUE AFTER ECCENTRIC CONTRACTIONS IS MUSCLE LENGTH DEPENDENT

Desbrosses, K., Babault, N., Meyer, J.P., Pousson, M.

INRS Nancy, France

It is well established that repeated maximal eccentric contractions induce a decline in the torque production capacity. Recently, McHugh (2004) demonstrated that this fatigue was length dependent during eccentric exercises and may be primarily attributed to peripheral factors. However, central contribution is not clearly described (e.g., Prasartwuth et al., 2005). So, the present study was designed to investigate fatigue mechanisms responsible for the muscle length dependency observed after repeated maximal eccentric contractions of the quadriceps femoris muscle group.

Twelve subjects performed, three weeks apart, two eccentric fatiguing sessions of the quadriceps muscles. Each session was conducted with a given range of motion, randomly presented: from 20° to 60° (SL, for short muscle lengths) or 80° to 120° (LL, for long muscle lengths) (0°, maximal knee extension). Fatiguing exercises consisted in maximal eccentric contractions (45°/s) repeated until a 40% torque decline. Before and immediately after each fatiguing exercise, maximal voluntary torque (MVT), activation level (AL, estimated by means of the twitch interpolation technique) and peak doublet torque (Pd) were assessed. All measurements were carried out during eccentric actions at 40° for SL and 100° for LL. Muscle soreness was evaluated with the CR-10 Borg scale (Borg, 1982) during five days after the fatiguing sessions.

To reach the 40% torque decline, 165.1 ± 78.2 (mean ± SD) and 74.8 ± 31.8 contractions were required for SL and LL, respectively. Decline in post-fatigue MVT was significantly ($P<0.05$) greater for LL (-27.9 ± 15.9%) as compared to SL (-8.7 ± 8.9%) whereas AL similarly decreased for both conditions (mean AL decreases: -9.4 ± 9.5%, $P<0.05$). For LL, Pd significantly declined (-23.9 ± 15.7%) while it was potentiated for SL (+16.2 ± 15.5%). Soreness significantly increased immediately after SL and LL fatiguing contractions and was maintained during the 3 following days for LL.

Our results demonstrated a greater torque reduction after eccentric contractions performed at long muscle lengths (LL). The lack of difference in AL between SL and LL exclude the contribution of central factors to the eccentric fatigue dependency on muscle length. Therefore, this dependency would primarily be peripheral in origin as shown by the Pd reduction for LL as compared with SL. Additionally, the persisting muscle soreness for LL suggests the presence of greater muscle damages. In contrast, the Pd increase for SL could likely result from an improved Ca2+ myofilament sensitivity at short muscle lengths. We can conclude that peripheral factors (contractile apparatus alterations) may be at the origin of the fatigue dependency on muscle length after eccentric contractions.

Borg GA. (1982) Med Sci Sports Exerc. 14:377-381.

McHugh MP. (2004) Eur J Appl Physiol. 93:286-293.

Prasartwuth O, Allen TJ, Butler JE, Gandevia SC, Taylor JL. (2005) J Physiol. 571:243-252.

INTER-SUBJECTS RUNNING DYNAMIC SIMILARITIES IN MEN AND WOMEN

Delattre, N., Lafortune, M.A., Moretto, P.

Faculté des Sciences du Sport et de l'Education Physique, France

The aim of this study is to test the validity of Froude number (NFr) or Strouhal number (Str) to determine inter-subjects similar running patterns.

Twenty male and eighteen female subjects ran barefoot on a runway equipped with a Kistler force platform sampled at 1 kHz and covered by an EVA foam. The running tests were performed in three experimental conditions. C0:all subjects ran at the same absolute velocity V=3.5 m.s-1; C1: the velocity was determined from the NFr; C2: the stride frequency was determined from Str. NFr and Str were determined to ensure that the mean velocity and mean step frequency were identical through the three conditions. The vertical ground reaction force (Fz) is analysed to check the contact time (CT); the active peak (Peak); the time to active peak; the loading rate between 10 and 90% of Fz peak; and the vertical impulse (Iz). Similarity ratios (k) were computed from each kinetic and anthropometric parameter in respect with the fundamental dimensions of length [L], mass [M], and time [T]. k ratios resulted from a paired subjects combination, which allows to proceed to 190 combinations in men and 153 in women. A r=0.7 ($r^2=0.5$) correlation value between anthropometric ratios and kinetic ratios has been considered for the analysis and enabled us to identify the running similarities between subjects.

The use of Str (C2) allowed obtaining the best correlations between anthropometric and kinetic parameters i.e. the best dynamic similarities. In men, 3 similarities are obtained with Str (C2) and with Nfr (C1), versus 2 similarities observed under C0. With a mean correlation reaching r=0.86, the C2 condition appeared the best one to obtain similarities, while r=0.78 under C0 and r=0.73 under C1. In women, 2 similarities are obtained in each experimental condition. However, similarities obtained with Str are qualitatively the best (r=0.91) while r=0.90 under C0 and r=0.89 under C1.

The study of similarities showed an interest in using the Str for the determination of similar dynamic running conditions. However, the sight of results showed that men and women's locomotor patterns significantly differ. Similarities in men are principally linked to CT, suggesting that men's pattern is mainly organised in accordance with time dimension. Likewise, women's pattern are principally organised in relation to the mass. This difference in the pattern organisation is probably due to leg stiffness differences between genders.

Thus, it appears that the determination of similar dynamic running conditions needs to be specified. Indeed, it seems interesting to take the difference of leg stiffness due to genders into account. The simultaneous use of NFr and Str could bring better results in this way.

Future investigations should be conducted to determine inter-subjects similar dynamic running conditions from dimensionless numbers taking the leg stiffness into account.

Acknowledgment: This study was supported by Nike (Oregon, USA).

MEAN POWER FREQUENCY LINEARLY DECREASE DURING 100 M MAXIMUM CRAWL SWIMMING

Stirn, I., Strojnik, V., Jarm, T., Vizintin, T., Kapus, V., Sarabon, N.

University of Ljubljana, Slovenia

INTRODUCTION

During sustained isometric and dynamic contractions power spectrum of the detected EMG signal compresses and mean power frequency (MNF) shifts towards lower frequencies. The validity of the MNF decrease during dynamic contractions has been tested with isometric contraction (2) and with the use of peak torque as a criterion variable (1). At the beginning of the fatiguing task the MNF decrease is linear, latter the MNF value approaches a plateau where no further decrease is observed (1,3). This may be connected to the lowest limit of muscle fatigue as expressed in an EMG signal. The purpose of the study was to evaluate the MNF decrease during 100 m crawl swimming at a maximum effort level.

METHODS

Eleven competitive swimmers (22.0 ± 2.9 years of age) were involved in the study. EMG signals from m. pectoralis major (PM), m. latissimus dorsi (LD) and m. triceps brachii (TB) were collected. Bipolar Ag-AgCl skin electrodes (9 mm diameter, Hellige, Freiburg, Germany) with inter electrode distance of 20 mm, were used. The cables from the electrodes were fixed to a coaxial cable connected to the telemetric EMG transmitter (Biotel 88, Glonner, Munchen, Germany) which was carried above the swimmer during swimming. For every muscle an envelope of generalized energy was calculated using a sliding 250 ms window. For every stroke and muscle an active part of the stroke was then extracted, defined as the part of the signal where EMG energy was greater than 50% of the maximum energy within the stroke in question. From the extracted segment we calculated the power spectral density (PSD) estimate and its mean frequency (MNF). A linear model was fitted to the scattergram of MNF values belonging to individual strokes for each muscle. We used this model to estimate values of MNF at the time of the first and the final stroke within every swimming session.

RESULTS AND DISSCUSION

MNF linearly decreased during swimming in all observed muscles. The greatest decrease of MNF was detected in TB (from 103.4±8.4 to 78.3±11.3 Hz, eq. 25.1±8.9 %), followed by LD (95.0±7.2-70±10.5 Hz, eq. 22.8 ± 8.8 %) and PM (88,0 ±17.3-67,8±10.7 eq. 20.2 ± 11.3 %). The differences between the decrements were not statistically significant.

The plateau of stabilized MNF was not observed in any of the analyzed muscles. We believe that if subject continued to swim with relative maximum velocity, MNF would decrease further finally reaching a plateau. The muscle first reaching the plateau could possibly limit the performance most and might need analytical training.

REFERENCES

1.Gerdle, B.,Larsson,B., & Karlsson, S. (2000). J Electromyogr Kinesiol.10 (4), 225-232.

2.Potvin, J.R., & Bent, L.R. (1997). J Electromyogr Kinesiol. 7 (2), 131-139.

3.Strojnik, V., Jereb, B., & Colja, I.(1997). Book of Abstracts. Second Annual congress of the ECSS. Copenhagen, Denmark, 370-371.

KINEMATICS CHARACTERISTICS OF SNOWSHOEING UNDER DIFFERENT RUNNING SPEED

Luk, T. C., Fung, L., Leung, M. L.

Hong Kong Baptist University, Hong Kong

Snowshoeing is one of popular sports and it became the top 20 participatory sports in US. Recently, snowshoeing has become an official event in Special Olympics. The idea of Special Olympics considered that snowshoe racing could help athletes enhance their fitness level during the winter months through a full body workout. Literature founding indicated that snowshoeing at a self-pace for 30 minutes provides sufficient intensity to improve the cardiovascular endurance. However, limited study was found in the literature about the biomechanical analysis of snowshoeing.

Moreover, the arrangement of venue became another problem in training or competition. Snow track may difficult to find in some countries or seasons. Sometimes, grassland or sand course may be employed for training or competition purpose instead of using snow course. Therefore, the purpose of this study was to identify the kinematics characteristics of snowshoeing on sand under different running velocity in elite Hong Kong mentally handicapped athletes.

Four athletes participated in this study. All the subjects were asked to perform the snowshoe running on sand with their maximal speed at a outdoor beach volleyball court for 5 laps. A 3CCD digital camcorder with 50Hz filming rate was located 14 meters away from the subject and the shutter speed was set at 1000Hz. A section of running motion at the first and fifth lap was video recorded. Kinematics parameters such as single leg support time, flight time, stride frequency, velocity of CG, vertical displacement of CG, cycle length, stride length, thigh and knee angle under different running velocities were measured. The repeated t-test was employed to examine the difference of the kinematics parameters between different velocities in snowshoeing.

When compared with over-ground running gait, snowshoeing found similar kinematics characteristics in changing of running velocity. The results of present study found that the stride frequency decrease as the snowshoeing velocity decreased. Moreover, both cycle length and stride length were significantly decreased when snowshoeing from high to slow velocity. When compared the CG oscillation in over-ground and snowshoe running, snowshoeing seems to have large vertical CG oscillation at given speed which may cause more energy expenditure.

The changing of kinematics parameters on snowshoeing on sand in different running speed showed similar finding when compared with changing velocity in over-ground running. However, the requirement of technique, such as thigh angle, for snowshoeing on sand seems higher than over-ground running at given speed. Further study should be conducted such as biomechanical comparison of snowshoeing technique on sand, grassland and snow course. Such information could be helpful for athletes, coaches in training program design and technique improvement under different training condition.

RESEARCHES OF STROKE PARAMETERS IN PARALIMPIC SWIMMING IN TEST WITH INCREASING INTENSITY

Petriaev, A., Kleshnev, I.

St.-Petersburg Research Institute of Physical culture, Russia

It is known that the average velocity of swimming on distance is determined by two its components: stroke rate and stroke length. It is very actual to find their optimal correlation. There are several different ways of resolution of this problem. As the planning of swimmer's preparing must emanate from the purposes of his activity – achieving results on main competitions – so the search for rational correla-

tion of stroke rate and length on distances is realized from the analyse of swimmer's. Another way is to find an optimal correlation using special testing of athlete increasing velocity and rate. These ways are very useful in classical swimming and they are described enough, but in paralimpic swimming, due to different degree of athletes' disability, generalized data of analysis of competition activity are approximate. The purpose of the research was to value influence of intensity increase to the parameters of stroke rate and length in depending on character of disease.

In the investigate took part 16 Paralympics national level athletes (S3-S13) women 20,1±4,6 years; stature 165,4 ±8,3 cm, mass 50,3±4,2 kg; men 24,5±7,4 years; stature 177,1±6,2 cm; mass 67,4±10,5 kg.

Athletes swam 6х50 m with increasing intensity. Stroke rate (SR), stroke length (SL), average velocity (v) were determined by video recorder. Heart rate (HR) was determined by Polar 810.

Studying the velocity range, that was showed in the test, it is possible to say that this range for women was 1,01±0,21 m/s (low intensity) to 1,32±0,25 m/s (high intensity). For men it was from 0,99±0,22 m/s (low intensity) to 1,38±0,34 m/s (high intensity).

Change of SR in test for women was from 35,0±20,7 cycles/min (low intensity) to 55,9±27,5 cycles/min (high intensity). For men it changed from 35,9±21,4 cycles/min (low intensity) to 52,6±10,5 cycles/min (high intensity). The dynamics of SL in swimming with different intensity for women was 2,00±0,73 m/cycle (low intensity) to 1,63±0,68 m/cycle (high intensity), for men it was from 2,01±1,01 m/cycle (low intensity) to 1,57±0,35 m/cycle (high intensity). The average pulse after a special test was 183,5±6,8 1/min for woman and 170±22,7 1/min for men.

The interconnection between: SR and SL; HR and v; SL and v; SR and v; SR and HR; SL and HR were determined on the basis of received data.

The analysis of results showed that the structures of special and technical preparedness of paralimpic swimmers have wide individual differences, that is connected with particularities of disability, which impose essential individual sport technique.

Its particularities do not allow to use the basis predications of forming sport techniques, which were developed for healthy athletes. For improving the technical skills of sportsman with limited possibilities it is necessary to have an individual biomechanical analysis of athlete's technique, individual analysis of special preparedness, and to develop an individual model of sport technique on the basis of it.

ENERGETICALLY OPTIMAL AND PREFERRED BICYCLING SPEEDS

Belli, A., Kram, R.

University of Saint Etienne, France

Introduction.

Humans and other animals prefer to locomote at the speeds that minimize the gross metabolic energy cost per distance travelled (1, 2). Is the same true for solo human bicycling? The optimal speed for bicycle racers is obviously the fastest that they can sustain. But for most of us, bicycling is either a form of transportation, a mode of moderate aerobic exercise or just plain fun. Our goal was to calculate the speeds that minimize the metabolic cost per distance for racing and recreational bicyclists. We then compared the energetically optimal speed to the preferred speeds of recreational bicyclists.

Methods.

The mechanical power output for bicycling (Pmec in W) at a constant velocity over level pavement through still air can be well approximated by equation 1:

Pmec = a.V + b.V3;

where a (in N) and b (in N.m-2.s-2) are rolling and aerodynamic resistance coefficients respectively and V is velocity in m.s-1. The coefficient of aerodynamic resistance varies with the size, shape and posture of the rider (3). We selected values from the literature (4) for an average sized rider using a racing bicycle with the dropped handlebar posture (a=2.8, b=0.193) and a recreational bicycle with a forward leaning trunk posture (a=5.8, b=0.271). Plotting metabolic power consumption (Pmet in W) vs Pmec yields a positive linear relationship (equation 2):

Pmet = Pmet0 + Pmech.n-1;

where Pmet0 is the intercept rate of energy consumption at zero power output and n is the muscular efficiency. Values of n =0.238, Pmet0 = 143.5 J (taking 20.1 J/mlO2 for the energetic equivalent of oxygen consumption), were also selected from the literature (5). Combining equation 1 and 2 and dividing by V in order to calculate the metabolic cost per distance (C, J.m-1) gives:

C = Pmet0.V-1 + a.n-1 + b.n-1.V2 (equation 3)

Finally, the optimal velocity (Vopt in m.s-1) that minimizes C (Cmin) was obtained by setting the first derivative of equation 3 equal to zero.

Results and discussion.

Vopt and corresponding Cmin were 4.46 m.s-1 and 60.1 J.m-1 respectively for a racing bicyclist and 3.98 m.s-1 and 78.5 J.m-1 respectively for a recreational bicyclist. Since bicycle time trial races involve speeds greater than 11;m.s-1, clearly racing bicyclists prefer to minimize time rather than minimizing metabolic energy cost per distance. However recreational/commuting bicyclists average 4.9 to 5.6 m.s-1on unobstructed bike paths (6) which is close to Vopt.

References.

1. Margaria R. Biomechanics and Energetics of Muscular Exercise, Clarendon Press, Oxford, 1976.

2. Hoyt DF & Taylor CR. Nature 292, 239-240, 1981.

3. Wilson DG. Bicycling Science, MIT Press, Cambridge, 2004.

4. di Prampero P. Eur J Appl Physiol 82, 435-360, 2000.

5. Lim A et al. Med Sci Sports Exerc 29. S286, 1997.

6. Smith DT Safety and locational criteria for bicycle facilities. Washington, D.C.: Federal Highway Administration (Report N° FHWA-RD-75-112), 1975.

BIOMECHANICAL MONITORING OF SCHOOLCHILDREN'S BODY KINETICS DURING PHYSICAL EDUCATION

Kashuba, V.

National University of Physical Education and Sports of Ukraine, Ukraine

Introduction. There is a necessity of the constant control of human organism condition at natural development and perfection of human motor function in complex modern conditions of his biological and social interaction with an environment [3]. The human body kinetics

term characterizes a condition of motor function, feature of a structure and the spatial organization of human body, biodynamics and a statics of the support-motional apparatus in physical culture and sports & pedagogical practice. However the human body thus is considered not as a point or system of points and as complete macroscopical object. We studied movements of its separate parts and elements which mechanical condition essentially depends on entry conditions of measurement in [1].

Methods: biomechanical analysis.

Results. We developed the "BioVideo" software for the biomechanical videocomputer analysis of movements, the «Torso» software for the dynamics of biogeometrical structure formation of child's bearing and «BigFoot» software for child's foot support-spring properties during the biomechanical control [2]. «BioVideo» consists of four modules:

The construction module.

The point coordinates module.

The calculation of movement characteristics module.

The biokinematic scheme of movement module.

The construction module was purposed for drawing up of scheme model of researched dynamic object. Model may include the points of child's total body or his separate bioparts or biolinks, for example, only the low or upper extremity, etc. «BioVideo» modules determine not only kinematic, but also dynamic characteristics of movement. The «BioVideo» program complex provides definition biomechanical characteristics of center of mass (CM) bioparts and general CM of child's body, and also the phase analysis of movement.

Discussion. As the «BioVideo» program complex is created for work with the equipment available to us, for example with analog or digital videocameras, naturally, coordinates of point should be marked manually, instead of an automatic mode which is provided, for example, with the ELITE Biomech and Qualisys special reflective markers of infra-red light.

Conclusions. The pedagogical experiments have shown, that the use of «BioVideo» as the technology of biomechanical monitoring of schoolchildren's body kinetics allows to estimate objectively a level of their physical development and to make corrections to physical education process on the basis of received data.

References:

1. Каshuba V.A. Biomechanics of a bearing. - Кiev: Olympic Literature, 2003. - P. 40-198.

2. Kashuba V.A., Sergienko K.N., Valikov D.P. Computer diagnostics of human foot support-spring function // Physical education of students of creative specialities: Scientific papers. Editor: Ermakov S.S. - Kharkov, 2002. - No 1. - P. 11 - 16.

3. Laputin A.N. Gravitational training. - Кiev: Znannya, 1999. - 315 p.

THE EFFECTS OF AGING ON FUNCTION OF THE TRICEPS SURAE MUSCLE GROUP DURING FATIGUING ISOMETRIC CONTRACTIONS

Walsh, M. 1, Mademli, L. 2, Arampatzis, A. 2

1 Miami University, 2 German Sports University in Cologne, Germany, United States

Knowledge about the effect of aging on muscle activation during fatigue is important to understand muscle-tendon function. Wolfe's law suggests that muscles will adapt to loading they encounter regularly. Since the muscles of the body are loaded differently it seems reasonable that they would adapt diferently. Since the triceps surae muscle group is involved in locomotion it is important we understand the effects of aging on those muscles. Therefore the purpose of this study is to examine functional differences between young and old subjects in the triceps surae muscles during a submaximum isometric fatiguing contraction. Our hypothesis: age related differences observed during fatigue will be muscle dependent.

Methods

14 elderly, 65.2(3.6) yr; 175.7 (5.4) cm; 76.2 (8.8) Kg, and 12 young males, 30.4 (7.1) yr; 178.6 (6.3) cm; 78.7 (6.3) Kg, participated in this study. A maximum voluntary isometric plantarflexion (MVC) was performed on a dynamometer (Biodex Medical Systems. Inc. USA) (ankle and hip angle 90°, knee 180°). The fatiguing protocol was a sustained isometric contraction at 40% of the MVC. Inverse dynamic analysis and center of pressure calculations to calculate the actual joint moment were performed as reported by previously (Arampatzis et al. 2004). Electrodes recorded the electric activity of the gastrocnemius medialis (GM) and lateralis (GL), soleus (SOL) and tibialis anterior (TA) muscles. For the independent variables an age by independent variable 2 way ANOVA with repeated measures was performed with follow up T-tests.

Results

The time to fatigue was greater for the older subjects. Results of the 2 way ANOVA showed increasing normalized RMS values of both GM and SOL for both groups during the fatigue trial. A significant group by fatigue interaction effect ($p = .032$) for the SOL indicated that the differences between the young and older subjects varied as a function of fatigue. The effects of fatigue for the SOL-MD showed an age group x fatigue interaction with younger subjects showing a greater decrease in SOL-MD during the fatiguing contraction than older subjects.

Discussion

The results indicate that there are functional differences of the triceps surae muscle group between age groups during sub-maximal contractions to fatigue. The normalized GM and GL RMS patterns were similar between subject groups while the soleus values are visibly, yet not significant ($p=0,68$) higher for the older subjects throughout the entire fatiguing task. An increase RMS and a decrease MD were found for both groups. The new finding here is the age x fatigue interaction. Thus, there are age related neuromuscular changes, but they do not occur to the same extent in all muscles.

References

Arampatzis, A., Morey-Klapsing, G., Karamanidis, K., De Monte, G., Stafilidis, S., Bruggemann, G. P., (2005). Differences between measured and resultant joint moments during isometric contractions at the ankle joint. Journal of Biomechanics, 38, 4, 885-892.

CHANGES IN THE STEP WIDTH, STEP LENGTH, AND STEP FREQUENCY OF THE WORLD'S TOP SPRINTERS DURING A 100 M RACE

Ito, A., Ishikawa, M., Isolehto, J., Komi, P.V.

Osaka University of Health and Sport Sciences, Japan

Changes in the step width, step length, and step frequency

of the world's top sprinters during a 100 m race

Akira Ito1, Masaki Ishikawa2, Juha Isolehto2, Paavo V. Komi2

1Sport Biomechanics Laboratory, OsakaUniversity of Health and Sport Sciences, Japan

2Neuromuscular Research Center, University of Jyvaskyla, Finland

The purpose of this study is to clarify the changes in the step width, step length, and step frequency of the world's top sprinters during a 100 m race and provide coaches and sprinters with useful step data.

The subjects were 18 male sprinters who participated in the heats of the 10th World Championships in Athletics held in Helsinki, Finland. They were divided into two groups based on race timing: the high performance group (HG; 10.12–10.32 s) and the low performance group (LG; 10.40–10.9 s). We set up two video cameras in the auditorium to record the spot at which the foot came into contact with the surface of the track during the starting dash and the sprint with full stride (approximately 60 m from the starting line). The x-y coordinates of the runners' foot prints on the track were calculated by the two-dimensional direct linear transformation method (DLT method).

The step length was observed to increase with the sprint speed ($p < 0.001$) in both groups; further, the step length of HG was longer than that of LG in the starting dash and the full stride (0.12 ± 0.03 m, $p < 0.003$). The step frequency was maintained at almost the same level (4.56 ± 0.16 steps / s) in the starting dash and the full stride, and no difference was observed between the groups. Although there was no difference in the step width, it decreased in both groups from 0.39 ± 0.07 m in the 1st step of the starting dash to 0.17 ± 0.04 m in the full stride ($p < 0.001$). These results suggest that sprinters change their step length and step width according to the change in acceleration of the sprint running speed.

The results obtained suggest the following conclusions: (1) Sprinters should not be forced to have a higher step frequency in the starting dash. (2) They should attempt a longer step length from the 1st step of the starting dash. (3) They should maintain adequate step width not only in the starting dash but also in the full stride.

AGE AND SEX DIFFERENCES IN THE SPEED OF ARM RECIPROCAL MOVEMENTS

Latecka, B., Warchalewska, M., Lapszo, J.

Academy of Physical Education and Sport in Gdansk, Poland

INTRODUCTION: Reciprocal arm-reaching movements are a basic form of daily human motor behavior. These movements consist of a target reaching movement and a returning movement back to the starting position. The purpose of this research was to test age and gender differences in the speeds of initiating and performing the movements with the right and left hand. 21 young subjects (11 males, 10 females – av. age 23) and 22 elderly subjects (10 males, 12 females – av. age 72) participated in the research. METHOD: The psychomotor efficiency timer developed by Lapszo (2002) was used in conjunction with a measurement station to test the reciprocal movements. The measurement station consisted of 6 tactile sensors (one starting position and 5 target sensors). The range of the tested movements was 25 cm. The movements were performed in the horizontal plane separately with the right and left hand in 3 series of 10 movements. The movements were stimulated by light and sound in the sensors. The average movement initiation time (MIT) and the total time (MTT) was measured for all the tested movements. MIT was measured (in milliseconds) from the instant the target location presented itself (light in the sensor) to the instant the starting position sensor was released; MTT was measured to the instant the target sensor was touched. RESULTS AND DISCUSSION:. Three-way ANOVA (age x sex x hand) was used to analyze the results. The research showed up differences between young and elderly subjects ($P0 < 0.0002$; Ho hypothesis), and between young and elderly female subjects ($P0 < 0.006$), with respect to both times (MIT, MTT) and both hands. Elderly male subjects were slower than young males to initiate movements ($P0 < 0.02$), but the total time (MTT) for the movements of the right and left hands was the same in these groups. Young male and female subjects performed reciprocal orientation movements with the right and left hand with the same speed, but elderly males performed right-hand movements faster ($P0 < 0.03$) than elderly females. Elderly subjects initiated movements on the average 22 % more slowly than younger subjects. Elderly subjects were also much slower than young subjects to perform (MTT) right-hand (29 %) and left-hand (30 %) movements. This finding endorse Welford's (1988) research results, which showed a 30 % longer movement time (MT) in older than in young adults. The age differences with respect to MTT are greater in the female (41 %) than in the male (18 %) group. This research has shown that ageing prolongs the initiation (MIT) and total (MTT) time, but that the age differences in these times are larger in the female than in the male groups.

REFERENCES

Lapszo (2002) Simulatory diagnostic and practice timer of movement speed, concentration and anticipation. Patent Office of the Republic of Poland. Patent number PL 183700.

Welford A.T. (1988) Reaction time, speed of performance, and age. Annals of the New York Academy of Science, 515, 1-17.

AGE AND SEX DIFFERENCES IN SPEED OF LOCOMOTION AND ROTATION MOVEMENTS

Latecka, B., Warchalewska, M., Lapszo, J.

Academy of Physical Education and Sport in Gdansk, Poland

INTODUCTION: Locomotion and rotation movements are very important forms of human motor behavior. The process of ageing brings about changes in our muscles (Lexell, 1995) and brain (Alexander, 1994). The purpose of this research was to test how such changes affect the human psychomotor system with respect to balance control and arm and leg coordination. 23 elderly subjects (9 males, 14 females – av. age 74 years) and 23 young subjects (10 males, 13 females – av. age 23.5 years) participated in the study. METHOD: A psychomotor timer (Lapszo, 2002) was used in conjunction with a measurement station to test locomotion and rotation movements. The locomotion station consisted of two tactile sensors located 3.5 m (locomotion) and 0.5 m (rotation) from each other. In the locomotion task, subjects were asked to walk as quickly as possible between the sensors (3 trials). The rotation task consisted of 3 complete turns through 360 degrees to the right and left. The result of these measurements was expressed as the average of 3 trials each of locomotion time (LT), right-hand rotation movement time (RRT) and left-hand rotation movement time (LRT), measured in seconds (accurate to 1 ms) from the instant the sensors were released to the instant the sensors were touched with both hand. RESULTS AND DISCUSSION: Two-way (age x sex) and three-way (age x sex x direction) ANOVA was used to analyze the respective differences in locomotion and rotation movement speeds. The analysis showed that the speed of locomotion was higher (47 %) in the young than in the elderly subjects ($P0 < 0.005$; Ho hypothesis). Elderly male subjects walked 19 % faster than elderly female subjects ($P0 < 0.04$) but 65 % more slowly than young male subjects ($P0 < 0.005$); in the same task elderly female subjects walked 96 % more slowly than young female subjects ($P0 < 0.002$). Young subjects turned to the right ($P0 < 0.001$) and left ($P0 < 0.001$) more quickly than elderly subjects (55 % and 57 % respectively). The differences in the speed of rotation movements between groups of the same sex correspond to the age differences.

Elderly males and females perform rotation movements with the same speed. No differences were found in the speed of locomotion and rotation movements between young male and female subjects. The analysis leads to the conclusion that ageing slows locomotion and rotation movements to a high degree.

REFERENCES

Alexander G.E. (1994) Basal ganglia-thalamocortical circuits: their role in control of movements. Journal of Clinical Neurophysiology, 11, 420-31.

Lapszo (2002) Simulatory diagnostic and practice timer of movement speed, concentration and anticipation. Patent Office of the Republic of Poland. Patent number PL 183700.

Lexell J. (1995) Human aging, muscle mass, and fiber type composition. Journal of Gerontology, Series A, Biological Sciences and Medical Sciences, 50, 11-16.

DIFFERENCES IN SPRINTING SPEED KINEMATICS DURING GROWTH

Tomazin, K., Dolenec, A., Skof, B., Coh, M.

University of Ljubljana, Faculty of Sport, Slovenia

Introduction

Sprinting speed, like other short-burst activities, increased significantly during growth (Asmussen, 1973). Sprinting speed is defined by strides frequency and strides length. Both of them mainly depend on force developed by hip, knee and ankle extensors during the contact time, neuromuscular coordination and morphological characteristics of the subject. Especially morphological characteristics changed significantly during growth and maturation, influencing the maximal sprinting performance. There is a paucity of information concerning growth influence on strides length and stride frequency during the sprinting. Therefore the present study was designed to examine the differences in kinematic parameters during maximal sprinting performance during growth, controlling for variation in body mass and leg length.

Methods

The subject sample consisted of two groups. The first group (A) included 37 girls (10.4±0.5 y.a., 34.7±4.6 kg, 142.9±5.8 cm), the second group (B) included 30 girls (8.5±0.5 y.a., 30.0±3.7 kg, 133.3±5.9 cm). Subjects performed 20 meters with flying start. Maximal speed (vmax), contact time during take off (CT) and stride flight time (FT) were measured during 20 meters segment with Opto-track system (Microgate, Italia). Average stride frequency (SF) and stride length (SL) over measured distance were calculated. Anthropometric variables were measured according to EUROFIT (1983). Descriptive statistics for measured parameters were calculated for each group. ANCOVA were performed to assess the differences in maximal speed kinematic parameters between groups, controlling for variations in body mass and leg length. Statistical significance was accepted with 5% alpha error.

Results

The maximal running speed increased from 5.6±0.4 m/s for the group B to 6.03±0.43 m/s for the older group A ($P<0.001$). It is interesting to note that stride length increased as well from 145.3±9.2 cm for the group B to the 160.0±11.6 cm for the group A ($P<0.001$), on the other hand contact time (0.149±0.4 s - group A, 0.148±0.1 - group B) and stride frequency (3.8±0.3 s-1 – group A, 3.9±0.3 s-1 group B) remained almost unchanged during the maximal speed test.

Discussion/Conclusion

Increased sprinting speed during growth was mainly due to changes in stride length, rather then strides frequency. Stride frequency depends on the functioning of the central nervous system and is to a large extent genetically predetermined (Mero et al., 1992), on the other hand we could probably concluded that also stride length were not affected only with quantitative but also qualitative neuromuscular changes during growth.

References

Asmussen E. (1973). Physical activity, human growth and development, New York: Academic Press, 60-79.

Mero A, Komi PV and Gregor RJ (1992). Sports Med, 13(6): 376-392.

A KINEMATICS AND A ONE-DIMENSIONAL COMPARISON OF PERFORMANCE FACTORS BETWEEN THE SPLIT JUMP AND THE SPLIT JUMP WITH THROW AND CATCH OF THE BALL IN RHYTHMIC GYMNASTICS

Mkaouer, B. 1, Jemni, M. 2, Amara, S.M. 1, Abahnini, K. 1, Agrebi, B. 1, Tabka, Z. 3, Feki, Y. 4

1 ISSport et Educ. Physique, Ksar Saïd/TN, 2 SSD Anglia Ruskin Univ. Cambridge/UK, 3 Fac. Méd. Sousse/TN, 4 Mini Jeunesse Sport et EP/TN, Tunisia

Purpose: This exploratory study sought to compare some execution factors particularly force; speed and flexibility during a split jump with and without throw and catch of the ball in Rhythmic Gymnastics (RG).

Method: Five female rhythmic gymnasts (13.8 ± 1.3 yrs; 1.58 ± 0.07 m; 46.59 ± 8.23 kg) from the Tunisian Junior National Team agreed to participate.

Test took lace in the gym during normal training session. A two-dimensional kinematics' analysis (Sony DCR PC 105E camera), associated with a one-dimensional force analysis (Kitsler force platform 500Hz) were performed to assess two skills: a split jump (SJ) and a split jump with throw and catch of the ball (SJth-c). Athletes performed ten trials of each skill in order to assess reproducibility. Only the best four trials were analysed and compared. Gymnasts were equipped with three markers: one on the hips (at 56% of the height) and two on the ankles to assess legs' split angular velocity. The geometrical centre of the ball was also considered.

Data were collected using AviStep & Regressi software: Horizontal force (Fx), vertical force (Fy), horizontal velocity (Vi), vertical velocity (Vy), take-off time (tc).

Non parametric one way ANOVA test (Friedman) was performed to assess the repeated measurements. The U test of Wilcoxon was applied to compare the two skills. The level of significance was set at 0.05.

Results: The reproducibility study did not show any significant variation of the performance factors. All gymnasts were able to repeat the same skill with or without apparatus. Meanwhile, performance factors were significantly different between (SJ) and (SJth-c).

Apart from the (Vy) and the angular velocity of the split which were significantly higher during the (SJth-c), all the other components of the same skill were significantly less than those measured during the (SJ) ($p < 0.05$). [1.6 ± 0.1 m/s vs 1.5 ± 0.2 m/s for the (Vy) and 963.4 ± 11.2 deg/s vs 803.3 ± 20.3 deg/s for the angular velocity of the split respectively for the (SJth-c) and (SJ)].

Peak power was significantly lower [1480.4 ± 217.9 W vs 1606.7 ± 291.6 W respectively for (SJth-c) and (SJ)]. Force was also significantly lower [924.8 ± 82.2 N vs 1032.3 ± 125.6 N respectively for (SJth-c) and (SJ)]. Vertical displacement was significantly lower [0.382 ± 0.02 m vs 0.4 ± 0.03 m respectively for (SJth-c) and (SJ)]. ($p < 0.05$).

Conclusion: The (SJth-c) is a double tasks' skill which requires focus on the ball as well as high level of technique and fitness. This study shows that performance factors of the (SJth-c) are lower than the (SJ). Arm's contribution in throwing and catching the ball may have prohibited force, velocity and flexibility. Particular attention in developing related components to these factors may enhance performance.

KINEMATIC ADJUSTMENTS IN THE BASKETBALL JUMP SHOT AGAINST A PASSIVE OPPONENT IN YOUNG BASKETBALL PLAYERS

Ignjatovic, A., Stankovic, R.

Faculty of Physical Education, Serbia and Montenegro

The jump shot is distinguished as the most important of all the shooting actions and have also been analyzed under different conditions. Many drills for young basketball players are consisted from a jump shot over the passive opponent (passive opponent is just standing with his hands raised high above his head). During one training session in this study shooting accuracy from a foul throw line was decreased from 62% to 42% in the present of a passive opponent. The participants of this study were 10 young 15-years old players who are members of regional champions at theirs age in season 2005/2006 in Serbia. The participants were shooting until each player had performed 15 successful jump shots in both conditions (with and without opponent). Ten successive shot by each player (five with and four without opposition) were selected for analysis.

Two-dimensional video techniques (50 Hz) were used to obtain images of basketball jump shot from two different conditions. 23 dependent variables that have been studied extensively in the literature were selected for analyze. The release angle of the ball increased from 43.32 +/-5.3 to 45.58 +/- 3.8. This mean release angle of the ball in this study was similar to results of Rojas et al., (2000.) and smaller then 48 found in the studies carried out by Satern (1988), and Miller and Bartlett (1996). The velocity of ball release increased from 6.45 +/- 0.2 to 6.49 =/- 0.2, and this mean value was similar to data reported by Rojas et al(2000) 6.33 m/s-1,and Walters et al. (1990) had between 6.6 and 6.9 m/s-1.and by Miller and Bartlett (1996) who reported values of around 6.2 m/s-1. The height the ball reached at release was higher when shooting against an opponent than without an opponent. this could be related to the greater release angle. Higher height reached by the CG is opposite of results of Rojas et al. (2000) and this could be explain by the different protocol of studies. In this study the opponents are not trying to block the shot so the players are shooting without a fear of blocking. But neither of these differences was significantly different. Only statistically significantly different between the two situations in this study was found between the angles of shoulder and hip at take off position. This could be explained by close present of an opponent 30 cm distanced from the place where the players are executing the jumps shots so the players can't perform tehnic as they used when nobody was in front of them.

Walters, M., Hudson, J. M., Bird, M. 1990, Kinematics adjustments in basketball shooting at three distances, in Nosek, M. (ed). Proc. of the VIIIth ISBS, Prague, 219-224.

Satern, M. N. 1988, Basketball: shooting the jump shot, Strategies, 1(4), 9-11.

Miller, S., Bartlett, R. M. 1996, The relationship between basketball shooting kinematics, distance and playing position, J. of S. Sci., 14, 243-253.

Rojas, F. J., Cepero, M., Ona, A., Gutierrez, M. 2000. Kinematic adjustments in the basketball jump shot against an opponent, Erg., 41(10), 1651-1660.

MECHANICAL DETERMINANTS OF THE JUMPER'S KNEE

Bisseling, R., Hof, A., Bredeweg, S., Diercks, R., Mulder, T.

University Center for Sport, Movement and Health Groningen, Netherlands

In volleyball jump serve, spike, and block are the volleyball players' skills to perform offensive and defensive jumps. To avoid injury, the kinetic energy generated from the jump should be absorbed properly by the extensor mechanism during landing. Repetitive high intensity loads during the jump-landing sequence can traumatize the quadriceps tendon. Among high level volleyball players, the most frequent injury is patellar tendinopathy (jumper's knee) with a prevalence of 40% to 50% (1).

To accommodate the impact during landing, lower extremity kinematics before and during impact phase influence the loads around the joints. By using joint moments of force and joint kinematics of the lower extremity, landing mechanics can be described, which contribute to neutralization of the kinetic energy from the jump. Differences in impact accommodation strategies, used by volleyball players could lead to get insight into the causal determinants of the jumper's knee. Besides landing mechanics, some evidence exists that the jump itself could give information to the causal mechanisms of jumper's knee in volleyball (1, 3). Still, no definite answer is known.

The main question to answer is why some volleyball players suffer from a jumper's knee and others do not, while training intensity and frequency are the same? By identifying etiological factors to get insight in the injury mechanism, preventive measures can be developed (2).

In the search for the potential role of the lower extremity dynamics related to the development of jumper's knee, twenty-seven well trained male volleyball players participated in this study. All subjects were diagnosed by a sport physician, who determined the diagnosis patellar tendinopathy or no patellar tendinopathy. The severity of symptoms of patellar tendinopathy was measured by the VISA-score. Together with the patellar tendinopathy diagnosis, subjects were classified in three groups. 1. healthy subjects, 2. jumper's knee patients with pain during the experiments and 3. jumper's knee patients without pain during the experiments. A three dimensional dynamical analysis was carried out to determine differences in effect of drop jump height on landing strategies used by the volleyball players, to find differences in the jump and landing dynamics during a countermovement jump, and to find differences in the jump and landing dynamics during the execution of a spike jump. These results could lead to a better insight into the developmental characteristics of the jumper's knee.

1. Lian, Ø., et al. Performance characteristics of volleyball players with patellar tendinopathy. Am. J. Sports Med. 31:408-413, 2003.

2. van Mechelen., et al. Incidence, severity, aetiology and prevention of sports injuries. A review of concepts. Sports Med. 14: 82-99, 1992.

3. Richards, et al. Knee joint dynamics predict patellar tendinitis in elite volleyball players. Am. J. Sports Med. 24:676-683, 1996.

THE INFLUENCE OF ARTICULAR SURFACE GEOMETRY OF FEMORAL CONDYLES ON CONTACT PRESSURE DISTRIBUTION

Boulti, V., Gigis, P.

Aristotel University of Thessaloniki, Greece

The objective of this study is to determine the changes of the load on the femoral condyles, depended on the geometry of the articular surfaces. On this purpose MRI scans of 18 individuals (6 females, 12 males) were used (age 41.55±12.8 years, min 17 max 63 years). The subjects had no complains about chronic pain of the knee joint and underwent the MRI scan after an acute injury which did not affect the articular surface. The distance between the slices was 2.5mm. They were digitized and by the use of a computer program (TableCurve3D) the best fitting equation was found. The accuracy ranged between 0.99 and 0.97. In respective parts of the surfaces the applied load was compared. The applied force was assumed to be of the same magnitude and direction in all cases. The force was resolved in three components (normal and tangent to the articular surface). The resolution is a function of the angles formed between the tangent plane and the direction of the applied force. The analysis revealed an increase up to 8% of the normal component in respective parts of the articular surface, which indicates that the cartilage is more loaded. The results of this study can be applied on the prediction of the degeneration of the articular surface.

ELECTROMYOGRAPHIC ANALYSIS OF THE DOMINANT UPPER LIMB DURING THE GOLF SWING

Pezarat-Correia, P., Cabri, J., Fernandes, O., Sousa, J.P.

Faculty of Human Movement, Technical University of Lisbon, Portugal

Purpose: The identification of neuromuscular patterns is an important cue for the management of muscular development, skill improvement and injury prevention. The main purpose of the present study was to characterize muscular coordination patterns in the dominant upper limb in the different phases of golf swing in experienced golfers.

Methods: Three low-handicap golfers (handicap lower than five) performed six full swing movements with a pitch iron. Surface electromyography (EMG) was recorded from 12 muscles: anterior (AD), middle (MD) and posterior (PD) deltoids, pectoralis major (PM), latissimus dorsi (LD), infraspinatus (IS), vastus lateralis (VL) and long portion (LP) of triceps brachii, biceps brachii (BB), brachioradialis (BR), wrist flexors (WF), and wrist extensors (WE). The EMG signals were sampled at 1000 Hz, full wave rectified, low pass filtered (second order Butterworth filter at 12 Hz) and normalized using the EMG of the maximal voluntary contraction (MVC) as a reference. In synchrony with the EMG signals, a three axis accelerometer fixed at the back of the golf club head informed about ball contact time (BC). Mean EMG value was calculated separately during each phase: backswing (BS), downswing (DS) and the first 500 ms of the follow-through (FT). For the movement analysis and phase delimitation the swing was filmed with four high speed video cameras (300 Hz). The recording of EMG and cinematic data was performed with a SIMI system (SIMI Motion, Munich, Germany).

Results: The average of normalized values of all muscles of the dominant arm in the three subjects, showed that the DS exhibited the highest muscular activity (28,8% of the EMG of the MVC) compared with the FT (19,9%) and the BS (15,7%). The elbow flexors (BB – 26%, BR – 45%) and the wrist extensors (WE – 26%) presented the strongest activation during the BS to promote elbow flexion and hand extension, and silenced before the DS initiation. During the DS the shoulder adductors (LD – 53%, PM – 38%) and the elbow extensors (LP – 50%, VL – 47%) presented the highest EMG activation. These muscles were activated at the beginning of the DS but the shoulder adductors peaked earlier. The AD peaked 70 ms before the BC and its activation may contribute to the arm internal rotation during the acceleration phase. The WF peaked during or just after the BC to accelerate hand flexion. The shoulder abductors (AD – 34%, MD – 14%) and the wrist flexors (36%) showed the highest activity during the FT. The posterior and middle deltoids showed low activity in all the phases (less then 20%).

Conclusions: The results demonstrated that the most active muscles during the golf swing were the shoulder adductors and the elbow extensors, and that the downswing was the phase where muscles from the dominant upper limb presented stronger activation. The EMG patterns we found can help to design training programs to improve strength and flexibility and to reduce injury risk in the golfer's upper limb.

Poster presentation (PP)

PP1-06 Psychology 1-3 - "Exhibition Hall"

THE PROCESSES BY WHICH PERCEIVED TEACHER BEHAVIOR IN PHYSICAL EDUCATION PROMOTES LEISURE TIME PHYSICAL ACTIVITY BEHAVIOR: A TRANS-CONTEXTUAL MODEL

Pihu, M., Hein, V., Koka, A.

Tartu University, Estonia

Introduction

Recently, trans-contextual model on the basis of self-determination theory and the theory of planned behavior was developed by Hagger et al. (2003) to investigate the determinants of the intentional physical activity behavior among adolescents. The trans-contextual models allow to investigate the processes by which motivation for physical activity in a PE context is transferred into a leisure-time physical activity context. The roles of perceived autonomy support from teachers, parents and peers in this model have been determined. The aim of this study was to test whether the other factors such as the students' perception that they are taught by teachers to use the learning strategy and students' perception of the teacher's positive feedback will fit to the trans-contextual model of motivation characterizing the intentional physical activity behavior.

Methods

The participants were 404 (126 boys and 278 girls) students. A three-wave prospective design was used. At the first occasion of data collection (time 1), self-report measures of perceived positive teacher feedback (Koka & Hein, 2005), use of strategies (Solmon & Lee, 1997) and the perceived locus of causality in a PE context were administered. One week later (time 2), a second questionnaire containing measures of attitude and intention (components of the theory of planned behavior) and perceived locus of causality in a leisure-time physical activity context was administered. After four weeks, self-reported physical activity behavior was measured at a third point in time (time 3) using the Leisure-Time Exercise Questionnaire (Hagger et al., 2003) A structural equation modeling was used for studying the hypothesized model.

Results

The values of fit indexes CFI =.91; RMSR=.07; RMSEA=.078 (CI .072 - .083) confirmed the hypothesized model. The effects of the perceived use of learning strategy and positive feedback on perceived locus of causality in a leisure-time physical activity context were mediated via the perceived locus of causality in a PE context. All together, the observed components of the model accounted for 58 % of the variance in physical activity behavior.

Discussion/Conclusions

Incorporating the components of the perceived teacher behavior to the trans-contextual model of the intentional physical activity behavior explained higher amount of the variance in physical activity than the previous models (e.g., Hagger et al., 2003).

The teachers should be acknowledged that students' perception of their positive feedback and that they teach students to use the learning strategy play an important role in forming the motivation in leisure-time physical activity context, which in turn influences intentional physical activity behavior.

References

Hagger, M. S. et al. (2003). J Educ Psychol, 95, 784–795

Koka, A., Hein, V. (2005). Int J Sport Psychol, 36, 91-106

Solmon, M. A., Lee, A. M. (1997). RQES, 2, 152-160.

THE DYNAMICS OF THE BIMANUAL COORDINATION AND THE CONCOMITANT ATTENTIONAL COST AFTER A SPECIFIC BILATERAL FATIGUE PROTOCOL

Murian, A., Deschamps, T.

JE 2438 , France

Especially interesting for the understanding of sport performance, fatiguing muscular activity is well documented. Vuillerme et al. (2002) found that after calf muscle fatigue, the subjects' posture was more variable and the associated attentional cost increased. Supported by dynamical approach to motor control, numerous studies have focused on the main principles by which the degrees of freedom problem overcame. First, studies on the influence of attention while performing bimanual coordination demonstrated that the more the movement variability, the more the central load (Monno et al., 2000). Secondly, it has been showed that peripheral constraints such as biomechanical factors altered the coordination variability but not the central load (Temprado et al., 2001). Thus the current study emphasized the influence of a specific bilateral arm fatigue protocol on the stability of bimanual coordination and associated attentional cost.

Ten volunteers participated in two sessions differentiated by the muscular activity preceding the 40 s coordination trials. In the "endurance" session (ES), bimanual coordination trials were preceding by an endurance time (T1) requiring to oscillate as long as possible both joysticks with added resistance, at a 1,5 Hz paced frequency. Then the participants had to carry out in anti-phase coordination trials (2 frequencies : 1.75 Hz and 2.25 Hz), with and without resistance, in a simple or double (reaction time task) task design. At the end, a second endurance time (T2) was performed. The "control" session (CS) replicated the same procedure, except the T1.

The standard deviation of relative phase, the absolute constant error (i.e. the absolute difference between the required and the performed coordination), and RT were classically analysed. The analysis of endurance times revealed that T2ES was shorter than T1 and T2CS. Results failed to reveal any effect of the T1 on the coordination variability and RT. However, absolute constant error was greater in the ES compared to the CS ($F1, 9 = 7.89$; $p < .05$).

Though our results did not reveal any effect of fatigue (evidenced by the significant difference between endurance times) on coordination stability and attentional cost, they showed that subjects were less accurate to maintain the anti-phase coordination pattern during the ES. It would be in line with the results of Temprado et al. (2001) who demonstrated that peripheral muscular constraints did affect the coordination but not the concomitant attentional cost. Nevertheless, analyses of the actual frequencies demonstrated that the subjects were not able to maintain the higher frequency when fatigued. To this consideration, current analyses are necessary for capturing the coordination dynamics according to the trials duration and the respect of frequency.

Monno A et al (2002) Acta Psychol, 110, 187-211

Vuillerme, N et al (2002) Med Sci Sports Exerc, 34, 1907-1912

Temprado, J-J et al (2001) Neurosci Letters, 303, 127-131.

PATTERNS OF PROTOTYPES IN SPORTING BEHAVIOR

Keresztes, N., Piko, B.

University of Szeged and Semmelweis University, Budapest, Hungary

A number of studies suggest that individuals have clear social images of the type of people who take part in different health risk behaviors. The role of these prototypes in youth's health risks behaviors has already been investigated while the relationship between these images and preventive health behaviors such as physical activity is a less investigated field of research.

Our data were collected in 2005 among 14-21-year-old students at the Southern Plain Region of Hungary (n=548) using self-administered questionnaire. Items measured youth's health behaviors, social images, anxiety and their attitudes (social comparison, altruism, rationalism, and competitiveness).

We hypothesize that there may be important differences in the structure of these images in the light of sociodemographics and youth's attitudes.

This study points out that the prototypes of sporting behavior reflect very clear social images similarly to health risk behaviors. Using factor analyses, three social image factors have been isolated: a factor of "positive, personality-associated image", a "positive, health and sports-related image", and a "negative image" factor. These factors are related to sociodemographics and youth's attitudes in different ways.

Based on these findings social images of preventive health behaviors should get more attention in future research.

ATTRIBUTIONS ACROSS TIME: CONTROLLABILITY AND GENERALISABILITY ATTRIBUTIONS ON EFFICACY EXPECTATIONS IN SPORT

Coffee, P., Rees, T.

University of Exeter, Exeter, EX1 2LU, UK, United Kingdom

Rees, Ingledew, and Hardy (2005) proposed that in sport psychology, attribution research should focus on the main effects of controllability attributions, together with interactive effects of controllability and stability, globality, and universality attributions upon an outcome such as expectations. Additionally, Biddle (1999) recommended investigation into the consistency of attributions across time. In the present study, data were collected at three time points. At Time 1 (day 1), participants (n = 117 elite athletes, mean age 25.77, SD 8.45 years) completed a measure of attributions immediately after performance. At Time 2 (day 4) participants were asked to reflect on their performance at Time 1 and then complete a measure of attributions. At Time 3 (day 8), participants completed a 7-item measure of efficacy expectations relating to their up-coming performance. Hierarchical regression analyses revealed that immediately after more successful performances (Time 1), participants had higher subsequent efficacy expectations (Time 3) when they viewed the cause of performance as controllable (R square = .17, p = .00) and/or universal (R square change = .13, p = .01). Upon reflection (Time 2), an interaction (R square change = .09, p = .03) demonstrated that participants had higher subsequent efficacy expectations when they viewed the cause of performance as controllable and universal. Immediately after less successful performances, participants had higher subsequent efficacy expectations when they viewed the cause of performance as controllable (R square = .11, p = .01); an interaction (R square change = .05, p = .04) demonstrated that participants had higher subsequent efficacy expectations when they viewed the cause of performance as controllable and stable. Upon reflection, participants had higher subsequent efficacy expectations when they viewed the cause of performance as controllable (R square = .06, p = .04) and/or stable (R square change = .10, p = .01). Based upon this study, immediately after more successful performances, applied practitioners should encourage athletes to perceive control over the causes of performance; upon reflection, athletes should be encouraged to perceive any uncontrollability over the causes of performance as common to all people. Immediately after less successful performances, athletes should be encouraged to perceive control over causes of performance, especially when causes are perceived to recur in the future; upon reflection, athletes should still be encouraged to perceive control over the causes of performance.

References.

Biddle, S. J. H. (1999). Motivation and perceptions of control: tracing its development and plotting its future in exercise and sport psychology. Journal of Sport and Exercise Psychology, 21, 1-23.

Rees, T., Ingledew, D. K., & Hardy, L. (2005). Attribution in sport psychology: seeking congruence between theory, research and practice. Psychology of Sport and Exercise, 6, 189-204.

RISK-TAKING, PERSONALITY AND MOOD - ARE QUESTIONNAIRES IN TOUCH WITH REALITY?

Jüngling, S., Kleinert, J.

Institute of Psychology, Germany

Introduction: The willingness to take risks is an important variable in sport science. It is not confined to extreme settings in risky sports. Willingness to take risks can also be of significance to explain accidents at each individual physical activity. Current research often uses questionnaires to collect data of risk perception and risk taking behavior. These instruments deal with theoretical statements and are usually personality-orientated. The variable of risk-taking as a result of situational assessment is often neglected in questionnaires. It can thus be assumed that the risk-behavior of a person depends on personality as well as on situational factors. The present study deals with reality-orientated measuring of risk acceptance in physically dangerous situations. The coherence between risk acceptance in a (real and virtual) physically risky test-situation on the one hand and stable and unstable psychological factors on the other hand are to be analysed.

Method: Two reality-oriented methods measuring risk-taking were developed: (1) a „blind-jumping-test" (real risk) and (2) a virtual „jumping-situation" (virtual risk). Test (1): The blindfolded subjects climb sideways up a wooden ramp as high as they dare, to a height of their choice, from where they think they might be able to jump still blindfolded. The height and speed of the climb are recorded. In test (2) the subjects are shown the video of a person climbing sideways up a sloping wall. The participants are to put themselves into the position of that person and to point out the highest level from where they think they might be able to jump. Following that the video is started by the blindfolded subjects a second time. They have to point out the spot which corresponds to the former estimate of the jump-off spot. The current study involved a group of 70 persons active in sports (34 male, 36 female) between the ages of 20 and 36 years. The subjects were divided into two groups, each group taking part in one of the two risk-tests. Each person was to carry out the test twice, with an interval of approximately 45 minutes. Between the tests they were physically or mentally stressed. The perceived physical state and the mood state were measured every time before a risk-test. Additionally, a few days after the test, the subjects had to fill in questionnaires concerning stable personality factors (e.g. sensation seeking).

Results: We found some significant but moderate correlations between psychological factors and the results of our risk-tests. In case of the virtual test-situation these correlations appear more often. This indicates that questionnaires have only weak or moderate relationships to risk taking in ecologically valid settings. The closer this setting is to reality the less marked this relationship appears to be. In addition findings suggest that especially psycho-social variables (e.g. self-confidence) are connected to the behavior in a physically risky test-situation.

TYPES OF PHYSICAL ACTIVITY AND PHYSICAL SELF CONCEPT IN OLDER ADULTS

Ouaghlani, M., Bertsch, J.

Université Paris Sud, France

Introduction: To date, few studies have been done to highlight the relation between aging and Physical Self Concept. Only a small amount of research exploring self esteem has been conducted and they have shown that as individual grow older, self esteem is likely to be affected (McAuley & al, 1997). Several types of exercise are effective in changing physical self perception in older adults, but there is most evidence to support aerobic exercise rather than other types of exercise (Netz & al, 2005). Thus, the purpose of this study was to examine the relationships between PSC and types of physical activity according to the age.

Method: 120 subjects represented two age groups: 60 young adults (M=23.7 years) and 60 older adults (M=69.2 years) who completed two questionnaires. The first one examined the physical self concept (PSDQ, Marsh et al, 1994). The second one measured the physical

activity (QUANTAP, Vuillemin & al, 2000). Each age group was divided into 3 groups of practice: sedentary, fitness (running, swimming, cycling, and walking), and specialised (petanque, bowling, golf, archery, and fencing).

Result: There was a large effect of age, F (1,108) =1429.2, p<.0001. The average of the older PSC responses (M Old = 3.02) was smaller than that of the young (M Young = 4.54). The group effect, F(2,108)=873.7, p<.0001, revealed that the score of PSC was lower for the sedentary group (M Sedentary=2.69) than specialised group (M Specialised=3.89) and fitness group (M Fitness=4.74). The 2Age X 3Group interaction was significant, F (2, 108) = 8.1, p<.0005. Scheffé post hoc analysis showed that, regardless of the age, the highest score of PSC was for the fitness group and the lowest one was for sedentary group.

Discussion: Regardless of the age, fitness groups get very high score of PSC, followed by specialised groups. It seems to be somewhat logical insofar as it has been deduced that aerobic training was most beneficial for psychological well being in older adults (Netz & al, 2005). The gender difference grew larger with age. It is fairly consistent with some studies on body satisfaction (Bruchon-Schweitzer, 1984).

References

Bruchon-Schweitzer, M. (1984). Corps et personnalité: Images corporelles et personnalité, Thèse d'Etat, ParisX, 250- 551.

Marsh, H.W. & Redmayne, R.S.(1994). A multidimensional physical self-concept and its relations to multiple components of physical fitness. JSEP, 16,43-55.

McAuley, E., and al. (1997). Exercise and self-esteem in middle-aged adults: multidimensional relationships and physical fitness and self-efficacy influences. J. Behavi. Med., 20, 67-83.

Netz, Y., and al. (2005). Physical activity and psychological well being in advanced age: Meta-analysis of intervention studies. Psychology and aging. 20, 272-84.

Vuillemin, A., and al. (2000). A computer-assisted assessment of lifetime physical activity: reliability and validity of the QUANTAP software. Rev. Epidém et Santé Publ. 48, 157-67.

GOAL ORIENTATION AND MAINTAINING PARTICIPATION WITHIN COMPETITIVE YOUTH SPORT

Konttinen, N., Laakso, L., Toskala, A.

KIHU - Research Institute for Olympic Sports, Finland

Past research on goal orientation has suggested that task orientation more often than ego orientation protects the athlete from disappointments and a lack of motivation (Duda, 1989). The purpose of the present study was to gain additional insights into this issue focusing on the relationship between goal orientation and continued involvement in competitive youth sport. The participants for the study were 3255 Finnish junior level athletes representing three different sports, ice hockey, floorball, and track and field. The participants ranged in age between 14 and 15 years (mean and S.D: age 14.90 and 0.29 years). Goal orientation was examined using the Finnish version of the Perception of Success Questionnaire, or POSQ (Liukkonen, 1998; Roberts, Treasure, & Balague, 1998). A longitudinal follow-up design was applied to provide a better understanding of the relation of motivational orientation to persistence in sporting context. Persistence, indicated by having a valid competition licence, was recorded one (Persistence 1) and three (Persistence 2) years after completing the initial questionnaire. The dependence of persistence on task and ego orientation, sport and gender was studied with forward stepwise logistic regression. For both the Persistence 1 and Persistence 2, the final regression equations contained Task orientation and Sport main effects and Task orientation by Gender interaction. The fit of the models were statistically significant for Persistence 1 and Persistence 2, Chi square = 115.200, df = 4, p = .000; Chi square = 76.800, df = 4, p = .000, respectively. The Sport main effect reflected differences between sports. One year after the initial data collection phase, 74.3 per cent of the ice hockey players, 52.0 per cent of the floorball players, and 43.5 per cent of the track and field athletes still held their competition licence. After three years, the corresponding figures were 41.8, 35.9 and 23.9, respectively. Task orientation by Gender interaction implicated that task orientation predicted both Persistence 1 and Persistence 2 better among boys than among girls. The prediction for maintaining participation, based on the regression equations, was correct in 72.7 per cent of cases for Persistence 1 and in 55.6 per cent of cases for Persistence 2. Even though the success of prediction was far from perfect, it was better than the predictions based on the actual drop-out rates. Taken together, it appears that the present findings support the results from previous studies, demonstrating that task orientation is related to continued involvement in competitive sport over the time span of three years, despite of several other factors affecting the persistence in sport among young athletes.

Duda, J. (1989). International Journal of Sport Psychology, 20, 42-56.

Liukkonen, J. (1998). LIKES – Research Reports on Sport and Health, 131.

Roberts, G.C., Treasure, D., & Balague, G. (1998). Journal of Sports Sciences, 16, 337-347.

MASS CAMPAIGN "GERMANY IS MOVING!" 2005 - ACHIEVEMENTS AND STUMBLING BLOCKS DURING THE FIRST YEAR

Neß W., Brehm, W., Wagner, P., Sygusch R., Bös, K., Tittlbach S.

University of Bayreuth; University of Karlsruhe, Germany

The German health insurance company Barmer jointly initiated the health campaign Germany is moving! (Deutschland bewegt sich!) with the media partners Bild am Sonntag and ZDF. The German Gymnastics Federation (DTB) is a partner in terms of the realisation of the initiative. Tests for the campaign were developed by the University of Bayreuth as well as the University of Karlsruhe in the year 2005. Among other things, the cooperation with the universi-ties shall assure that intervention units are developed and evaluated for the campaign. On the one hand, these units provide comparative levels of physical performance and thus establish the basis for a bonus system for preventive successful behaviour. On the other hand, the units allow for an initiation of change in the test participants' behaviour of inactivity to more activity.

The three developed intervention units are based on a four-staged concept of behavioural change: Deliberation (reflecting to be physically active); preparation (preparing to be physically active); implementation (trying out some physical activities); habilitation (stabilising the physical activities). Each unit contains a fitness test for assessing or for objectively identifying the fitness level of adults as well as for a follow-up consultation on the next step of change to more physical sportive activity. The intervention units are usually carried out by DTB helpers. Amongst others, the intervention unit Test 1 (for Preparing and Trying Out) was deployed during a city tour through 19 major cities in Germany in the year 2005. Additionally, in the final two cities a survey on the demographic structure and fitness level of the participants

as well as an evaluation of the process was conducted. Overall, 5,636 evaluated surveys from the intervention unit Test 1 are available. Nonetheless, during the practical implementation of the intervention unit Test 1 & Consultation a number of serious problems un-folded.

The initiation of behavioural change appears to be possible with the help of the campaign intervention units. However, this implies unperturbed cooperation and accurate execution of the intervention measures. The objective to collect nationwide data on comparative levels of physical performance in order to establish the basis for a bonus system for preventive successful behaviour could not be accomplished yet. Hence, for the year 2006, improvements are planned in the following areas: a) a more selective engagement of the target group containing the risk factor lack of exercise, b) an improvement in the implementation of the test, c) the preparation and application of a standardised consultation concept for the systematic evaluation and exploitation of behavioural effects, and d) a more intense usage of potential behavioural effects on behalf of the cooperation partners, in particular on the part of the DTB.

A LONGITUDINAL STUDY OF SPORT IDENTITY AS A MEDIATOR OF CHILDREN'S PARTICIPATION IN SPORT

Lau, P.W., Fox, K.R., Cheung, M. W.

Hong Kong Baptist University, Hong Kong

Sport identity has been a core construct in explaining sport participation of individuals in the past decades (Brettschneider & Heim, 1997; Brewer, Van Raalte & Linder, 1993; Lau, Fox, & Cheung, 2004; Theodorakis, 1994). These studies have demonstrated the positive relationships between sport identity and individuals' sport involvement. Since all the previous studies in sport identity were cross sectional, it would be valuable to investigate the longitudinal changes of sport identity and sport participation. The purposes of this study were to examine (a) the relationships between sport identity and sport participation in children using the 3-year longitudinal data, (b) the longitudinal changes of all constructs, and (c) test the preliminary sport participation model. Participants were 238 boys and 231 girls aged 12 to 15 from a secondary school. A series of established questionnaires was conducted to the participants including the Task and Ego Orientation in Sport Questionnaire, Self-Regulation Questionnaire, Sport Competence Subscale from Physical Self-Perception Profile and Perceived Importance Profile, and Athletic Identity Measurement Scale to assess psychosocial variables. In addition, socio-environmental questionnaires were developed for the study to assess the influence of parents, peers, school and accessibility.

Correlation results showed that sport identity was significantly associated with sport participation of children in year 1 ($r = .37$, $p < .01$) and year 3 ($r = .36$, $p < .01$). MANOVA contrast analysis found that only task orientation, Relative Autonomy Index (RAI), school influence, peer influence and accessibility had significant changes after two years period. Finally, structural equation modeling indicated that the model was consistently a good fit of the data (year 1: CFI = .994, Standardized RMR = .027; year 3: CFI = .976, Standardised RMR = .038). These results demonstrated that children's sport participation could be explained by the sport identity model.

REFERENCE

Brettschneider, W. & Heim, R. (1997). Identity, sporting commitment and youth development. In K. R. Fox (Ed.), The physical self: From motivation to well being (pp. 205-228). Champaign, IL: Human Kinetics.

Brewer, B. W., Van Raalte, J. L., & Linder, D. E. (1993). Athletic identity: Hercules' muscles or achilles heel? International Journal of Sport Psychology, 24, 237-254.

Lau, Patrick W. C., Fox, K. R. & Cheung, Mike W. L. (2004). Psychosocial and socio-environmental correlates of sport identity and sport participation in secondary school-age children. European Journal of Sport Science, 4(2), 1-21.

Theodorakis, Y. (1994). Planned behaviour, attitude strength, role identity, and the prediction of exercise behaviour. The Sport Psychologist, 8, 149-165.

THE EVOLUTION OF THE AFFECTIVE DEMAND IN THE COACH-ATHLETE RELATIONSHIP

Huguet, S.

University of Luton, United Kingdom

Lots of researches on the coach-athlete relationship have focused on the social interaction (Carron, 1977 Jowett, 2000) or the leadership (Chelladurai, 1978; Cote et al., 1995), rather than the affective process. However, this relationship may sometimes lead the coach to face an affective demand that he/she is not prepare to handle.

Therefore, the psychoanalysis approach proposed to analyse the unconscious affective process in the coach-athlete relationship through the concept of transference initially developed by Freud (1922). The concept of transference helps to understand that previous relationships with significant others may have consequences on the next relationships. A previous research (Huguet, Labridy, 2004) had already concluded that the coach might be a substitute or come as a replacement of a parent's figure.

This study aims to analyse the affective process behind the coach-athlete relationship and how the affective demand evolve from childhood to adulthood depending on the athlete's family structure.

We interviewed 14 high level tennis players (7 males and 7 females ranged from 13 to 29 years old). We had between 3 and 4 interviews with each player that were transcribed verbatim. A thematic analysis was then designed according to the psychoanalytical theories on the relationships of the subject with the others and how he/she structured his/her identity within his/her family and what were the relationship with the coach since the beginning.

As the result of this study was case study, it is not possible to develop all the 14 case studies in depth in this part.

However, these case series show similarities in terms of structure between athletes. The affective demands towards the coach evolve depending on whether the athlete has decided that the primary motivation to compete is the desire to play for him/her or whether he/she remains dependant on the parent or coach's desire.

The beginning of practising often means that the child is dependant upon his/her parent's desire. The fact that he/she playing for fun as well at this stage may explain why the coach is not a significant figure for the player. During adolescence, the athlete is either still pursuing sport on a parent's desire or on the coach's desire as they experience more identification and idealisation phenomenon. Therefore there is a transference process that may put the coach in a parent's substitute position.

When the player becomes professional, there are two options: he/she is still not fulfilling his/her own desire to compete sport and that often leads to a series of unexplained injuries or bad performances. Or the athlete finds his/her own signification of practicing sport and do not require the coach to fill his/her affective demand anymore.

The coach has to be aware of the unconscious mechanisms that happen in the relationship as that would help him/her to understand the affective demand of the athlete. This demand will vary according to the athlete's previous relationship with parents and significant others.

ARE SPORT INJURIES RELATED TO AFFECTIVE PRIMING?

Fries, U., Hoffmann, A., Würth, S., Alfermann, A.

University of Leipzig, Germany

Introduction

The study "Attention and risk of injury (Az. VF 07/10/01/2005-2006)" is supported by the Federal Department of Sport Science to deliver a contribution to the understanding of causes of sport injuries. On the basis of Kleinert's Stress-Injury-Modell (2002) it has been examined to what extend former experiences of injuries influence attentional processes in terms of negative priming and so, abet (re-) injuries. It is assumed that acute experiences of injuries stay fixed in the athlete's memory. Activated by subliminal presented pictures with high risk of injury (negative prime) these reminiscence could affect the following motoric Reactions and increas the number of errors (and so the risk of injury). This effect should be even higher in stressful situations.

Method

For the study in hand we won over one female and one male team of each sport: Basketball, Handball and Hockey. In a choice-reactiontime-experiment the influence of primes of different emotions on the athletes' reactions has been examined. Based on an expert-rating 60 photos were chosen for each sport to reflect positive mood, neutral mood and negative mood combined with high risk of injury and used as primes. Coloured chequered patterns provided target and non-target. Reactiontime and percentage correct were measures of performance.

The control condition was without distracting influences. In the experimental condition stress was generated with typical noises recorded at competitions of each sport.

Results

The results are to be presented and discussed in reference to the following questions: Do primes with high risk of injury impact the speed or accuracy of reaction? If yes, is this effect more eminent for athletes with experiences of injuries? Does stress augment this effect?

CAN SIGNIFICANT OTHER'S BEHAVIOUR INFLUENCE OUR WAY OF THINKING? THE EFFECTS OF POSITIVE AND NEGATIVE BEHAVIOUR ON AUTOMATIC THOUGHTS DURING A TENNIS STROKE

Zourbanos, N., Theodorakis, Y., Hatzigeorgiadis, A.

University of Thessaly, Trikala, Greece

Cognitive-behaviour theories have been based on the premise that a person's thinking can affect emotions and behaviour (Meichenbaum, 1977). Considering the importance of thoughts and their significant role on behaviour and emotions, it would be interesting to examine the extent to which behaviour of significant others affects individuals' thoughts (Mead, 1964). The present study examined the influence of instructor's behaviour on participant's negative self talk (worry). Sixty physical education students participated in the study. The experimental task was to execute forehand drives (4 sets of 10 repeats) in a tennis court using the Broer-Miller Forehand-Backhand Drive test. Participants, after performing a baseline trial (B) were assigned into two groups; positive instructor's approach (PIA) and negative instructor's approach (NIA). Each group was tested under two more conditions, which were counterbalanced, within a two-week period; with time pressure (TP) and without time pressure (NTP). During the execution of these trials, participants in the PIA group were provided with positive reinforcement from the instructor, whereas participants in the NIA group received negative criticism. The effectiveness of the group manipulation (instructor's approach) was evaluated with the Coaching Behaviour Questionnaire (CBQ). In addition, participants completed the Automatic Self-Talk Questionnaire for Sports (ASTQS), from which only the worry dimension was used. Independent sample t-tests showed that there were no differences between the groups in performance and worry for the initial assessment, $t(38) = .43$, $p = .67$ and $t(38) = -.46$, $p = .65$, respectively. Correlation analysis showed that there were negative relationships between performance and worry in all conditions (ranging from -.25 to -.44). Therefore, two mixed model ANOVAs, with group as an independent factor (PIA, NIA), condition as a dependent factor (B-TP, B-NTP), and performance as covariate (to control for effects of performance on worry) were calculated to test for differences in the patterns of worry between the two groups. Regarding the TP condition, the analysis revealed a significant group x condition interaction effect, $F(1,37) = 5.04$, $p < .05$. Follow-up paired samples t-tests showed that worries for the NIA remained stable, whereas for the PIA decreased significantly. Regarding the NTP condition, a similar pattern was identified, however the interaction effect only approached significance $F(1,37) = 3.68$, $p = .06$. The results of the study provide support for the importance of instructor's behaviour and verbalizations on individuals' thought patterns and especially worry.

References

Mead, G.H. (1912/1964). The mechanism of social consciousness. In A. J. Reck (Ed.), Selected writings: George Herbert Mead. Chicago: University of Chicago Press.

Meichenbaum, D. (1977). Cognitive-behavior modification: An integrative approach. New York: Plenum Press.

EVIDENCE ON THE VALIDITY OF THE AUTOMATIC SELF-TALK QUESTIONNAIRE FOR SPORTS (ASTQS): A PRELIMINARY ANALYSIS ON NEGATIVE SELF-TALK

Zourbanos, N., Hatzigeorgiadis, A., Theodorakis, Y., Chroni S.

University of Thessaly, Trikala, Greece

Interest in self-talk research in sports has been increasing the last decade. Although some answers regarding the phenomenon of self-talk have been revealed (Hardy, 2006), still many remain unanswered. An aspect that has not received much attention is the conceptualization of the structure of athletes' internal dialogue. This research aimed to construct an instrument to assess athlete's automatic self-talk during training and competition. The present investigation focuses on athletes' automatic negative self-talk. At the first stage of the investigation, row data (negative self-talk) were collected through open-ended questionnaires from a sample of 355 athletes representing a wide variety of sports. Athletes' responses were then screened by the authors to eliminate redundant items. An initial pool of 62 items was cull. Following Dunn, Bouffard, and Rogers' (1999) recommendations item-content relevance analysis was conducted. This resulted in a pool of 44 items which were retained to be further processed. In the next stage of the investigation these items were submitted to exploratory factor analysis. Athletes from a wide variety of sports completed the prospective instrument (N = 337). Athletes were asked to indicate how frequently they experience the listed thoughts during training or competition. Principal components analysis was conducted to identify the number of factors to be interpreted. The analysis supported the existence of three factors. Subsequently, a forced three-

factor solution using oblique rotation was applied. Items with loadings below .30 and items with similar loadings on more than one factor were eliminated, leaving a total of 19 items. The three factors accounted for 56,77% of the variance. The first factor was labeled worry, the second factor was labeled somatic fatigue, and the third factor was labeled disengagement. These factors appeared to reflect the structure of Hatzigeorgiadis and Biddle's (2000) Thought Occurrence Questionnaire for Sport, apart from factor somatic fatigue which was made up of items revolving body disturbs caused by exhaustion. The reliability of the instrument was tested through the internal consistency of the subscales. Cronbach's Alpha coefficients ranged between .74 and .88. The results of this study suggest that ANSTQS demonstrates promise as a measure of athletes' negative self-talk.

References

Dunn, J.G.H., Bouffard, M., & Rogers, W.T. (1999). Assessing item content-relevance in sport psychology scale-construction research: Issues and recommendations. Measurement in physical education and exercise science, 3(1), 15-36.

Hardy, J. (2006). Speaking clearly: A critical review of the self-talk literature. Psychology of Sport and Exercise, 7, 81-97.

Hatzigeorgiadis, A., & Biddle, S.J.H. (2000). Assessing cognitive interference in sports: The development of the Thought Occurrence Questionnaire for Sport (TOQS). Anxiety, Stress, & Coping, 13, 65-86.

FACTORS UNDERLYING PARTICIPATION MOTIVATION OF YOUTH HOCKEY PLAYERS WITHIN A CLUB SETTING. A COMPARATIVE STUDY

Campbell, R., Lloyd, S.

Stranmillis University College , United Kingdom

Background: Sports clubs are increasingly reliant on youth sections for recruitment and development of future adult players (Sports Council Northern Ireland, 1996). In order to optimise the quality of experience for children it is vital to discover what motivates young people to participate in particular sports (Irish Sports Council, 2003).

Objectives: To compare the reasons for club sport participation in field hockey by females across three age groups (9&10, 11&12, 13&14 yrs). To assess coaches understanding of children's motivation for participation.

Methods: An adapted version of Gill et al's (1983) Participation Motivation Questionnaire was used to assess subjects' (n=60) motives for participation. Further descriptive data was obtained in an attempt to understand how sessions could be improved. Qualitative information was obtained from the coaches via interviews. Chi square was used to examine if differences in motives across year groups were significant.

Results: Questionnaire responses indicated that key motivating factors vary with age. Across the groups, 'fitness' and 'skill development' were found to have significant differences. Several non significant trends were highlighted. The children also identified a range of areas in which sessions could be improved. However, these were not considered to be barriers to participation. Responses from interviews indicated that coaches understand their players' needs with the programmes offered reflecting this.

Conclusions: This study gives those involved in youth sport an awareness of the main participation motives of children involved in field hockey in a club setting. This child centred approach will benefit the future of clubs' development as well as returning many benefits in terms of the health and well being of our future adult population (SCNI, 1996). The small sample size within this study means results should be considered exploratory in nature, with a more in depth study being required to strengthen findings.

References

Gill, D.L., Gross, J.B. and Huddleston, S. (1983) Participation Motivation in Youth Sports. International Journal of Sport Psychology, 14 (1), 1-14.

Irish Sports Council (2003) The Code of Ethics and Good Practice for Children's Sport in Ireland. I.S.P

Sports Council Northern Ireland (1996) Developing Junior Hockey: Junior Hockey club development pack. N.I.C.L.R.

A NEW CONCEPT "THE HEART SINK ATHLETE"

Rogers, R., Worth, N., Mahoney, C.

University of Wolverhampton , United Kingdom

There are certain athletes whose usual frequent appearance makes the medical staff's "hearts sink". This is a phenomenon that many Sports clinicians and sports scientists experience, however to our knowledge there is no mention of it in the literature. The "Heart Sink Athlete" is a new phase taken from a known phenomena experienced in General Practice, the "Heart Sink Patient". These are patients who give the doctor and staff a feeling of "heartsink" every time they consult. These patients evoke an overwhelming mixture of exasperation, defeat and sometimes plain dislike that causes the heart to sink when they consult. In other words the term refers to the clinician's emotions which are triggered by certain patients. The term "Heart Sink" can be viewed as a politically incorrect judgment made about a patient. It can however also be seen as the honest appraisal, by a mindful professional, of his or her own response to a particular patient /athlete. This alternative view allows us to move from blame to understanding, and involves accepting that the negative feelings experienced are the product of the interaction between patient and professional. Many heart sink athletes have medical records which can be 10 times thicker than those of the average athlete. In addition many athletes present with unexplained chronic pain. Some athletes can also be described as malingerers. This could be as a result that they are "not good enough". It is also common for athletes to experience an increased tendency to be injured when they are not performing well or the team is not winning. Ever wonder why the treatment room is less busy when a team is winning? Most of these athletes have been seen by several specialists and have scores of laboratory tests and imaging examinations. The difficulty in managing these athletes often arises because they have been given different explanations for the same condition, this may leave them confused and frustrated. These feeling can be projected in the consultation and as a result create a problem between the clinician and athlete. In addition each new clinician has to familiarize himself with the ever growing set of notes, or adopt an unsatisfactory temporizing measure, e.g. sending patients for x-rays or putting them on placebo.

This presentation will discuss the, profile, problems, differential diagnosis and possible management of these athletes.

MENTAL SUPPORT OF THE TRANSITION PERIOD- SPORTPSYCHOLOGICAL PREPARATION OF HUNGARIAN HANDBALL JUNIOR TEAM

Lénárt, Á., Gyömbér, N.

Semmelweis University, Faculty of Physical Education and Sport Sciences, Hungary

Introduction.

The youngmaking process of the hungarian man handball team, which achieved the fourth place in the Olympic Games in Athens, 2004, became neccessary. Having aimed to reach the same mental preparation level with juniors, that we had been able to manage with the Olympic players before. The goal of the new team is the participation on the World Championship (2007, Germany), and qualification for the next Olympic Games.

Methods.

Steps were worked out according to the following.

1. Tests, statusmeasurement, exploration (n=18) and discussions with coaches. Applied tests: ACSI-28/2, CSAI-2, Lüscher, Wartegg, TOPS, Sociometry.

2. The preparatory course (duration 4 weeks, two hours a day) contained autogenic and mental training, goal setting, cognitive techniques, self- confidence development, attentionfocusing, communication skills improvement and team building. Parallelly individual sessions were held (about five hours a day).

3. During this period they adapted the acquired methods, after it, the effectiveness of this preparation has been evaluated (retest).

4. Individual work, in form of consulting were also available during the World Championship.

Results.

Concluding the results of the first testing, the team in respect of practice strategies initially owned good level of goal-setting (also the same among competition strategies) and imagery. However the ability of relaxation and activation needed considerable development, which is the same in the case of automaticity, considering competition strategies (TOPS).

According to ACSI-28/2, beneficial values could be found, in the respect of the following cooperation. The level of cognitive and somatic anxiety were approximately the same, and they showed a good level of self-confidence, which suggested optimistic attitude. After retesting, there were significant difference ($p<0,01$) in all factors, both among practice and competition strategies (goal-setting, emotional control, automaticity, relaxation, self-talk, imagery, attentional control, activation and negative thinking). This can be unequivocally explained with those basic psychological techniques, what they acquired during preparation.

We can consider positive, that making up to the World Championship all competition and practice strategies had improved.

There was also significant difference in self-confidence ($p<0,05$, CSAI-2) and peak performance ($p<0,01$, ACSI-28/2), which can be consider as a really good value before the championship. Furthermore team cohesion and conflict- management also improved.

The team has finally won bronz medal.

Conclusions.

The best six players were chosen into the national team. Joining they could perform, in psychological meaning, as high level as the others, thus creating a new and homogenous team. This is expressly beneficial in respect of the long run cooperation (Beijing, 2008), because this way juniors can be also the part of a physically and psychologically integrated work, that is absolutely necessary for the future successes.

ANALYZING EXPERT BASEBALL COACHES' STRATEGY FOR SUBJECTIVE KNOWLEDGE

Nagayama, T., Kitamura, K., Saito, S.

Tohoku University, Japan

Physical tacit knowledge is subjective knowledge. Tacit knowledge refers to the highly subjective insights, intuitions and hunches (Nonaka, 1991), and the accumulated skills and experience (Leroy and Ramanantsoa, 1997). In addition, it is difficult to be formalized, organized (Kim, 1993). Physical tacit knowledge is an important topic, when we research motor learning. But there are a few studies that clarified physical tacit knowledge in motor learning. Therefore, the purpose of this study was to investigate expert coaches' strategy for the transformation of physical tacit knowledge into explicit knowledge during baseball pitching training. Three expert coaches and five players served as the participants for this study. 30 training sessions where coaches instructed players in physical tacit knowledge of baseball pitching skills were observed and recorded. In-depth interview was conducted with each coach and player stimulated recall by VTR every training session. Interviews were focused on coaches' strategy for externalizing their personal knowledge. Interview transcripts were divided into 56 meaning units. These meaning units were regrouped into three categories which were crucial for a way to make the tacit dimension of their knowledge explicit. Three categories emerged from the analysis consisted of 1) comprehension of player's body experience, 2) externalizing internal imagery, and 3) enhancement of kinesthetic sensitivity. Results showed that expert baseball coach tried to comprehend players' body experience and instructed them in coach's internal imagery by figurative languages which brought out some kinesthetic sensitivities which were essential for skill acquisition. As a result, players could comprehend physical tacit knowledge by which he/she linked some kinesthetic sensitivities they had already experienced. And it was most important coaches' work to make players sensitive their kinesthetic sensitivities during training. Expert coaches gave players the reference so that players could pay attention to their kinesthetic sensitivities. The reference allowed players adjusting their performance to internal imagery consisted of some kinesthetic sensitivities. It was difficult for coaches to externalize their physical tacit knowledge, because physical tacit knowledge was subjective knowledge. However, expert baseball coaches always tried to transform physical tacit knowledge into explicit knowledge by means of figurative languages and make players sensitive their kinesthetic sensitivities by the reference.

References

Kim, D.H. (1993) "The link between individual and organizational learning" Sloan Management Review, 35, 1, pp37-50

Leory, F. and Ramanantsoa, B. (1997) "The cognitive and behaviorism dimensions of organizational learning in a merger: an empirical study" Journal of Management Studies, 34, 6, November, pp871-894

Nonaka, I. (1991) "The knowledge-creating company" Harvard Business Review, November-December, pp96-104.

A QUALITATIVE ANALYSIS OF THE ATHLETE-COACH RELATIONSHIP OF PROFESSIONAL SOCCER TEAM IN BRAZIL

Kitamura, K., Nagayama, T., Saito, S.

Tohoku University, Japan

This study provided an in-depth description of the dynamics of the athlete-coach relationship indicating that the coach-athlete relationship as a suitable psychological climate provide both chances to develop adaptive person and performance accomplishment. Jowett, & Ntoumanis (2003) indicate that Closeness, Co-orientation and Complementarity are salient components of the coach-athlete relationship. The purpose of this study was to describe an in-depth description of the athlete-coach relationship in professional soccer team in Brazil taking into account their coaching philosophy in relation to coaching expertise development. Ten coaches (four coaches, four physical coaches, two goalkeeper coaches) from four categories (professional B, U-19, U-17, and U-15) and thirty two athletes from each category served as participants for this study.

In-depth open-ended interviews were used to gather data on ten coaches and thirty two athletes from four categories. Participated observation was also used to describe a detailed atmosphere during the practice. The interviews were systematically transcribed verbatim from the integrated circuit recorder immediately after the completion of each interview, and a total of 188 meaning units were extracted from the data set. The data was decontextualized using an inductive procedure for analyzing unstructured qualitative data. The inductive analysis process resulted in regrouping these interview transcripts into three categories: (reliability, commitment, and mutual supporting), and six properties (having feelings of sympathy, respecting, understanding, helping substantially, share the goal, commitment to the attainment of the goal, motivating, providing positive feedback, and communication).

This study found significant agreement between the suitable psychological climate on how the athletes and coaches evaluated their mutual supporting activities in relation to performance enhancement of soccer players and how this suitable psychological climate between the athletes and coaches affected their development in the professional soccer team in Brazil. The strong relationship between reliability, commitment, and mutual supporting indicates that a desirable interpersonal relationship direct athletes to commit to deliberate practice as a way of overcoming the constraints for performance enhancement.

Results showed that the athlete-coach relationship is a very dynamic, multifaceted, interpersonal phenomenon. Successful coaches construct the relationship with athletes in a manner that maximizes athletes' commitment to daily effortful practice.

PERCEIVING PATTERNS IN DYNAMIC ACTION SEQUENCES: IDENTIFYING THE CRITICAL INFORMATION UNDERLYING ANTICIPATION SKILL IN SOCCER

North, J.S., Williams, A.M., Hodges, N.J., Ward, P., Ericsson, K.A.

Liverpool John Moores University, United Kingdom

Anticipation is essential to top-level performance in sport. Pattern recognition is thought to be an essential component of anticipation (Williams et al., in press). We examined the processing mechanisms employed by skilled (n = 11) and less-skilled (n = 15) players when recognising complex, dynamic soccer sequences. Also, we considered the relationship between pattern recognition and anticipation performance. In an anticipation phase, players viewed filmed action sequences from a defender's perspective and anticipated an opponent's pass destination. In a subsequent recognition phase, players identified whether or not each sequence was presented during the anticipation phase. During recognition some sequences were presented in point-light rather than film format, removing superficial display features and maintaining relational information between players. Visual search behaviours were assessed. Skilled players were expected to demonstrate superior recognition performance than less-skilled players, particularly for point-light sequences. If pattern recognition is an essential component of anticipation, performance on these tests was predicted to be correlated and the processing strategies not to differ.

Skilled players (M = 64.3%, SD = 6.29) were better at anticipating pass destination than their less-skilled peers (M = 55.7%, SD = 3.85). Moreover, skilled players (M = 58.0%, SD = 12.9) were more accurate than less-skilled participants (M = 52.0%, SD = 16.3) in recognising patterns of play. This skill advantage was maintained when clips were presented in point-light format. Skilled performers develop elaborate task-specific knowledge structures providing an advantage when making such perceptual judgments (Ericsson & Kintsch, 1995). Performance on anticipation and recognition tests were not correlated. Visual search behaviours during anticipation and recognition differed markedly, implying that contrasting perceptual-cognitive mechanisms underpin performance on these two tasks. Participants employed more fixations (M = 1.3 vs. 1.1) of shorter duration (M = 683.0 vs. 978.0 ms) and spent more time fixating areas other than the ball (37.0 vs. 25.6%) when attempting to anticipate rather than recognise patterns of play. In conclusion, skilled performers make use of relational information between players and associated higher-order strategic knowledge to detect meaningful patterns of play. However, pattern recognition may not be an essential component of anticipation performance, but rather a related by-product of exposure to the task domain. Findings have implications for the development of training programmes to enhance perceptual-cognitive skill in sport.

Ericsson, K. A., & Kintsch, W. (1995). Long-term working memory. Psychological Review, 102, 211–245.

Williams, A. M., Hodges, N. J., North, J. S., & Barton, G. (in press). Perceiving patterns of play in dynamic sport tasks: Identifying the essential information underlying skilled performance.

Poster presentation (PP)

PP1-07 Physical Education and Pedagogics 1-2 - "Exhibition Hall"

A QUALITATIVE ANALYSIS OF VALUE ORIENTATIONS OF UNIVERSITY INSTRUCTORS: A CASE STUDY

Sarac, L.

Middle East Technical University, Turkey

Introduction: In the typical teaching-learning environment, teachers make curricular decisions. These curricular decisions often include the questions such as what should be taught to whom, when, how, and why? Curriculum theorists states that, teachers' curricular decisions constructed on their set of educational beliefs (Ennis, Chen & Ross, 1992). In physical education area, five value orientations have defined as affecting teachers' educational decisions: Disciplinary Mastery (DM), Learning Process (LP), Self-Actualization (SA), Social Reconstruction/Social Responsibility (SR), and Ecological Integration (EI) (Bain & Ennis, 1995).

Purpose: The purpose of this case study was to find out the impact of physical education instructors' value systems on their curricula by examining 2 physical education instructors' curriculum content and implementation.
Method: The value profiles of 8 physical education instructors were determined by using Value Orientation Inventory (VOI). Then, 2 instructors were selected by using criterion (having different value priorities) type of sampling. According to the results derived from the VOI, one of the instructors (Cem) was founded as SR oriented and the other (Berfin) was DM oriented. In order to collect data on reflection of value orientations 2 instructors and their students were interviewed. Additionally, instructors' behaviors during actual teaching setting were observed, and their verbal behaviors were recorded by tape recorder. Observational data were collected based on the physical context, lesson content and structure, classroom management, activities, etc. Coding categories and the themes was constructed according to the literature (Ennis & Chen, 1993).
Results: In the current study Berfin was a DM oriented instructor mainly focusing on the development of psychomotor and cognitive behaviors necessary to be successful in skill related and fitness activities. However, it was clearly observed in the SR oriented teachers' class session that he was focusing on teaching SR oriented concepts such as self responsibility, respect to social orders, classroom rules. In general, it was founded by the class observations that the each instructor reflects their value profiles in their lessons. Also, instructors were consistent with their value profiles during formal interviews. Additionally, students' perspectives on their instructors teaching environment revealed that both DM oriented and SR oriented instructor reflected their value orientations in their classes.
Conclusion: In order to provide maximum learning, curriculum developers consider some factors such as learner, society, nature of the content etc. Teachers' values are also important factors affecting implementation of the curriculum. Because, teachers are a bridge between the theoretical and practical part of the curriculum and it would be beneficial to find out value profiles of the teachers and consider these profiles during the curriculum development process.

REASON FOR NON-ATTENDANCE TO PHYSICAL EDUCATION CLASSES IN PRIVATE ELEMENTARY SCHOOLS

Yildirim, A., Cicek, S.

Middle East Technical University, Turkey

The purpose of this study was to investigate reasons of non-attendance to physical education classes in private schools in Turkey.
Three private elementary schools were participated in the study in Ankara, Turkey. 12 classes from 8th grade, 10 classes from 7th and 10 classes from 6th grade were observed (total 32). Data were collected classroom observation and interview with non-attending students. Information related with attendance, gender, physical appearance, reason for non-attendance, and behaviors of non-attending students were noted. Data collection was performed during regular physical education classes.
Descriptive statistics were used for statistical analysis.
Results showed that, there were 129 non-attending students over the observed 32 classes. Non-attendance rate was 16.8%. Non-attendance rate were 6.3%, 23.5% and 21.7% for grades 6-7-8 respectively.
In all classes female students had slightly higher non-attending rate than male students (54.3% vs 45.7%). Physical appearance of non-attending students considering body fat was quite normal.
Behavior of the non-attending student was passive sitting on a bench in gymnasium (79.1%).
Forgetting sports equipment (50.4%), illness-injury (36%), having health report (11.6%), parents permission (9%) were seem to major reasons for non-attendance to physical education classes.

WHY DO ATHLETES PERCEIVE LOWER LEVELS OF CHRONIC STRESS? THE RELATIONSHIP BETWEEN RESOURCES AND THE PERCEPTION OF CHRONIC STRESS AMONG CHILDREN IN COMPETITIVE SPORTS

Hoffmann, K.

University of Leipzig, Germany

Much research has been conducted in recent years regarding the benefits of physical activity on mental health. However, this research mainly focuses on adults and adolescents, and is predominantly based on physical activity and exercise in general. Consequently, research investigating children in competitive sports is limited. Recent work indicates that children active as athletes experience significantly lower levels of chronic stress than their non-active peers (Richartz, Hoffmann & Bernardt 2005).

Based on this result the present study aims to answer the question why the levels of chronic stress are lower among athletes than among non-athletes. By using a combined model of the Cognitive-Motivational-Relational Theory (Lazarus 1991) and the Conservation of Resources Theory (Hobfoll 1998) the role of competitive sports in the process of chronic stress will be analyzed. For this purpose the relationship between children's perception of chronic stress and different kind of protective resources shall be explored.
The empirical research comprises a longitudinal survey with two points of measurement in two groups of children (athletes n=598; non-athletes n=499) aged 7-12. The data was collected using the questionnaire 'Strains and Resources among children' (BR-K, Belastungen und Ressourcen im Kindesalter) which was designed specifically for the project. Findings derived from the first point of measurement verify the significantly lower stress-scores for active athletes in comparison to their non-active peers.
Hobfoll, S.E. (1998). Stress, culture and community. New York.
Lazarus, R.S. (1991). Emotion and Adaption. New York.
Richartz, A., Hoffmann, K. & Bernardt, J. (2005): Chronische Belastungen und protektive Ressourcen im Kinderleistungssport. In: BISp Jahrbuch 2004, Bonn.

THE EFFECT OF COOPERATIVE SCHOOL GAMES ON PUBESCENT GIRLS' DECISION AND STUDY ASPECT OF SOCIOMETRIC STATUS

Katalin, K.

Semmelweis University Faculty of Physical Education and Sport Sciences, Hungary

According to Kotschy (1998) one of the traits of practical cognitive aspect in applied pedagogy is that the solution for most educational problems is the development of an aptitude for thinking. The cognitive aspect is not concerned with either the emotional development of the student or the quality of interaction between students, in spite of the fact that the quality of social interactions has a major impact on

performance. Therefore, one of the major issues in educational social-psychology is the modification of inter-student contacts and relationships to improve personal develop and group structure.

To develop personality, physical skills and/or social qualities and abilities must be used as an educational tool. Indeed, in a good group the students require the support of each other and benefit from the cooperative attitude as well as high performance (N. Kollár, 1997). Thus school games and cooperative games in particular, are an excellent tool to develop personality traits.

Our research of several years hypothesized that cooperative games have a positive impact on group structure and reduce the degree by which students on the group periphery were marginalized by their peers. Success in cooperative games depends on working together, so the answers to the decision question will mirror social abilities which could also be apparent in the answers to the study question.

Sociometric status for the aspects of decision and study were measured by asking each student two questions ("How willingly would you make a decision in an important question with each of your class mates?" "How willingly would you study with each of your class mates?") and plotting the results using an expanded matrix version of the Shellenberger's Group-Evaluative Method (1980).

The participants were freshman girls (experimental group N=74, control group N=71), from three different secondary schools (downtown, suburban, and catholic) in Budapest, Hungary. The test groups practiced cooperative school-games during every P.E. class for 10 to 15 minutes twice weekly during the first examination period. In the second examination period the physical education teacher decided on a case by case basis how often to utilize the cooperative games program.

In the answers for the decision aspect, it was found, primarily in the small groups, that the overall position the girls in the experimental group (both liked and disliked) shifted in a positive direction, indicating that for important decisions the classmates would listen to each other more then before the program. However, because the entire group shifted in a positive direction, the socio-distance between the group and the disliked students did not increase, but it did not decrease either. In the control group the position of the students either deteriorated or did not change.

In this presentation we analyze the answers for the study aspect to determine if the same or different results are observed.

TEACHING SOCCER IN PHYSICAL EDUCATION – LONG-TERM EFFECTS OF USING A FUTSAL BALL INSTEAD OF A NORMAL OR AN INDOOR (FELT) FOOTBALL

Heim, C., Frick, U.

Johann Wolfgang Goethe-University Frankfurt, Germany

Introduction

Football (soccer) is – at least in Europe – one of the most popular sports for pupils. At the same time, soccer is often regarded as a difficult sport to teach (see Heim & Frick 2006a in this volume for a detailed description of some possible difficulties). A possible solution for some of these difficulties may lie in the use of a Futsal ball (FUT) instead of a normal (FOT) or a felt (FEL) football. The aim of this study was therefore to evaluate whether beginners learning success may be enhanced by the use of a FUT in comparison to a FOT or FEL.

Methods

Over a period of two years, a longitudinal study was conducted with 64 fifth-grade pupils (age-range 10-12 years) in three different classes. Identical six-week teaching units were performed in each of the classes; each class was instructed with a different ball (FUT, FOT or FEL). Participants' technical football skills were tested in isolated trials (e.g. controlling a bouncing ball that drops from a certain height with a reproducible velocity) and during play using a quantitative video analysis (every action – e.g. passing, shots on goal etc. was counted for each player and coded as "positive" or "negative") before and after the teaching unit. All classes performed the isolated trials with all three balls; the tournaments before and after the teaching were played with ball each class used during the teaching unit. Additionally, to attain reference values, each class played a second tournament with a FOT before and after the teaching unit.

Results

Evaluation of the tournaments played with the ball used for training in each class before and after the teaching unit showed significant increases in the number of ball contacts each player had during play (FUT +10.9%, T=1,634; df=21; p=0,059; FOT +4.0%, T=0,649; df=20; p=0,649; FEL +10.9%, T=1,868; df=23; p=0,038). A comparison of the actions coded as "positive" however showed significant differences in favour of the class that trained with the FUT (FUT +16.2%, T=1,826; df=21; p=0,038; FOT +3.3%, T=0,458; df=20; p=0,326; FEL +2.1%, T=0,363; df=23; p=0,360). Similar results were achieved for the isolated tests of football skills. An analysis of transfer effects when playing with a FOT after training with either a FEL or a FUT showed significant increases for the class training with the FUT only (+8,5%, T=0,907; df=21; p=0,188; FEL -12,9%). Again, similar results were achieved in the isolated tests of footballs skills (class instructed with a FUT +13.1%, T=2,329; df=21; p=0,015; class instructed with a FEL +6.0, T=1,736; df=21; p=0,049).

Discussion

Results indicate that the beginners can greatly benefit and achieve better results if a FUT instead of a normal or a felt football is used in PE soccer tuition. It is therefore concluded that football tuition in schools should be performed with a FUT instead of a FOT or FEL when soccer is played indoors.

References

Heim C & Frick U (2006a). Teaching soccer in Physical Education – immediate effects.

WAYS OF MARKETING WATER SPORT IN A.R.E

Mekky, A.

Physical Education, Egypt

Ways of marketing water

Sport in A.R.E

The research aimed at the aknowledg of the best scientific ways marketing water sports which involved of water saeling , water skiting , catching fish and diving in A.R.E , and the difference between the academics and the practicas in their ways of some marketing water sports . the research designed an application form for academic coachers . the staff at the faculty of physical education and the faculty of commerce and practical cooches who had trianed turns and working in water sport club . the researcher applied the application form on (60) members of the staff specified in water at the faculty of commerce specified in business arrangement and 75 coaches from water sport club .

The researcher attained some results the most important once are :

* the best marking ways which used in measurement by a scientific ways .

* the best way which depend on investment and the development of materials for water sports club .
* put are bublic staratigy for developing and marketing the water sport in all Egypt areas , espiecally in the cities which look at the sea such as the Red sea middel what sea the cancel of
* establishing a specific parts for sport tourism in the ministry of tourism , these parts making a plans and programmes in order to activited sport tourism of water sport , and this is for have shows and competion and working to increasing the coaches in the field of water sport tourism among the faculties of phisycals and the faculity of tourism and hotel .
* put in consideration the scintific principle in planning for water sports club in A.R.E .

RESULTS OF OLYMPIC EDUCATION IN POLISH SCHOOLS

Nowocien, J.

The Jozef Pilsudski Academy of Physical Education in Warsaw, Poland, Poland

"Olympic education" refers to all the processes aimed at transforming a person-student mainly through sport and Olympism according to relevant social ideals and educational pur-poses. Its essence consists in the application of sport and olympic values of P. de Coubertin in the education process: Olympism being the main education content, while sport the major educational method.
Since 1990's, Polish schools implement alternative curricula for Olympic education. 15 years of education resulted in significant pedagogic results.
1. Positive change in students' attitude towards sport and other forms of physical education.
2. Positive students' social attitudes have been marked by implementing the fair play principle as major educational content.
3. Education through sport and olympism has successfully raised students' moral be-haviours in the area of sports and others.
4. Educational results depend on teachers' knowledge, their motivation, readiness to embrace innovative teaching methods, ability to co-operate with students, other teachers and parents.

CHILDREN'S OPPORTUNITIES TO BE PHYSICALLY ACTIVE IN PRESCHOOL

Cools, W., De Martelaer, K., Adries, C., Samaey, C.

Vrije Universiteit Brussel, Belgium

Introduction Early childhood is known as a sensitive period for the development of fundamental movement skills (Gallahue & Ozmun, 1995). The development of fundamental movement skills is crucial for a child for several reasons:
- being capable to perform daily routines like getting out of bed, brushing tooth, walk to school, etc. …,
- becoming able to be engaged in physical play activities (Bredekamp, 1992); through play preschoolers explore and experience their surroundings,
- participating in physical activities at a very early stage in life is positively related to a child's health (Ketelhut et al., 2005; Zimmer, 2002).
Both school and family environment of the child have been recognized as actors when it comes to proximal influences on the child's behavior (Bronfenbrenner, 2000). In this contribution we will focus on the school environment as stimulus for physical activity among preschoolers, preliminary results of school environmental opportunities to be physically active will be presented.
Methods All schools in the province of Antwerp (537) were informed about the study. 100 school directors signed up and agreed to take part in this study. All participating schools completed the survey concerning the opportunities for preschoolers to be physically active during school time.
Results The results provide preliminary information on children's opportunities to be physically active during: PE lessons, other moments (free play moments, morning, noon and afternoon breaks) and classroom time.
Conclusion In several schools there is a positive attitude towards the importance of a physically active lifestyle. Nevertheless there are some spearheads to be taken into account:
Schools should engage parents, teachers and children to take the effort:
– to decorate the walls with attractive paintings serving as target to throw and kick at.
– paint squares and lines (traffic zones) onto the hard surfaced playground floor,
Because of the overall decrease in green zones there is a challenge for school to offer children the experience of playing in natural mazes and on grass fields.
Every school should create a covered play area, providing enough space for the children to play when it rains.
Schools must be stimulated to look and act more 'movement inclusive' in education in general and in early childhood in particular.
References:
BREDEKAMP,S. (1992).What is developmentally appropriate and why is it important. JOPHERD, 31-32.
BRONFENBRENNER,U., & EVANS,G.W. (2000).Developmental Science in the 21st Century: Emerging questions, theoretical models, research designs and empirical findings. Social Development (1), 115-125.
KETELHUT,K., MOHASSEB,I., GERICKE,A., SCHEFFLER,C., & KETELHUT,R. (2005).Verbesserung de Motorik und des kardiovasculräre Risikos durch Sport im frühen Kindesalter. Deutsches Arzteblatt, 102(16), 1128-1136.
ZIMMER,R. (2002).Gesundheitsförderung im Kindergarten. Bundesgesundheitsblat-Gesunsheitsforsuch-Gesundheidsschutz 2002, 964-969.

A COMPLEMENTARY PROGRAM FOR SIX TO EIGHT-YEAR CHILDREN WITH WEAK KINETIC PERFORMANCE

Hammoudy, A.S.

Faculty of Physical Education, Assiut Univ. Assiut, EGYPT, Egypt

Background and Problem
Physical education has specific goals and different types whereas kinetic education helps children enjoy their spare time and encourages them to be active. It tends to enable children understand their bodies and kinetic communication.
It is believed that the best age for kinetic education is ranging from 6 to 12. In this stage, children are ready to learn the rules and skills of specific games. Due to the importance of this stage, the researcher believes that low-kinetic primary stage children need a supplemen-

tary program for developing their physical fitness and kinetic activities. As known, the need of kinetic decreases as a result of elimination of kinetic.
Objectives
- Eliminating children's fear of athletic kinetic activities through the preparatory physical fitness and kinetic activity stage.
- Developing low-kinetic children's athletic kinetic performance.
Approach
Due to the nature of this research, the experimental approach is used.
Sample
This research involves 225 first, second and third graders from 15 government and private primary schools in Assiut Governorate.
Instruments
- Questionnaire prepared by the researcher.
- Burdo's scale of kinetic recognition abilities.
Pilot Studies
In the period from 20-30 September 2005, the first pilot study was carried out to check the validity and reliability of Burdo's scale of kinetic recognition abilities. This study repeated on 15 October 2005.
In the period from 20 - 22 October 2005, the second pilot study was carried out using some activities of the program to check their suitability.
Success Conditions
Affording training experiences and tools.
Affording training chances related to the program objectives.
Playing with and on the athletic equipment.
Controlling study groups.
Training Principles
Basic elements Activity Time
Warming-up
Actual Playing
Development
Closing Free play to create self- confidence.
Developing the concept of playing.
Focusing on certain style of play.
Positive relaxation 10 ms, 20 ms, 10 ms, 5 ms
Pre-Test: The study groups were pre-tested on 23-27 October 2005.
Program Application: The program was administered in the period from 1/11/2005 to 2/1/2006.
Post-Test: The study groups were post-tested on 3 -9 January 2006.
Main Findings
As a result of the preparatory stage of kinetic education, children got ride of fear of kinetic activities. They could walk forward and backward on a wooden bar 15cm high, 2.40cm long and 10cm width using their left leg, right leg and both.
The program developed children's kinetic recognition and physical fitness. The children could, in stand position, move their arms and legs. They could pass the obstacles of Burdo Scale.

SCREENING OF GROSS MOTOR SKILLS AMONG SWEDISH CHILDREN AND ADOLESCENTS

Tidén, A., Nyberg, M.
Stockholm University College of Physical Education and Sport, Sweden

Physical Education teachers in Sweden have noticed that pupils are getting worse in their ability to manage gross motor skills. The gross motor skills and coordinative skills are the solid ground for sports and other health activities. If not developing their gross motor skill children tends to avoid taking part in games and sports. The benefits of sports and outdoor activities such as social and health benefits can therefore be missed. In the spring 2001, The aim of this study, the motor skills test, was to make a survey of what Swedish pupils can manage in gross motor skills today. Based upon these results we can in the future tell whether the pupils are maintaining today's level of gross motor skills or not. The Swedish curriculum for "sports and health" states that pupils should manage gross motor skills in the 5th year of school. The study started with the construction of the gross motor and coordinative skill tests. The movements selected for the test were based on gross motor skills, coordinative skills and combinations of these skills. The test included 16 movements measured on a scale from 1 to 4. The levels of the scale have a written description to support the ocular observations. Examples of skills tested were; skipping, jumping, crawling, rolling, being upside down, bouncing and throwing balls. The results are analyzed both on an aggregated level here referred to as gross motor skills profile, as well as on a single movement level. The results indicate that 29% of the pupils in the 6th school year are not able to manage the gross motor skill tests without remarks. The pupils with the lowest scores can be found among young female children with low strength and overweight. The test also shows that in the 9th school year boys are stronger than girls. Boys and girls in the lower ages (school year 3 and 6) are more similar in the gross motor skills profile but not on the single movement level. It can also be noted that girls are better in skipping and some of the movements of more gymnastic character whereas boys are better in throwing. Boys and girls have nearly identical results in the test of balance, walking on a balance beam where gender or age does not seem to have any affect. From the main findings of the tests we can observe that the younger pupils have not yet developed the gross motor skills. It is also noticeable that many of the pupils in the 6th school year are achieving poor results in the tests even though the Swedish curriculum for "sports and health" states that the pupils should have achieved these skills already in the 5th school year. Many of the girls in the 9th school year are very poor in the movements that included some strength ability. If children do not have the gross motor skill and some strength it is more likely that they will choose other activities or have other interest then physical activities and sports on their leisure time. This may in the future give them health problems because we know from fact that physical inactivity is one of the main causes to bad health.

CHALLENGES AND OBSTACLES IN MOTOR LEARNING: CONTEXTUAL FACTORS IN GYMNASTICS AND CALISTHENICS

Fügedi, B., Bognár, J., Honfi, L., Salvara, I. M.

Eszterházy Károly College, Hungary

Introduction

Although growth and maturation influence the acqusition of motor skills in physical education, learning plays a more significant role in the process. During the process of motor learning, significant changes occur in knowledge, error detection and correction, cordination, and visual attention.

Gymanstics and calisthenics are included in most physical education programs in Hungary. It is well known that physical education takes place in a specific context. This context refers to all factors that can certainly influence what and how content is learned. These influences could either facilitate or inhibit the implementation of instruction.

PE teacher are challenged to teach gymnastics and calisthenics to children of varying physical maturity, interest, and physical abilities. Also, the different levels of contextual factors can have major influences on the quality of the teaching-learning process.

Hence, the purpose of this study was to find out how future physical education teachers perceive the challenges and issues concerning gymnastics and calisthenincs at the primary school level. More specifically, the center of our attention was to examine instructional resources and teachers' knowledge levels in these two activities.

Methods

Participants of this study were purposefully sampled and were all undergraduate students in the Eszterházy Károly Teacher Training College in the Physical Education program, Eger (N=194). All students filled out questionnaire with closed- and open ended questions. Questions were formed in a five-item Likert scale (5 being exceptional and 1 being poor). The questionnare was preceeded by initital semi-structured interviews with 12 students (3 from each year). The purpose of the initial interviews was to identify common themes and ideas in instructional resources and teachers' knowledge.

Results

From the intitial interviews, two contextual factors seemed important to explore: PE faculty and instructional resources. Schol location, student demographics, and administration, according to future PE teachers' beliefs, do not play a significant role in progressing in gymnastics and calisthenics.

The level of instructional resources in gymnastics was rated very low (M=1.9433), and in calisthenics medium (M=3.1443) level. PE teachers' knowledge base both in gymnastics and calisthenics rated in medium level (M=3.03 and M=3.47). 44.8% of students found 'poor' instructional resources in gymnastics. For each question chi-squared showed a significant difference. Interestingly, there were no significant differences between genders, among year in college, and best sport result.

Summary

Teacher knowledge level is paralel to the instructional resources, which mean they teach according to their possibilities. Both should be improved for better learning experiences. Better facilities, equipment, resources would possibly increase the level of practices and success levels, so teachers' knowledge base would also be perceived higher.

COMPARISON ANALYSIS OF DIFFERENT SPORT GROUPS CONCERNING TO BALANCE

Huszar, A., Leibinger, E., Muranyi, N., Hamar, P.

Semmelweis University, Hungary

Hungarian public education is typically multicolored if the education politics and control are taken into consideration. The applying of different school structures and curriculum refers to this. Besides traditional sports many other movement ingredients such as extreme sports can be found among the syllabus. Therefore these new sports are getting more popular between the students. It can be stated that these kinds of movements can help the students conditional and coordination abilities positively.

Analyzing the coordination abilities it is known that gymnastics helps and develops the children' balance activities. The best period to develop static balance is 7 to 9 age and dynamic balance is 10-12 ages.

In our research primary school students balance activities were measured. The research took place in Hungary in 2006. The following groups were observed:

1.Students who take part only in physical education class

2.Students who take part in not only physical education class but also extracurricular gymnastics activity (also doing gymnastics in physical education class)

3.Students who take part in not only physical education class but also extracurricular skating/roller-skating activity (also doing skating/roller-skating in physical education class)

The question is if there are differences between the groups. We also would have liked to know which group was the best in these abilities. Therefore not only curriculum writers can use our results but also can help physical education teachers' decision while choosing activities.

COMPARING THE CURRENT SITUATION OF PHYSICAL ACTIVITY FOR ELDERLY PERSONS IN EUROPEAN COUNTRIES

Djobova, S., Van Coppenolle, H., Huijsmans, K., Niemiro, A.

Katholieke Universiteit Leuven, Belgium

Ageing is undoubtedly an issue that more than ever stands in interest. In the past 50 years, one of the most important changes within Europe has been the rapid increase in the number of people living into their 70s and beyond. Most of those ageing people will have some physical or mental disability, regardless the fact if they acquired this disability at birth, later in life or through the normal process of ageing.

Recently, the traditional disability model has changed to agree with the suggestion that disability is not only the consequence of a disease or an accident but also of lifestyle choices. Ageing is a process which brings gains as well as losses: gains, because it brings maturity, wisdom and respect; and losses, because it often affects and restricts the physical and psychological level and devalues the social perceptions of people who are growing older. Numerous research projects have successfully demonstrated that the benefits of physical

activities for health are indisputable. As seniors are the fastest growing age group, attention needs to be given to them as a special population with specific needs in the area of exercise and sport.
Qualified professionals in the area of physical activity for the elderly have to be prepared now, so they can meet the new demands of the future. A Thematic Network is needed to bring together data throughout whole Europe, concerning physical activity for seniors, to create a basic profile and to implement the subject of adapted physical activity for the elderly in the European higher education curricula, in order to compensate for the current lack of information in that specific domain.
The aim of this study is to analyse and compare the data gathered by the Thematic Network, THENAPA II.

TEACHING SOCCER IN PHYSICAL EDUCATION – IMMEDIATE EFFECTS OF USING A FUTSAL BALL INSTEAD OF A NORMAL OR AN INDOOR (FELT) FOOTBALL

Heim, C., Frick, U.

Johann Wolfgang Goethe-Universität Frankfurt, Germany

Introduction
Football (soccer) is – in Europe – one of the most popular school sports. Yet, soccer is often regarded as a difficult sport to teach. Many schools do not have their own pitch, and so football in Physical Education (PE) is normally taught indoors in gymnasiums with the result that the ball bounces a lot more on the hard floor than it would on a grass field. This makes it difficult to control the ball, particularly for beginners. Also, as there is less space in a gymnasium than on a pitch, opponents are in close proximity to each other, further increasing the pressure on the time players have to control the ball. However, ball control is essential for any further skills such as passing, dribbling or shooting. Literature (e.g. Schmidt 2004) suggests using semi-pressurised or soft balls to make it easier for beginners to control the ball. However, this reduces the ball's form stability, making it more difficult to dribble and enhancing the risk of twisting an ankle by stepping onto the ball. A possible solution for this problem may lie in the use of a Futsal ball (FUT) instead of a normal (FOT) or an indoor (felt) football (FEL). FUTs are constructed in such a way that they bounce a lot less than either FOT or FEL, making them easier to control while at the same time being form stable. The aim of this study was therefore to compare the immediate effects of using a FUT in PE instead of a FOT or FEL.
Methods
A cross-sectional study was designed with 410 fifth-grade pupils (ages 10-12 years). Participants' technical football skills were assessed in isolated trials and during play using quantitative video analysis (see Heim & Frick 2006b in this volume). Both the trials and the videotaped tournaments were performed with a FUT as well as a FOT and a FEL. Additionally, after the tournaments pupils were asked to complete a questionnaire of 19 football-related items comprising statements relating to four categories (fear of the ball, enjoyment, involvement in the game, quality of play). Pupils were to indicate their agreement with the statements on a likert-type scale.
Results
The results of the trials indicate that isolated technical elements can be performed significantly faster with a FUT than with either a FOT or a FEL. Video analysis of the matches with the different balls showed that the number of ball contacts and the number of "positive" actions significantly increased for each player when playing with the FUT compared to playing with the other balls. Results of the questionnaire data indicate that pupils are significantly less afraid of hurting themselves when playing with the FUT (T=4,208; df=126; p=0,000).
Discussion
Results indicate that the quality of play can be greatly enhanced with beginners when using a FUT instead of a FOT or a FEL in indoor-soccer. It is therefore concluded that football tuition in schools should preferably be performed with a FUT.
References
Schmidt W (2004). Fußball. Hofmann, Schorndorf
Heim C & Frick U (2006b).

PARENT, TEACHER AND PEER AUTONOMY SUPPORT AND LEISURE-TIME PHYSICAL ACTIVITY: A CROSS-GENDER EVALUATION OF THE TRANS-CONTEXTUAL MODEL

Pihu, M., Hein, V., Koka, A.

University of Tartu, Estonia

Introduction
Teacher, peer and parent autonomy support to the leisure-time physical activity (PA) have been tested with the trans-contextual model (Hagger, 2005). The trans-contextual model proposes a motivational sequence in which perceived autonomy support predicts autonomous motives, intentions, and behavior in a leisure-time PA context. Although, the differences between cultural contexts have been investigated (Hagger 2003; 2005), the gender differences are still unclear. Therefore, this study tested equality of models across gender in which the influence of the perceived autonomy support by peer, teacher and parents on physical education and leisure-time motives, attitudes, intention and PA behavior were observed.
Methods
The participants, at age of 14 –17 years (girls = 149; boys = 115) completed measures of the model constructs using three-wave prospective design. To measure perceived autonomy support from teachers, peers and friends, perceived locus of causality in a physical education and leisure-time context, intentions and attitudes, leisure-time PA behavior, different questionnaires were used (Hagger, 2005). Equality regression model was specified so that perceived autonomy support from different sources predicts PA behavior directly and indirectly via autonomous motives, attitudes and intentions in both groups – boys and girls.
Results
The multiple-group regression model with no cross-group equality constraints (the basic model), showed acceptable fit (chi-square/df =42.55/32, GFI= .96, NFI=. 95, RMSEA=.050), indicating that the general structure is tenable. The results of the equal regression analysis indicated that error variances of the dependent variables of the two groups were not different, as the change in chi-square statistics was not significant. The change in chi-square statistics between freely estimated model and the model with the equality constraints on the intercepts was also non-significant. These results indicated that the model have equivalent measurement properties and are invariant across gender. All together, the observed components of the model accounted for 43 % of the variance in physical activity behavior.
Discussion/Conclusion

The results showed that pattern of relationships between the perceived autonomy support by peer, teacher and parents, physical education and leisure-time motives, attitudes, intention and PA behavior were similar across groups of boys and girls. However, the impact of the teacher autonomy support on intentional physical activity behavior among girls was higher in comparison with boys.

References

Hagger M S, Chatzisarantis N, Biddle S J H (2002). Br J Health Psychol, 7: 283-297

THE EFFECT OF SELF-DEFENCE TRAINING ON MORPHOLOGICAL AND MOTOR DIMENSIONS

Zorec B.

Faculty of Criminal Justice and Security, Ljubljana, Slovenia

Self-defence belongs to the group of polystructural acyclic sports where there dominate acyclic movements carried out in a limited and direct fight with the opponent. Self-defence training has an important place in the training processes forming part of the education in the police, military forces and recently among pupils and students also due to the fact that by training or recreational training of self-defence significant influence on the dimensions of the psychosomatic status can be achieved. The study has been carried out on a sample of 48 students attending the University of Ljubljana aged from 19 to 24 years. The experiment (of self-defence training) lasted 7 months and took place two times a week. The morphological status has been defined by 15 morphological measures and the motor status comprises 7 motor variables. First, all basic statistic parameters were calculated for all variables: arithmetic mean, variance, maximal and minimal result. The significance of the differences between the results of initial and final measurements was assessed by the application of the t-test for small dependent samples. The significant differences in the morphological space of the trainees between the initial and final state of the measurements show above all in the dimensions of subcutaneous fat tissue. Some significantly smaller transformations occurred in the dimensions defining the voluminosity. From this it can be concluded that in the morphological space the effects of self-defence training show above all in the reduction of subcutaneous fat tissue: it decreased by 19 %. Similar results were obtained by Agrež, 1992. At an insignificant change of the body weight this means that there occurred, to the same extent, the increase in the muscular mass and significant differences in the circular measures of the forearm and thigh that is in the segments of the lower and upper extremities which are the most active ones during training. The largest progress was achieved in the field of strength. The repetitive strength of the trunk increased by 14 % and the static strength of the arms and shoulder girdle by 12 %. The training of self-defence techniques caused significant positive changes in the segment of flexibility as well. The flexibility of the trainees improved by 8%. Despite expectations there were no significant differences in the test of basic endurance (600-m-run), where the results depend on the capacity of the cardiovascular, respiratory system, rationality of running and motivation. The results of the research represent a strong argument in favour of the fact that by self-defence training it is possible to improve the quality of some dimensions of the psychosomatic status, which in turn can also indirectly have a positive effect on the improvement of the health status.

Agrež, F. (1992). Vpliv usmerjenih motoricnih programov na morfološke in motoricne dimenzije odraslih oseb. Kinesiologia Slovenica, 2(1): 9-12.

EFFECT OF EDUCATION METHODS USED BY PHYSICAL EDUCATION TEACHERS FOR STUDENT AFFECTIVITY IN HUNGARY

Murányi, E., Huszar, A., Leibinger, E., Hamar, P.

Faculty of Physical Education and Sport Sciences, Semmelweis University, Budapest, Hungary

Introduction: Different education methods are used in the interest of the solution of certain didactic problems. Choosing of the method is a foundation-stone of PE –theory or one of the measures of effectiveness of the attainment process. This question is supported by the pedagogy specialist e. g. Endre Ballér, Zoltán Báthory, Edit Biró-Nagy, Sándor Nagy.

A research from other aspect could be also important besides the methodology namely: what is the affectivity of the students towards the education domain of PE and Sport. This question is also supplied by pedagogy specialise e. g. Endre Burka, Edit Biró-Nagy, Pál Hamar or Ariah Lewy at international level. On the basis of all these the aim of the research is to map the attitude of the students of different ages during the PE lessons. Beside it answer was searched how does the methods chosen by the teacher influences the affectivity of the students. This is important for several reasons: 1.: By choosing the right methods effectiveness of the attainment process and positive attitude of the students towards PE can be reached. The other reason is that the teacher shouldn't leave out of consideration that during his/her work some changes in the students' behaviour, attitude towards PE can happen, as a result of the process of teaching-learning cautiously.Methods: The aim of the research justified the use of a double method. On one hand the affectivity of Hungarian primary and secondary school students towards PE was surveyed within cross-sectional research. The answer for the question was searched for with the help of a questionnaire. The so called „target" model was applied instead of the traditional one. The survey was carried out in academic year 2003/2004. The number of the tested persons was (n=) 300. The other method was the observation. The frequency distribution of the methods was surveyed during the observation. An observation diary was kept. The survey was carried out in the first semester of academic year 2002/2003. The research was carried out between 6 to 12 year-old students of Hungarian primary and secondary schools. 30 schools from Budapest and from the countryside took part in it with altogether 300 pupils. During data processing the basic statistical calculations, correlation matrix calculation and calculation of percentage were done.

Results: As a summary, it can be said that the 12 to 18 year-old primary and secondary- school students feel well during the PE lessons. So the affectivity towards the subject seems to be given. But it is a striking surprise that oral communication has an excess rate during the lessons. The students do not feel that they can learn such things which can be useful later as well. It is not a favourable viewpoint either that students do not often meet the feeling of tiredness after these lessons. The students do not feel the importance of learning the teaching material of PE, and that the evaluation of the students' work is pushed to the back with the secondary school teachers.

WHAT DO CHILDREN INVOLVED IN SPORT THINK ABOUT MORAL DILEMMATIC SITUATIONS?

Graça, A., Fraile Aranda, A.

University of Porto, Portugal; University of Valadollid, Spain, Portugal

Introduction

Children involvement in sport is a rich domain for querying and reflecting about moral dilemmas. As Stuart (2003) refers sport offers opportunities for children to identify and resolve moral issues, however the child's perspective has been relatively ignored by researchers. Psychological research conveyed that comparing boys to girls and team sport participants to individual sport participants or non-

participants, boys and team sport participants are less mature in moral reasoning (Beller & Stoll, 1995; Bredemeier & Shields, 1986). Nevertheless, the soundness of that research is not unquestionable (Jones & McNamee, 2000).

This study has a double purpose, firstly it intends to examine the choices children sport participants make on sport specific moral dilemmas, taking in account gender and type of sport, and then to probe how children justify the reasons for their choices.

Method

Participants were 273 Portuguese children (from 11 to 13 years old) of both sexes (120 girls and 153 boys), involved in sport (176 team sport and 97 individual sport). Children were faced with 8 typical sport situations embodying moral dilemmas related to fairness, companionship, discrimination and racism, equality of opportunity and peace/violence in sport. In each situation participants have to choice one of two alternatives. Descriptive statistics were used to analyze children responses.

Complementarily, four participants, two girls (gymnastic and team handball), and two boys (swimming and basketball) participate in a small group discussion for collecting arguments children use to justify their choices. Basic descriptive, interpretative procedures were used to make sense and draw conclusions from qualitative data.

Results and conclusion

Excepting for one dilemmatic situation (faking a penalty), for which opinions divided, a wide majority of sport participants made reasonable choices. Albeit, both gender and type of sport have an impact on children stance towards moral dilemmas associated to sport situations. In comparison to other groups, boys and team sport participants reveal higher percentages of objectionable choices.

Arguments for children choice rely on weighting principled reasoning and team or self interests, along with the particularities of the situation.

References

Beller, J. M., & Stoll, S. K. (1995). Moral Reasoning of High-School Student-Athletes and General Students - an Empirical-Study Versus Personal Testimony. Pediatric Exercise Science, 7(4), 352-363.

Bredemeier, B. J., & Shields, D. L. (1986). Moral growth among athletes and nonathletes: a comparative analysis. J Genet Psychol, 147(1), 7-18.

Jones, C., & McNamee, M. (2000). Moral reasoning, moral action, and the moral atmosphere of sport. Sport Education and Society, 5(2), 131-146.

Stuart, M. E. (2003). Moral issues in sport: The child's perspective. Research Quarterly for Exercise and Sport, 74(4), 445-454.

Poster presentation (PP)

PP1-08 Nutrition 1/1 - "Exhibition Hall"

LONG TERM MULTIDISCIPLINARY THERAPY DECREASE PREVALENCE OF METABOLIC SYNDROME IN BRAZILIAN OBESE ADOLESCENTS

Caranti, D.A., Cristofalo, D.J., Siqueira, K.O., Prado, W.L., Stella, S.G., Piano, A., Tock, L., Tufik, S., Mello, M.T., Dâmaso, A.R.

Federal University of São Paulo Paulista Medicine School - UNIFESP-EPM-Brazil., Brazil

Adolescence has been emphasized as a critical period for the development and expression of obesity-related co morbidities in both sex, especially metabolic syndrome. The aim of this study was to determine the prevalence of metabolic syndrome and verify effects of a multidisciplinary long-term therapy (1 year) in predictors of metabolic syndrome among Brazilian obese adolescents. Were recruited 51 post-puberty obese adolescents, 24 boys (36,19+2,64 wt/ht2) and 27 girls (34,34+2,89 wt/ht2). Visceral fat was analyzed by ultrasound and metabolic syndrome was determined under WHO criteria. All patients were submitted to a weight loss multidisciplinary program (nutrition, exercise, psychology and clinical). We observed that 31,37% of the obese adolescents presented metabolic syndrome and only 2% after intervention. Indeed, in boys BMI (36.19+2.64 to 30.82+5.92), visceral fat (4.14+1.01 to 2.91+1.01) and HOMA (3.77+2.07 to 0.75+1,51) and in girls glucose (92.09+5.85 to 86.00+5.92) showed statistical reduction. The multidisciplinary long term therapy was effective to promote beneficial changes in some parameters and decrease the prevalence of metabolic syndrome.

NUTRITIONAL INTAKE IN JUDOKAS 3 DAYS BEFORE AND DURING THE COMPETITION DAY

Ramon, K., Verbeke, K., Zinzen, E., Deriemaeker, P., Vanmalderen, K., Clarys, P.

Vlaamse Judo Federatie; Vrije Universiteit Brussel; Hogeschool Antwerpen, Belgium

Introduction

Judo is a contact sport with heavy demands for the athletes. As competition is performed in weight classes a number of athletes are involved in weight reduction practices competing up to 5 to 10 % below normal weight. Most common methods for weight reduction are energy restriction and dehydration the last week or even the last days before competition. It was the aim of our study to estimate nutritional intake and energy expenditure 3 days before the day of the competition and to estimate the nutrient and fluid intake during the day of the competition.

Methods

32 Belgian judoka's (21 female and 11 male) volunteered. They completed a questionnaire concerning normal weight, competition weight and weight loosing strategy. A 3-day nutritional intake and training diary (before competition) was completed. During the day of the competition the athletes were asked to record fluid and food intake and this before and after the weigh in procedure but equally between the different fights.

Results

72% of the volunteers had to reduce weight before the competition. Hence, the judokas were divided into 3 groups: female judokas who needed to lose weight (FLW), male judokas who needed to lose weight (MLW) and female judokas that were on competition weight (FCW). Only 17% of the judokas involved in weight reduction practices did this in a gradual way using a 3 weeks period. The remaining judokas performed their weight reduction in less than 2 weeks before the competition. The used methods were: heavy sweating by training with occlusive clothing (52.1%); strong reduction of the fluid intake (39.9%) and taking a sauna (30.4%). Total weight reduction averaged 2.31 ± 0.91 kg which is 3.51 ± 1.3% of their body weight.

The 3 days diet and training dairy indicated that weight losing judokas had a deficient energy intake compared to their expenditure with intakes of respectively 3919 ± 2550 kJ for the FWL and 5828 ± 1272kJ for the MWL while their expenditure reached respectively 10288 ± 1989 kJ and 11848 ± 2119 kJ. In the FCW group the energy intake met the energy expenditure. Quantitative analysis of the nutrient intake indicated that for judokas under weight reduction carbohydrate intake was too low (2.31 ± 1.27 g/kg body weight for the FLW and 2.59 ± 0.69 g/kg body weight for MLW – recommended intake = 3.5 g/kg body weight). Fluid intake was equally too low with 30.31± 15.69 ml/kg body weight for the FWL and 23.77 ± 11.20 ml/kg body weight for the MWL – recommended intake 40-60 ml/kg body weight). The time between the weigh in procedure and the first fight averaged 2 hours.

Discussion

Judokas performing weight reduction show a significant energy deficit in regard to their average energy expenditure the last 3 days before the competition. Especially the carbohydrate and fluid shortage may compromise the performance capacity during the competition since the judokas under weight reduction have to compete with low glycogen levels and in a status of dehydration.

THE EFFECT OF RED BULL ADMINISTRATION ON 2000M ROWING ERGOMETER PERFORMANCE IN ELITE OARSMEN

Donovan, T., Nichol, C., MacLaren, D.P.

Manchester Metropolitan University, United Kingdom

Introduction. Caffeine has been shown to improve both short term (Jackman et al., 1996), prolonged (Graham et al., 1998) endurance exercise and 2000-m rowing ergometer performance (Bruce et al., 2000) at doses of both 5 mg.kg-1 and 9 mg.kg-1 body mass. One of the current methods for athletes to ingest caffeine is through Red Bull which has a relatively low caffeine concentration (30 mg.100ml-1) but also contains taurine (0.04%) and glucose (4.4 g.100ml). Purpose: To investigate the effect of administration 2 cans of Red Bull (500ml) on 2000-m rowing ergometer performance in elite rowers. Methods: In this randomised, double blind crossover study 14 elite male rowers (peak oxygen uptake [VO2 peak] 5.3 ± 0.32 l.min-1, mean ±SD) performed a familiarisation trial of 2000-m rowing on an air barked ergometer, followed by 2 experimental trials 7 days apart, each 45 min after ingesting 2 cans of Red Bull or placebo. Venus blood samples were taken 5 minutes prior to the warm up and 5 minutes following the 2000-m trial. Heart rates and breath by breath VO2 and VCO2 were measured throughout the trials. The trials were preceded by a standardised warm up of 5 mins at 70% VO2 peak. Results: Administration of 500ml of Red Bull resulted in a significant (p = 0.0013) improvement in performance of 2.9-s ± 2.7. There were no differences in heart rate, VO2 or plasma lactate between the trials. The athletes could not distinguish between the treatments both before and after the trials. Conclusion: Ingestion of 500 ml of Red Bull 45 minutes prior to exercise produces an improvement in 2000-m rowing ergometer time of 2.9 (± 2.7) seconds in elite rowers.

Bruce et al., (2000). Enhancement of 2000-m rowing performance after caffeine ingestion. Med. Sci. Sport Exerc. 32 (11), 1958-1930.

Graham et al., (1998). Metabolic and exercise effects of coffee and caffeine ingestion. J. Appl. Phsiol. 85: 883-889.

Jackman et al., (1996). Metabolic, catecholamine and endurance responses to caffeine during intense exercise. J. Appl. Phsiol. 81: 1658-1663.

THE EFFECTS OF PROBIOTIC YOGURT ON GASTRO-INTESTINAL PROBLEMS DURING ONE WEEK OF ALTITUDE ADVANTURE ACTIVITY IN YOUNG ADULTS

Dinç, S.C.,C., Basoglu, S., Turnagöl, H., Karaman, M., Yenipmar, G.

Hacettepe University, Turkey

Probiotics have been reported to enhance the digestion and absorption of protein, fat, calcium and phosphorus. They produce their own lactase and may help overcame lactose intolorance. It refers to use of microorganism in a positive way to benifit health. An example is the way some people ingest bacteria in live yoghurt to enhance their intestinal flora and so aid digestion. Thus, the purpose of this study is to prevent the digestive problems frequently encountered by the university students during outdoor adventure activity at altitude approximately 2500 meters on Taurus Mountains for a one week, by intake of probiotic yoghurt. 59 students (n:39 male, and n:20 female) voluntarily have participated as subjects. One week prior to the activity the subjects were devided in to control (n: 29) and experiment (n:30) groups, where feces samples were taken and while control group was given a normal yoghurt, the experiment group was given probiotic yougurt, totaling up to 500 ml in two porsions daily. All subjects had similar diet during the activity according to their needs. All digestive problems were recorded daily according to toilet frequency and feces consistency. At the end of the activity feces samples were collected for the analysis of Lactobacillus Aciddophilus and Clostridium Perfringens values for comparison. As a result there was no statistical difference between the normal and probiotic yoghurt groups ($p>0.05$). However, there was less complaint among the probiotic group in diarrhoea and digestive problems compare to normal yogurt group ($p<0.05$). In conclusion, probiotic yoghurt can be suggested to those who stay at certain altitudes for outdoor activities, to lessen the frequency of diarrhoea complaints due to normal yoghurt intake.

THE EFFECT OF SHORT-TERM HIGH CARBOHYDRATE DIET WITH HIGH AND LOW GLYCAEMIC INDEX ON ENERGY SUBSTRATE UTILISATION DURING RUNNING EXERCISE

Malkova, D., Aberham, T., Taylor, P., MacAlphine, K., Kessaris, D., Hillier, F., Higgins, S.

University of Glasgow, United Kingdom

Pre-exercise ingestion of carbohydrate rich foods of varying glycaemic index (GI) has been reported to cause alterations in glycaemic, insulinaemic and lipolytic responses during subsequent exercise (Febrraio et al, 1996, DeMarco et al, 1999). Specifically, high GI foods, consumed prior exercise, may significantly increase blood glucose and insulin levels and by attenuating fat oxidation compromise exercise performance (Thomas et al, 1991 Kirwan et al, 2001). It remains unclear if consideration of GI of CHO foods is important when prior an athletic event a high-CHO diet is consumed for the duration of several days. Thus, the aim of the present study was to investigate the effect of high carbohydrate diet with high and low GI consumed for the duration of 3 days on metabolic responses and energy substrate utilization during running exercise conducted in the fasting state.

Thirteen healthy, recreationally active men (age, 26 ± 5 years; BMI, 23.4 ± 2 .4kg∙m-2; body fat, 14.9± 3.5%) in counterbalanced order performed three 90 minute treadmill running trials. Trials were separated by at least 14 days and were conducted in the fasted state at a speed corresponding 90% of lactate threshold. In the last minute of every 15-minute exercise stage samples of expired gas and blood were obtained and measurements on heart rate were conducted. One trial was performed after subjects had been consuming their habitual diet (control trial), another after three days on a high CHO low GI diet (LGI trial), and third after three days on high CHO diet

with high GI (HGI trial). Diets were isoenergetic and provided 9.5 ± 1.6, 10.9 ± 0.9 and 10.8 ±1.0 MJ in control, LGI and HGI trials, respectively. In the habitual diet % of energy obtained from CHO was 47 ± 5% while in LGI and HGI diets CHO provided approximately 70% of total energy. The GI values were 54 ± 6, 36 ± 1, and 76 ± 3 for control, LGI and HGI diet, respectively.

There were no significant differences between trials with respect to plasma insulin and non-esterified fatty acids (NEFA) response. Concentration of plasma glucose was lower (two-factor ANOVA, P = 0.05) in the control trial than in LGI and HGI trials but was not different between LGI and HGI trials. Rates of CHO and fat oxidation and the proportion of energy derived from fat (Control, 46.1 ± 3.4 %; LGI, 41.0 ± 4.7 %; HGI, 45.5 ± 3.6 %) and carbohydrate (Control, 53.9 ± 3.4 %; LGI, 59.0 ± 4.6 %; HGI, 54.5 ± 3.6 %) were not significantly different between the three trials.

In conclusion, changing from habitual diet to high CHO diet with either low or high GI for the duration of 3 days facilitates plasma glucose maintenance and at the same time has no detrimental impact on fat oxidation during submaximal exercise conducted in the fasted state.

References

Febrraio et al. J App Physiol, 1996, 81, 1115-20

DeMarco et al. Med Sci Sports Exerc, 1999, 31, 164-70

Thomas et al. Int J of Sports Med, 1991, 12, 180-6

Kirwan et al. Metabolism, 2001, 50, 849-55.

EFFECT OF CREATINE SUPPLEMENTATION ON THE CONCENTRATION OF BLOOD LACTATE IN PROTOCOL OF WEIGHT EXERCISES UP TO EXHAUSTION IN TRAINED WOMEN

Trindade, M., Dodero, S.R., Cyrino, E.S., Tirapegui, J.

Group of Study and Research in Metabolism, Nutrition and Exercise (GEPEMENE); Faculty of Pharmaceutical Science/University of São Paulo., Brazil

The objective of this study was to evaluate the behavior of blood lactate in a protocol of weight exercises up to exhaustion, after five days of creatine supplementation. Thirty healthy young women ((22.1 ± 4,4 years; 60,8 ± 8,8 kg; 165,1 ± 5,0 cm), after being trained in a in a systemized program of exercises with weights throughout 16 weeks, were submitted to a protocol of effort up to exhaustion. The protocol was executed after these women were supplemented with creatine (n=17) or placebo (n=13) (maltodextrine) during 5 days (4 doses of 5 g = 20g/day), in a double blind delineation. 48 hours after the accomplishment of the tests of one maximum repetition (1-MR), the volunteers performed four series of bench press exercises in horizontal bench, squat and arm curl of biceps, at 80% of 1-MR until exhaustion. The interval of recovery between the series was of two minutes and the interval between the different exercises from was of three to five minutes. A sample of arterial blood was collected in basal situation (pre-effort) and one minute after the accomplishment of the last series of each exercise during the exhaustion protocol, for the dosage of blood lactate, using an electrochemical analyzer (YSL 1500 Sport). For statistical treatment the analysis of variance (ANOVA two-way) for repeated measures was used followed by the post hoc test of Scheffé when $P < 0.05$. Although the concentrations of blood lactate increased during the protocol up to exhaustion, no modification that could be attributable to creatine supplementation was verified in the comparisons among the groups ($P< 0.05$). The highest concentrations of lactate after the protocol up to exhaustion were identified after the squat exercise (7.2 ± 2.2 versus 5.4 ± 2.5 mmol, for the creatine and placebo groups, respectively). The results suggest that the supplementation of creatine doesn't seem to modify metabolic acidosis provoked by efforts of high intensity and short duration, executed up to exhaustion, in women trained in exercises with weights.

MUSCLE DAMAGE IN RATS SUBMITTED TO MODERATE PHYSICAL TRAINING AND DIETARY DEFICIENCY IN MAGNESIUM

Amorim, A., Pires, I., Tirapegui, J.

University of São Paulo Faculty of Pharmaceutical Sciences , Brazil

INTRODUCTION: Physical exercise can lead to tissue damage, especially in the muscle. Several studies have suggested that a dietary deficiency in magnesium causes an increase in the susceptibility to muscle damage resulting from physical exercise. Nonetheless, this has been poorly investigated by experimentation in animals. This study aims to verify if the ingestion of a diet poor in magnesium may increase the muscle damage in rats submitted to moderate physical activity.

MATERIALS AND METHODS: Male Wistar rats (n=18, with initial body mass of 280g) were divided into 4 groups: sedentary control (SED, n=4); exercised control (EX, n=4); sedentary and deficient in Mg (DEF, n=5); and exercised and deficient in Mg (DEFEX, n=5). The control diet was formulated according to the AIN93M recommendations (500 mg of Mg/ Kg diet) whereas the Mg deficient diets had only 200 mg of Mg/Kg diet. The animals were fed during 6 weeks ad libitum and submitted to swimming exercises sessions, 1 hour/day, 5 times weekly. Blood was collected 24 hours after the last exercise session. The activity of enzymes creatine kinase (CK) and lactate dehydrogenase (LDH) in the blood serum was evaluated.

RESULTS: The activity of CK of each group was (in increasing order): SED (348 U/L), EX (449 U/L), DEF (458 U/L) and DEFEX (492 U/L), without significant differences. The activity of LDH in the animals belonging to the DEFEX group was greater than those presented by the other groups and a significant difference ($p<0,05$) was found with respect to the DEF and EX groups.

CONCLUSIONS: The dietary deficiency in magnesium increased the susceptibility of the muscle tissue to lesions in exercised animals. Consequently, the time taken for muscle recovery in animals submitted to Mg deficiency is greater compared to that of animals with a diet adequate in Mg.

Acknowledgements: CAPES for financial support.

RAPID WEIGHT LOSS IN GERMAN TAEKWONDO ATHLETES IN PREPARATION FOR COMPETITIONS - A REPRESENTATIVE SURVEY

Furian, T., Bluemel, M., Euen, K., Striegel, H., Brueckner, H., Niess, A.

Medical Clinic, Department of Sports Medicine, University of Tuebingen AND Institute of Nutritional Sciences, University of Giessen, Germany

Rapid weight loss (RWL) in preparation for competitions is a common method in certain sports to achieve a desired weight which enables the athlete to compete in a lower weight category. To reach the requested competition weight, athletes achieve RWL by dehydration

through such methods as vigorous exercise, fluid restriction, wearing vapor-impermeable suits, and using hot environments such as saunas. Illegal practices include the consumption of diuretics, emetics, or laxatives. Less often, a negative energy balance is created by restricting food intake, increasing endurance exercise, and self-induced vomiting. More often, combinations of these techniques are employed during the days preceding the competition.

These methods adversely affect cardiovascular function, electrical activity, thermal regulation, renal function, electrolyte balance, body composition, and muscular endurance and strength. Sporadic deaths associated with intentional RWL have also been reported. The incidence of these undesired effects is dependent on the period, the amount of weight loss, and the practices used.

Most of the studies and reports to date have been carried out with North American wrestlers. Data from other sports and regions have not been published extensively.

The objective of the study was to gain representative data about RWL in German Taekwondo (TW) athletes.

Athletes from the national and state TW teams, as well as athletes from local TW clubs were surveyed using a standardized questionnaire. 582 questionnaires (response rate 32.1%) were analyzed.

More than half of the athletes stated having used RWL to prepare for a competition at least once, and 52.2% stated they often had to lose weight before competitions. On average, athletes reported losing 2.1+/-2.1 kg, which is equivalent to 3.3 +/- 2.0% of their body weight (BW) 8.4 +/- 7.8 days before a competition. The highest weight loss reported was in the two lowest weight classes, with 4.0 +/- 2.8% and 4.1 +/- 2.4% BW, as well as in members of the national team with 3.6+/- 2.6%.

Aside from restricted food intake (79.4%), the athletes also reported tampering with their fluid balance (sweat suits 51.4%, sauna 25.9%, reduced fluid intake 13.3%). During RWL, it is relatively common for athletes to experiences subjective health problems, for example fits of dizziness (11.4%), headache (10.8%), or cardiac arrhythmia (5.6%). Furthermore, 15.1% of the athletes experience deterioration of their general performance and 17.1% in their sport specific performance, particularly strength (26.9%) and endurance (19.1%). Nevertheless, 42.5% of the athletes are convinced that RWL is necessary to increase their chances of success in a competition.

We can conclude that RWL is a common practice in German TW athletes although to a lesser extend as reported in studies examining North American wrestlers. In contrast to the latter group only a few athletes exceed the critical limit of losing 5% of their body weight within a few days; however health problems still occur relatively often.

LARGE EFFECT OF CARBOHYDRATE ELECTROLYTE DRINKS CONTAINING GLUCOSE AND FRUCTOSE ON ENDURANCE PERFORMANCE

Hulston, C., Stevens, C., Hetherington, R., Jeukendrup, A.E.

The University of Birmingham, United Kingdom

Introduction: Carbohydrate (CHO) feeding has the potential to improve endurance performance typically by 1-3%. Recently we have demonstrated that ingesting drinks containing glucose and fructose during exercise increased exogenous CHO oxidation rates, spared endogenous energy stores and increased fluid delivery compared with glucose-only drinks. The effects of a glucose+fructose drink on performance, however, have not been investigated. Also, few studies have investigated the magnitude of a placebo effect in these conditions. Therefore the aims of this study were (1) to investigate the effect of a carbohydrate-electrolyte solution (CES) (glucose+fructose) on performance and (2) to determine the size of a placebo effect during prolonged cycling exercise.

Methods: In a double blind, cross-over design eight endurance-trained male cyclists (VO2max: 63 ± 3 mL/kg/min) performed three exercise trials separated by at least 7 days. Each trial consisted of 120 min cycling at approximately 60% VO2max followed by a performance test (time trial) designed to last approximately 1 h. During the time trial subjects were required to complete a set amount of work as fast as possible. In random order subjects ingested either plain water (WAT), artificially coloured and flavoured water (Placebo) or a 6% CES containing glucose and fructose in a 2:1 ratio. Subjects ingested a 600 mL bolus at the onset of exercise followed by a further 150 mL every 15 min thereafter and after completion of 25, 50 and 75% of the time trial. Placebo and CE solutions were produced with identical colour and taste. To investigate the possibility of a placebo effect subjects were told that both flavoured drinks would contain CHO.

Results: Mean power output sustained during the time trial was significantly higher with CES (245 ± 18W) compare to WAT (219 ± 12W; $P < 0.05$) and Placebo (219 ± 12W; $P < 0.01$). This resulted in a significant reduction in time to complete the set amount of work and thus exercise performance was improved with CES ingestion (11.7% compared to WAT $P < 0.05$ and 11.3% compared to Placebo; $P < 0.01$). Time to complete the set amount of work was 59.69 ± 1.24 min, 66.67 ± 2.42 min and 66.44 ± 1.49 min for CES, WAT and Placebo, respectively.

Conclusions: The main finding of the present study was that a carbohydrate-electrolyte drink containing glucose and fructose substantially improved time trial performance by approximately 11.5%. Additionally, we conclude that during a prolonged (~3 h) test of cycling performance the placebo effect is negligible.

Supported by a research grant of GlaxoSmithKline, Consumer Healthcare (UK).

IMPACT OF A SINGLE EXERCISE SESSION ON PREPRANDIAL AND POSTPRANDIAL RESPONSES OF PLASMA GHRELIN

Malkova, D., McLaughlin, R., Manthou, E., Nimmo, M.

University of Glasgow and University of Strathclyde, United Kingdom

Ghrelin, one of the most potent orexigenic substances produced by the human body (Broglio et al, 2003) seems to be resistant to exercise (Schmidt et al, 2004). However, information in relation to exercise and ghrelin is very limited and there are no studies that report on the impact of exercise on ghrelin concentrations in the postprandial state. Therefore, the aim of the study was to investigate the role of a single exercise session on preprandial and postprandial responses of plasma ghrelin and evaluate how these responses are mediated by insulin and IL-6. Eleven healthy, recreationally active male individuals were recruited (age, 23.8 ± 5.8 years; BMI, 23.3 ± 2.9 kg∙m-2; body fat, 13.7 ± 3.4%; VO2 max, 41.8 ± 7.2 ml•kg-1 •min-1). Subjects took part in two trials, one exercise (E) and one control (C), separated by 3 days. Both trials started after a 12-hour fast. In the E trial subjects exercised on a cycle ergometer at 90% lactate threshold for the duration to expend 2092 KJ and in the C trial subjects rested quietly for the same duration of time. Two hours after the intervention a meal, isocaloric to the subject's habitual lunch was provided. Mean values of the plasma concentration of ghrelin, insulin and IL-6 over preprandial and postprandial periods were calculated using the total area under the concentration versus time curve divided by time. For the preprandial calculations values at base line, immediately after and 2 hours after intervention and for the postprandial calculations values at 2 hours after intervention (pre-meal) and at 30, 120, and 180 minutes after meal consumption were considered. Mean preprandial values of plasma ghrelin (C, 724 ± 65 pg∙ml-1; E, 697 ± 55 pg∙ml-1) and insulin (C, 6.6 ±

2.0 µU∙ml-1; E, 5.1 ± 1.1 µU∙ml-1) were not significantly different between trials while mean preprandial values of IL-6 were significantly higher in the E trial (C, 1.53 ± 0.26 pg∙ml-1; E, 2.76 ± 0.55 pg∙ml-1; P< 0.05, t-test). Mean postprandial values of insulin were not significantly different between trials (C, 34.9 ± 9.0 µU∙ml-1; E, 36.1 ± 8.4 µU∙ml-1) but mean postprandial values of ghrelin were significantly lower (C, 670 ± 47 pg∙ml-1; E, 585 ± 41 pg∙ml-1; P< 0.05, t-test) and values of IL-6 were significantly higher (C, 1.62 ± 0.26 pg∙ml-1; E, 2.31 ±0.33 pg∙ml-1; P< 0.05, t-test) in the E trial. Plasma ghrelin was not only negatively correlated with insulin in both trials but also with IL-6 immediately after exercise (r = -0.8, P<0.05) and 3 hours after meal consumption (r = -0.7, P<0.05) in exercise trial. In conclusion, these findings suggest that preprandial and postprandial ghrelin does not increase in a compensatory manner to changes in energy homeostasis induced by exercise and allows the hypothesis that the response of ghrelin to a negative energy balance induced by a single exercise session is blunted because of exercise induced increase in IL-6 concentration.

References

Broglio et al. (2003). Hormone Research 59, 109-17

Schmidt et al. (2004) Hormone and Metabolic Research 36, 174-7.

POST-EXERCISE REHYDRATION WITH APFELSCHORLE, A SPORTS DRINK AND MINERAL WATER

Shirreffs, S.M., Keil, M., Phillips, S., Love, T.

Loughborough University, United Kingdom

Many athletes will become dehydrated during exercise because of the amount of sweat they lose. Effective replacement of these losses after exercise may be an important part of the recovery process if further exercise is to be undertaken later the same day. This study aimed to determine the effectiveness of four commercially available drinks in restoring fluid and electrolyte balance after exercise-induced dehydration.

After University Ethical Committee approval and written informed consent of the volunteers, eight healthy males undertook, on four occasions, intermittent exercise in the heat until they had lost 1.94±0.17% of their body mass. This was estimated to be a sweat loss of 1.33±0.23 l in which an estimated 88±27mmol of sodium (Na) and 6.4±1.3mmol of potassium (K) was lost as determined from sweat patch collection from the upper back during exercise. Thirty minutes after the end of the exercise subjects started a 1h rehydration period during which they ingested, either a sports drink (Gatorade: 353±4mosmol/kg, 26±0mmol/l Na, 6±1mmol/l K), carbonated water/apple juice mixture (Apfelschorle: 404±14mosmol/kg, 8±1mmol/l Na, 30±1mmol/l K), or two different brands of mineral water (Evian: 16±4mosmol/kg, 0±1mmol/l Na, 0±0mmol/l K and San Benedetto: 15±4mosmol/kg, 1±0mmol/l Na, 0±0mmol/l K) in a volume equal to 150% body mass loss. The effectiveness of the drinks was monitored for 4h after the end of the rehydration period. All volunteers were subject to all treatments, with the order determined by an incomplete latin square randomisation. Trials were separated by seven days. Immediately before and 30min after exercise and at 1h intervals thereafter blood and urine samples were collected to monitor water and electrolyte balance recovery. Statistical differences (P<0.05) were determined by repeated measures ANOVA and appropriate post-hoc tests.

Four hours after the end of the rehydration period, subjects were in net negative fluid balance on trials Apfelschorle (-365±319ml; P=0.030), Evian (-529±319ml; P=0.000) and San Benedetto, (-401±353ml; P=0.016) but on trial Gatorade subjects were essentially euhydrated compared to their pre-exercise state (-201±388ml; P=0.549). Subjects were in negative sodium balance on all trials for the rehydration and recovery period and only on trial Apfelschorle did subjects remain in positive potassium balance after rehydration. However, when net cation balance was estimated from net sodium and potassium balance, the deficit was significantly less on trial Gatorade (-88±15mmol) compared to trials Evian (-156±49mmol; P=0.010) and San Benedetto (-163±36mmol; P=0.004), but similar to trial Apfelschorle (-103±38mmol; P=0.872).

These results suggest that in this scenario, recovery of fluid balance can be achieved when significant quantites of sodium are ingested after exercise but replacing this with potassium does not result in as effective a recovery.

This study was supported by the Gatorade Sport Science Institute.

HYPOHYDRATION IN YOUNG FEMALE GYMNASTS

McNeal, J.R., Sands, W., Colvin, K., Jemni, M., Walker, J.

Eastern Washington University, Cheney, WA , United States

Euhydration is the term used for normal daily body water content, while hypohydration is defined as a decrease from the euhydrated state. It takes a remarkably small reduction in body water to lead to performance decrements. Most studies on children and youth regarding hydration have utilized athletes working in warm and humid environments. Gymnasts represent a population of young athletes who typically work in comfortable environmental temperatures, but who often participate in long training sessions and multiple training sessions per day, which may induce a hypohydrated state independent of environmental characteristics. The purpose of this study was to describe the hydration status of young gymnasts prior to and following a gymnastics training session using measures of urine specific gravity (SG). Twenty-eight gymnasts (age 14.7 ± 1.7 yrs, mass 43.1 ± 9.7 kg, height 151.5 ± 9.8 cm) completed this study. Participants ranged in competitive level from USA Gymnastics Level 7 to pre-elite, and were currently training 21.4 ± 4.6 hours per week. Gymnasts provided a mid-stream urine sample at their gymnastics training facility immediately prior to their training session and within 15 minutes following the conclusion of the same training session. Gymnasts trained 4-5 hours between samples. Urine specific gravity was measured using a refractometer to the nearest 0.001 g/mL. All gymnasts exhibited a pre-training SG of ≥ 1.020 g/mL, with 13 gymnasts (46.4%) achieving a value of 1.025 g/mL or higher, and 4 gymnasts (14.3%) above 1.030 g/mL. Regulations by the National Collegiate Athletic Association and data provided from previous research suggest that a euhydrated state exists when SG is less than 1.020 g/mL, while increasing values represent increasing hypohydration. A one-sample t-test showed no significant change in SG from pre to post training (p = 0.093). However, a Wilcoxon signed ranks test showed that there were significantly more gymnasts who became further hypohyrated following the training session than those that either improved or showed no change in their hydration (p =.04). At the conclusion of the training session, 2 gymnasts had SG values below 1.020 g/mL, while 19 (67.9%) were above 1.025 g/mL, and 7 (25%) were at or above 1.030 g/mL. No significant correlations were found between age, ht, wt, competitive level, or training hours and the change in SG. The results of this study show that competitive female gymnasts are not properly hydrated when they begin training, and they tend to become further hypohydrated throughout the training session. These results point to the importance of promoting fluid intake by young gymnasts before and during training sessions, as well as following training when consecutive sessions will occur within a matter of

hours. Further study needs to be conducted to investigate whether or not decrements in gymnastics performance occur subsequent to hypohydration.

Poster presentation (PP)

PP1-09 Motor Learning 1/1 - "Exhibition Hall"

DESCRIPTION OF MOTOR LEARNING PROCESS OF ELDERLY SUBJECTS IN ECCENTRIC ERGOMETER TRAINING

Purtsi, J., Vihko, V., Havas, E.

LIKES-Research Center and University of Jyväskylä, Finland

Eccentric exercise has recently been proposed as a feasible and effective method for strength training especially for the elderly (LaStayo et al. 2003). However, as a relatively uncommon and seldom used training modality eccentric exercise may be a challenging motor task and difficult to learn for the elderly. The purpose of this study was to evaluate and describe the learning process during the course of eccentric training intervention.

17 females and 16 males (64, sd 6 yrs) volunteered for the study. The subjects completed a 10-week individually administered progressive training program on motor driven eccentric bicycle ergometer (2-3 training sessions per week). The subject´s task in eccentric bicycle ergometer exercise was to resist the movement of pedals by producing a constant and steady force against the pedals. The target force level was indicated to the subjects by a visual feedback system, but the actual force the subjects generated was also continuously recorded from the current intake of ergometer´s motor. The uniformity of force production during a 30 second period was used to describe the motor performance, named here as proficiency index (PI). PI was calculated by dividing the standard deviation of peak force values by the average of peak force values times 100. PI was analyzed from the second, sixth, 12th and 18th training sessions.

Every subject was capable of operating and function with the eccentric ergometer safely by the 12th training session. The initial PI for the subjects in the 2nd training session was 24.9 (sd 9.1) %. PI improved ($p<0.01$) continuously during the course of training, being 19.3 (sd 8.8) % in the 6th, 12.1 (sd 5.2) % in the 12th, and 9.2 (2.4) % in the 18th training session, respectively. Interestingly, a significant difference in PI between the superior leg and the inferior leg was found in every training session ($p<0.001$). Unfortunately, neither the dominant leg nor specific leg being superior in every training session could not been indicated in these experiments.

By using an objective measure of motor performance we were able to characterize the progress of acquiring a new motor task in a group of elderly subjects. The results indicated that the subjects reached a fairly constant level of motor performance during a 10-week training program. The results suggest that most of the motor learning occurred before the 12th training session, and after that some subjects showed sings of the autonomic phase of motor learning such as being able to talk without it influencing the performance. However, the results also suggest that there may be differences in the motor control and coordination between lower extremities of elderly subjects.

Reference: LaStayo et al. J Gerontol Med Sci 5, 419-424, 2003.

EFFECTS OF HIGH-INTENSITY RUNNING ON SENSORIMOTOR ADAPTATION UNDER CONSIDERATION OF THE EEG SPECTRAL POWER

Mierau, A., Schneider, S., Abel, T., Strüder, H.K.

German Sport University, Germany

Introduction: In most sports physical fitness and technical skills are key factors for high performance. In the practical field, athletes often work on both aspects during one training session. Therefore the correct temporal order of training contents is very important for coaches and athletes. So far only little research has been conducted investigating the interaction between exercise and motor learning with inconsistent results. The aim of this study was to investigate the effects of running at high intensity (anaerobic energy consumption) on brain cortical activity and sensorimotor adaptation. Methods: The testgroup (TG) consisted of 10 right handed subjects (age: 26 ± 1.6 years, height: 178.8 ± 6.2 cm, weight: 74.7 ± 9.1 kg). The experiment started with a pre-exercise resting EEG recording of 2 min duration. After completing EEG recording, subjects started running on a treadmill at 2.0 m•s-1. Velocity was increased in 5 min stages by 0.5 m•s-1. Subjects stopped running when subjective exhausiation was reached. Heart rate (HR), blood lactate concentration, and Borg rate of perceived exortion (RPE) were recorded after each stage. Immidiately after running a 2 min post-exercise resting EEG was recorded. Thereafter subjects were asked to perform 30 episodes (6 Blocks x 5 Episodes) of tracking with reversed visual feedback in the horizontal plane. Manual performance of each tracking episode was quantified as root mean square error (RMSE). The experiment finfished with a post-tracking EEG of 2 min and in resting postion. The controlgroup (CG) (age: 23.9 ± 3.2 years, height: 183.4 ± 5.8 cm, weight: 79.4 ± 7.0 kg) learned the same tracking task without exercising. 2 min resting EEG recording were done before and after tracking. Results: After running abortion subjects reached a mean blood lactate concentration of 10.5 ± 2.19 mmol/l, a mean maximal heart rate (HRmax) of 201 ± 5.3 beats • min-1 and a RPE of 20. Analysis of variance (ANOVA) with the factors Group x Block x Episode showed a significant Group x Block interaction (p ≤ 0.01) in the tracking task. This interaction was further analysed with the LSD-Post hoc Test showing significant smaller RMSE for Block 1 and 2 (first 10 episodes) in the TG. EEG alpha and beta2 power were increased after running in the testgroup as well as alpha, beta1 and beta2 after tracking in the controlgroup (ANOVA: p ≤ 0.01). Conclusion: We concluded that there is an overal increase in cortical activation after running at high intensity. This activation could have positive effects, such as higher level of attention, on the initial sensorimotor adaptation process. Further research is needed to investigate whether peripheral changes, such as muscular fatigue, are more likely to be the reason for reduced sensorimotor adaptation after intensive exercise.

STUDY OF ATTENTIONAL FLUCTUATIONS DURING A BALL FLIGHT, IN NEUTRAL OR OFFENSIVE CONDITIONS IN TENNIS PLAY

Journeault, N., Chabaud, P.

Université Claude Bernard - Lyon 1, France

The aim of this study was to highlight the attentional processes engaged by the tennis player during incoming trajectories. Two hypotheses are tested: firstly, attentional level of the player should vary during the ball flight; secondly, the player should be able to pay different

attention (at the same time of the ball flight) between two conditions: in neutral situation (backhand to backhand), and when the opponent is going to play a volley. So, we built an experimental protocol to probe attentional demands for the player involved in the game, and respecting real conditions of the game: ball speed, uncertainty and variability.

This study is based on the dual-task methodology. The explanatory model is Kahneman's (1973). Twelve male tennis players voluntary participated in this experiment. Subjects (aged 17 to 34 years) are intermediate level (30 to 15/1, french ranking). They were equipped with a High-Frequency (HF) helmet and a HF microphone. First, they were asked to perform a Choice Reaction Time task, with sound stimuli (lateralised left/right) and vocal answer ("Left" or "Right"). This is the Reaction Time (RT) reference condition. Then, on the court, Subjects (S) were asked to perform a dual-task. They have simultaneously to answer to the same stimuli (named secondary task) and to play against a Partner (P) player (named primary task). Each point is divided into two phases. In a first time, S and P are playing together (the exchange phase, or neutral condition), cross the line, on the backhand side of the subject. Then, at any time, P can break the exchange phase (attack, or offensive condition). Among these breaking actions, P must go to play a number of hitch volley. The subject tries to win the point as soon as he detects an offensive action from P.

During these two experimental conditions, some critical instants of the time course of the trajectory from P to S are studied. The neutral condition presents 4 temporal zones studied : zone 1- close to P hitting the ball; zone 2 - when the ball cross the net; zone 3 - just before the ball bounds; zone 4- between the bound and S hitting. The offensive condition explores only the two last zones.

Median RT for the reference condition is 432 ms. In neutral condition, zones 1 and 3 present the most important RTs (770 and 759 ms respectively) versus zones 2 and 4, lower RT (712 and 713 ms respectively). Zone 1 differs significantly from zones 2 and 4, zone 3 differs only from zone 4 ($p<0.05$). Different attentional levels engaged by the player in neutral condition are shown during trajectory of the ball. Then, offensive condition presents median RTs significantly higher in zone 4 from zone 3 (853 vs 736 ms, $p<0.05$). Zone 4 median RTs are significantly different between neutral and offensive conditions ($p<0.05$). This shows that attentional fluctuations are also dependent on the condition of play (neutral vs offensive).

"BRAINS IN SPACE I" - EFFECTS OF STRESS ONTO SENSORIMOTOR ADAPTATION

Brümmer, V., Schneider, S., Mierau, A.

German Sport University Cologne, Germany

Background

Changed forces of gravity lead to a variation of sensorimotor coordination. Until now it has not been differentiated between primary influences of weightlessness and secondary influences due to psycho-physiological factors (e.g. stress). Therefore it seems necessary to correlate sensorimotor deficits during weightlessness with stressors that arise from the situation. This would show whether changes in the level of gravity themselves lead to changes in sensorimotor performance or whether these changes are merely secondary stress-related. Moreover it seems helpful to substantiate previous assumptions of „non-specific effects of multiple stressors" (Fowler, Bock, and Comfort, 2000; Manzey, 2000) as well as to clarify what consequences potential changes in central nervous activities and increasing concentration of hormones do have on sensorimotor qualities. The result should reveal basic information on the processing of the human sensorimotor system and therewith allow a better preparation for long-term inhabitations of space and to enhance the scheduling of minute motor activities in space

Method

During the recuring one-G (normal gravity) phase of a first parabolic flight campaign seven subjects were asked to perform a sensorimotor learning task. Task performance was quantified as RMS-Error over 23 episodes, each lasting 18 seconds. To visualise changes in cortical activity a EEG at rest was taken at the beginning, at the end and at two times during the flight. EEG was subdivided by FFT into alpha and beta frequency ranges. Blood was taken from the subjects before the first parabola, after the 5th, the 15th and the 25th parabola. Cortisol and prolactin were determined out of this blood samples. A second group of subjects performed the same procedure including tracking task, rest EEG and blood collection under 'stresslless' conditions in our laboratory.

Results

Comparing the learning performance we found a distinct decrease in performance during the one-G phase compared to the control group. This decrease came along with an increase of beta1 and beta2 frequency ranges which traditionally is regarded as an increase of arousal and stress. No changes in cortical activity were found for the control group. Moreover cortisol and prolactin values increased significantly for the flight group whereas no changes were detected for the control group.

Discussion

Results seems to approve the assumption that a decrease of sensorimotor performance during phases of weightlessness is not only dependent on gravity levels. Psycho-physiolocigal effects have to be considered as a relevant factor for sensorimotor processes as a decrease in sensorimotor performance can be found even when tasks are performed under one-G-conditions in parabolic flights.

A following parabolic flight campaign in May in which subjects will perform the same task under zero-G conditions should reveal to what extend task performance is dependent on gravity level.

CAN PROCEDURAL AND DECLARATIVE MEMORY BE INFLUENCED BY BLOCKED PRACTICE ORGANIZATION IN ADOLESCENTS?

Berchicci, M., Robazza, C., Bertollo, M.

Faculty of Human Movement Science, Italy

The interference that results from practicing various tasks was called contextual interference (Battig J.W., 1979). Moreover Anderson J.R. (1982) proposed that, during motor skill acquisition, declarative process come before to procedural memory process. However procedural knowledge can be acquired in absence of declarative knowledge (Maxwell J.P., Masters R.S.W. & Eves F.F., 2003).

Our primary purpose, in the present study, was to determine the influence of the practice organization (blocked, random and control) on motor learning. The second aim was to establish the different level of learning acquisition between blocked or random organization on motor memory and memory for movement, which are related to procedural and declarative knowledge.

Sixty-nine students (age M=16.06, SD=1.17) were required to perform a complex skill, constituted by a sequence of steps, electronically originated through the "all music dance" instrument. The participants had to follow a luminous arrows sequence prospected on the screen. No participants had prior experience with the task. The software assigned a score in function of spatial and temporal precision. Scoring was available on video during practice.

The protocol phases were:

1. Testing phase: in the first day four assessment were implemented (1 baseline and 3 tests) comprising different footstep sequences.

2. Practice phase: practice involved 25 participants in a blocked organization and 22 participants in a random organization. The control group (22 participants) took part in regular physical education lessons on coordinative tasks. Each group performed tasks in six lessons (30 min per lesson), twice a week.

3. Retention and recognition phase: in this step all participants reproduced the 3 footstep sequences on a mat controller. Afterwards 3 recognition test (McPherson & Thomas, 1989) were administered to evaluate memory for movement that refers to their knowledge on relevant facts for each footstep sequences.

RM-ANOVA 3 (practice condition: blocked, random and control) X 2 (mean test and mean re-test) showed significant effects of practice organization on performance, F2,69=7.409, p=.001, eta2=.183. Sheffè post hoc test (p=.001) indicated that the blocked group obtained higher score than the control group.

MANOVA 3 (practice organization) X 4 (test: baseline, mean test, mean retest and mean recognition) showed significant difference between performance in the test main factor, Wilks' λ=.733, F2,69=2.651, p=.001, eta2=.144. Univariate ANOVA showed significant difference only for practice organization group at retest, F2,69=9.524, p=.000, eta2=.224. Scheffè post hoc yielded significant differences at retest. Both blocked and random groups reported higher learning score compare to the control group.

In conclusion finding support the argument that motor memory and memory for movement contribute differently to performance (Maxwell J.P., Masters R.S.W. & Eves F.F., 2003).

ELECTROMYOGRAPHICAL CHANGES OF REPETITIVE BALLISTIC CONTRACTION TASK IN SHORT TERM

Yamanaka, K., Sasada, S., Yoneda, T.

Juntendo University, Japan

The neural mechanism for the rapid voluntary movements such as kicking or jumping has been postulated to be derived from the stereotyped neural program of the cerebral cortex. This means that the results of ballistic force exertion must depend on the precision of the program made by the cerebral cortex. It has also been reported that ballistic force exertion is not only a stereotyped simple phenomenon but is a changeable. If the training effect is observed in ballistic contraction training, how long a term and/or how much strength should be required? This is an especially important factor for muscle activity in sports which need powerful work. Classen et al. (1998) reported that rapid plasticity of "cortical movement representation" occurred in continuous training during only 30 min. We tested whether the repetitive practice of ballistic force exertion in short term induced training effects or not, by means of EMG.

Twenty-three subjects (7 women and 16 men) conducted 3 sessions (1st, 2nd and 3rd session in a day) of a "Force matching task" (3 targets, 10, 30 and 50%MVC) under ballistic isometric voluntary contraction by knee extension with the electrodes affixed continually (60 trials = 1 session). Subjects were instructed to perform the task as fast as possible and with accuracy. From surface EMGs (from m. rectus femoris, m. medial vastus and m. lateral vastus), we analyzed EMG dwell time (EDT) and integrated EMG only for the period when it contributed to the force generation.

First, we confirmed that time to peak force of force performance was improved by training. Secondly, we observed that EDT of 3rd session was shortened significantly in all agonist muscles across subjects compared with those of 1st session ($p<0.001$). Furthermore, amount of discharge was decreased significantly at only m. rectus femoris between 1st and 3rd ($p<0.001$). However that of m. lateral vastus was increased significantly ($p<0.001$). That is, muscle discharge tendencies which showed increase or decrease were not unitary among muscles.

From these results, it could be said that the on-off neural program of ballistic force exertion could change in the short terms through repetitive training. In terms of amount of discharge, the inconstant results described above showed inconstant contribution among agonist muscles after repetitive training. It seems likely that the neural strategy using single joint muscle and double joint muscle should be flexible.

Classen J., Liepert J., Wise S., Hallett M. and Cohen L. (1998) Rapid plasticity of human cortical movement representation induced by practice. J Neurophysiol 79, 1117-1123.

HEART RATE VARIABILITY AND BREATHING RTHYTHM DURING LIANGONG OF CHINESE HEALTHY GYMNASTICS

Nagata, A., Yokoyama, Y., Tajima, T.

Toyama International Research Center for Traditional Medicine, Japan

Purpose: This study has been planned to get what effects would appear on the neurology field of the autonomic nervous activity (ANA) during Liangong gymnastics (LG). Also, we designed this experiment having the object of demonstrating some relationship between the breathing exercises and ANA. And as the traditional Chinese exercise, LG should be proposed as "Breathing relax" gymnastics, psychophysiologically. Methods: Five patterns of LG were selected such as MAHO, SUIKEN, SHOUKI, KAIKYU, and HAKU-IKI as the typical motion, and these LG patterns were practiced three routines of each motion for five minutes. As other exercise, the slow walking (WK, 75m/min) was practiced on the treadmill for five minutes to compare with LG on the viewpoint of the neurology. Six healthy volunteers of three LG career and three beginners were measured the expired gas, the heart rate variability (HRV), and the breathing rhythm (BR) during those exercises. HRV and BR were processed by the time series analysis to get Power Spectra (PS) for 30sec with the sampling rate of 500Hz. The frequency program of MemCalc was applied for those data of HRV and BR at elapsed time during those exercises. Then, PS of HRV was divided to twice bands of High Frequency (HF, 0.15-0.4Hz) and Low Frequency (LF, 0.05-0.15Hz). PS of BR were classified in four bands related to densities of PS and following bands were divided to Low Frequency (LF, 0.03-0.15Hz), Middle Frequency (MF, 0.15-0.4Hz), High Frequency (HF, 0.4-1.0Hz), and Very High Frequency (VHF, 1.0-10.0Hz). Those densities of PS bands have been estimated with the activity balance of ANA of the parasympathetic nervous system (PSN) & the sympathetic one (SN), individually. Results: The heart rate of LG showed average 90±5 bpm, and WK one was mean 105±7 bpm. Cardio-circulatory variables of the oxygen uptake and the carbon dioxide output were observed on little changes during those exercises, and LGs metabolic intensity was kept the average 2.5 ± 0.7 METs. While, METs of WK was the mean 3.2 ± 0.8. HF and VHF bands of HRV and BR in the case of the career during his LG increased more remarkable than ones in the case of the beginner during his WK, significantly. In reverse, LF and MF bands of HRV and BR during LG decreased more substantially than ones during WK. Discussion & Conclusion: PSN activity during LG of the career might increase more significant than that during his WK. While, SN one should be attenuated during this LG. Then, WK is thought to be the typical aerobic exercise with SN, and LG may be such a relax type with PSN as a breathing movement. Furthermore, such Chinese classical gymnastics as LG or Wuginxi should be dignified as the typical psychological exercise promoting action of PSN, utilizing to the mental healthy treat-

ment and the spiritual healing in our living. Reference: Mikko p. Tulppo, et al, Effects of aerobic training on heart rate dynamics in sedentary subjects. J Appl Physiol 95: 364-372, 2003.

EFFECT OF CADENCE ON LEG MUSCLE RECRUITMENT DURING CYCLING IN NOVICE AND HIGHLY TRAINED CYCLISTS

Chapman, A.R., Vicenzino, B., Blanch, P., Hodges, P.W.

The University of Queensland, Australia

The relationship between muscle recruitment, cadence and cycling training history has not been fully investigated. This study investigated the relationship between leg muscle recruitment and cadence in novice and highly trained cyclists. Participants were nine highly trained and ten age-matched novice (i.e. recreational level) cyclists, who had been cycling for 10.2 ± 1.4 and 1.4 ± 0.4 years, respectively. Each of the highly trained cyclists had Australian national or international level competition experience or had qualified for World Championship representation in the year of testing. Four experimental conditions of cycling at individual preferred cadence (IPC), 55-60, 75-80 and 90-95 rpm were investigated. Cycling intensity was controlled using ratings of perceived exertion (RPE). Participants were provided with feedback to modify exercise intensity until an RPE of 15 was obtained. Electromyographic (EMG) activity of tibialis anterior, tibialis posterior, peroneus longus, gastrocnemius lateralis and soleus muscles was recorded using intramuscular electrodes. The effect of cadence on muscle recruitment was analysed by comparing times of EMG onset, offset and peak amplitude, mean and peak amplitudes, individual variance (variability of muscle recruitment between pedal strokes), and muscle coactivation between cadences, using analysis of variance (ANOVA), and modulation of muscle activity (i.e. relative amplitude and duration of primary (main burst) and secondary (between main bursts) muscle activity) between cadences using general linear models. The relationship between EMG variables and IPC was investigated using regression estimates and ANOVA. IPC was not different between novice (77.1 ± 4.4 rpm) and highly trained cyclists (79.7 ± 3.4). Peak EMG amplitude increased linearly with cadence in both groups. However, EMG amplitude in periods between primary EMG bursts (secondary muscle activity), as well as the duration of primary EMG bursts (and therefore muscle coactivation), increased with increasing cadence in novice cyclists but were not influenced by cadence in highly trained cyclists. Cadence did not influence times of peak EMG activity or individual variance in either group. EMG variables were not different at IPC to predicted values in either novice or highly trained cyclists. Therefore, IPC does not appear related to leg muscle recruitment. However, increases in the duration of primary muscle activity, relative amplitude of secondary muscle activity and muscle coactivation with increases in cadence are likely to reflect less skilled control of the movement and increased energy cost at higher cadences in novice cyclists.

MEASUREMENT OF CAPACITIES OF DECISION IN THE BASKETBALL

Refoyo, I., Sampedro, J., Calderon, J., Lorenzo, A., Calleja, J.

Faculty of Sciences of the Physical Activity and Sports. U.P.M., Spain

The object of this study is the one to value the improvement of the capacities of decision in an equipment sport as it is the basketball. The selected methodologic design is based on a qualitative method descriptive compound, adapting it to the characteristics that come together in this investigation. We made a longitudinal temporary design, in which to the group it is compared to him with same himself. In our case, 11 players of between 17 and 18 years old of high level. In order to measure this reliability between the registries 300 (approximately a 10% of the total) registries of each observer and each observation were chosen (second and third). Was a coefficient of correlation of 0,90. The triangulation method determining to 3 observers was used. Between the 300 registries a value of 0,92 was determined the coefficient of correlation between these three observers obtaining. In the conceptual measurement of the knowledge of the correction of the tactical decision a questionnaire of 12 questions was used type test the questionnaire was validated by 22 experts. For the analysis of the tactical decision in game actions of numerical equality were used and in those of offensive numerical superiority. The final election of these exercises was validated with the contributions of 17 experts: 1 against 1; 2 against 2; 2 against 1 and 3 against 2. The valuation of the tactical decision was always made on the player in possession of the ball. For the valuation of the decisionales aspects the technique of observation of the exercises previous, being elaborated a registry table contemplating the following sections and valued was used like INCORRECT vs CORECTO. These tests were repeated with a difference of 3 months. In the statistical valuation of the percentage differences a chi-square test was used (2, SPSS 9,0).

Results: the subjects that have better conceptual knowledge, are those that less incorrect decisions make. (11,2%), on the contrary the subjects whose value is located below the value of the medium one in the score of the questionnaire, present/display a greater percentage of mistakes (16,9%). The results reflect an improvement in the tactical decision obtained in the second test with respect to those of first. The percentage correct decision of the 1 against 1 in the first test is of a 78.5% being of a 87.2% in the second test. In the situation of 2 against 2, in the first test a percentage of correct decision of a 77.2% being in the second test of a 92,9% takes shelter. In the situation of game of 2 against 1, in the first test we found that the percentage of correct decisions is of 87.4%, being of a 93.1% in the second. Finally, in the situation of game of 3 against 2 we appreciated a percentage of correct decisions of the first test of a 90.1%, and a 92.7% the percentage of the second test.

VISUAL SEARCH PATTERNS AFTER VISUAL TRAINING PROGRAMMES IN NOVICE TENIS PLAYERS

Moreno, F., Luis, V., Menayo, R., Reina, R.

Universitiy of Extremadura , Spain

Introducing visual training programmes to a tennis player's regime has proved to be very effective in reducing the time between visual perception and reaction response (Abernethy & Wollstein, 1989). Researchers have suggested that knowledge of the most pertinent or informative areas of the display is crucial to successful performance (Williams et al. 1999).

The aim of this study is to examine the role of visual search strategies in sport learning and how can it be modified. We have analysed the influence of two visual training programmes and practice on visual search strategies of novice tennis players in a task of approaching the net. Many programmes have used video as a means of improving reaction response time but few studies have been performed in real-life, on court situations. In this work, analysis has been made both in a video-based condition and on court. A tennis approach shot situation is simulated by a video-projection, whereby the player has to react quickly and precisely in an attempt to win the point with a volley. The programmes applied, based on anticipation techniques, seek to improve performance responses to the specific task.

Forty novice tennis players participated in the experiment. After an initial evaluation of their performance, the participants were divided into the following four experimental groups of equal size and similar performance level. Using a 5x3m retro-projection screen in the laboratory, the players had to simulate an approach to the net in an attempt to win the point with a volley. They observed film of a skilled

tennis player hitting a passing shot and then had to react as quickly as possible in the correct direction to the on-coming passing shot. Two of the groups carried out two training methods, precueing and occlusion. One group only practice in laboratory situation and one group was used as control.

The dependent variables were the fixation location, fixation time and, specially, visual search pattern. The variables have been analized regarding to visual training programmes, in relation with the type and direction of pashing shot, and in video-based or on-court conditions. The results show differences in visual fixations in duration and location after the training. The visual search pattern shows singular modification regarding both the most pertinent areas located by the players and the sequence of fixations. This poster presentation will focus on to represent qualitative changes in visual patterns after the training.

Abernethy, B, Wollstein J.R. (1989) Improving anticipation in racquet sports. Sports Coach. 12, 15-18

Williams, A.M., Davids, K. and Williams, J.G. (1999). Visual perception an action in sport. London: E & FN Spon.

SHORT TERM TRAINING EFFECTS OF VOLUNTARY RAPID CONTRACTION

Sasada, S., Yamanaka, K., Yoneda, T.

Juntendo University , Japan

Estimation ability of ballistic force exertion is important for understanding rapid work capacity. It has been reported that some training effects were shown in long term training of repetitive ballistic contractions (Yoneda & Kimura 1984). Furthermore, it has been reported that voluntary movements were exposed to plasticity of CNS even in thirty minutes (Classen et al. 1998). An interesting new problem arises as to whether rapid force estimation can be improved in the short term or not. The purpose of this study was to clarify the training effects of repetitive voluntary rapid contraction in the short term.

Twenty three subjects (7 women and 16 men) performed a "ballistic force matching task" (3 targets force, 10%, 30% and 50%MVC, repectively) by knee extension under isometric condition in a day. Subjects were asked to hit the target line as fast as possible, and accurately, in the task. One session of each target force consisted of sixty trials (15trial ×4set), and then subjects performed three sessions (1st -2nd -3rd). The interval between each session was 4 hours. Forces performed by subjects were analyzed according to the performance of accuracy (absolute error: AE and constant error: CE) and time (time to peak force: TPF and force ratio: df/dt). We compared the recorded data in intra- and inter-session.

TPFs of all target forces in the 2nd session were significantly shortened in comparison to these of 1st session ($p<0.05$) in all subjects. TPFs of 30%MVC and 50%MVC target forces in 3rd session were also significantly shortened in comparison to that of 1st session ($p<0.05$) in all subjects. AE of 30%MVC and 50%MVC target forces did not significantly change in all subjects. In 10%MVC target force, the performances were not uniform in all subjects. However, training effects were not uniform in the short term for each subject.

In this study, TPF improved in spite of the fact that AE remained in ballistic force matching task. Taking account of "Speed-Accuracy Trade-Off' (Fitts, PM, 1954), these results suggested that performance was improved. Our results supported these of previous studies (40 days training: Yoneda and Kimura.1984, a weeks training: Moritani & Mimasa, 1990). Furthermore, this study clarified the training effect of voluntary ballistic force exertion in a day. The improvement of the performance implies at short term training causes some changes of CNS.

References

Classen et al., J. Neurophysiol., 79:1117-1123, 1998.

Fitts, J. Exp. Psychol., 47: 381-391, 1954.

Moritani and Mimasa, J. J. Sports Med & Sci., 4: 35-43, 1990.

Yoneda and Kimura, Juntendo. Bull. Healh & Physical. Edu., 27: 7-15, 1984.

Poster presentation (PP)

PP1-10 General I (Physioth./Rehab./Traumat.) 1-2 - "Exhibition Hall"

PROGRESSIVE RESISTANCE TRAINING FOR RESTITUTION OF MUSCLE MASS AND STRENGTH IN HUMAN CANCER CACHEXIA

Renk, H., Krakowski-Roosen, H., Weber, M.A., Kinscherf, R., Künkele, A., Schmitt, T.L., Kauczor, H.U., Hildebrandt, W.

German Cancer Research Center, Germany

Cancer cachexia is associated with progressive muscle wasting leading to reduced exercise capacity of relevant locomotor muscles. At present there is no effective clinical intervention to preserve muscle mass and function. It is unclear whether workloads that are anabolic stimuli at health may aggravate muscle wasting in cancer cachexia, because circulating cytokines that to contribute to cancer cachexia (IL6 and TNFα) are expressed and released by skeletal muscle itself upon exercise. This study for the first time evaluated the effect of strength training on muscle mass, function, and morphology in cancer-cachectic patients compared to healthy controls.

The anabolic effect of progressive resistance training (isokinetic system ISOMED 2000) was studied in 10 cachectic patients with mainly gastrointestinal cancer as compared to 26 healthy controls of similar age. The training program was performed in 16 sessions (8-10 weeks) of isokinetic knee extension-flexion-cycles at 75% peak torque (PT) and isometric contractions at 100% PT. Measurements before as well as after training included body weight, body cell mass (BCM) by bioimpedance, knee extensor maximal cross-sectional area (CSA) by magnetic resonance tomography, and aerobic capacity (VO2max). Knee extensor isokinetic and isometric PT were assessed at each training session. Moreover, biopsies from the vastus lateralis muscle were obtained for morphological analysis from all patients and 10 age- and gender-matched controls at baseline and after training (5 patients).

The training increased muscle mass and strength in cachectic patients which revealed incremental slopes of knee extensor isometric and isokinetic PT (20.1+-6.1% and 13.7+-4.4% per 8 w, respectively; mean+-SEM) that were virtually identical to that of controls (22.2+-5.8% and 10.2+-4.1%). Corresponding increases in knee extensor CSA were observed in both groups together with slight increases in BCM and body weight. Muscle biopsies at baseline showed a significantly reduced mean fiber size and an increased count of type IIa fibres at the cost of type I and IIx fibers in cachectic patients compared to controls. Upon training intervention type IIx fiber size and fractional area increased in controls ($p<0.05$) and patients ($p<0.10$). Isokinetic PT per muscle CSA correlated with type IIx fiber size and fractional area

and increased as well. Training significantly enhanced VO2max in patients but decreased it in controls, thereby corresponding to the morphological response of type I fibers.
Controlled progressive resistance training is a save, tolerable and effective countermeasure against muscle wasting and weakness in cancer cachexia. It increases muscle strength, CSA, and BCM within a rather short time and may reverse the morphological changes with cachexia. Thus it has the potential to become an important component of rehabilitation programs.

RESISTANCE TRAINING IMPROVES NATURAL KILLER CELL ACTIVITY IN CACHECTIC CANCER PATIENTS

Künkele, A., Renk, H., Schmitt, T.L., Hildebrandt, W., Krakowski-Roosen, H.

German Cancer Research Center, Germany

Training has already been described as a modulator of human immune defence leading to increased activity and count of NK-cells, which are reduced upon over-training. In healthy humans moderate e.g. endurance training succeeded in stimulation of NK cell activity but data in cancer patients are scarce. The aim of this study was to evaluate the influence of a strength training program on the immune system of healthy humans and cachectic cancer patients.
Method: Blood samples from 16 cancer patients that suffered from cachexia and from 30 healthy controls were taken before the resistance training period: 16 times in 8-10 weeks with isokinetic (60-90°/s) and isometric bouts of knee flexion and extension with a workload of up to 100% MVC. 5-10 days after the last training set blood was taken again in 4 cancer patients and 24 controls. NK cell activity was obtained by a Chrom51-release immunoassay. VO2-max was obtained by a spiroergometry with stepwise load increments of 25 W every 2 minutes. All data are given as mean ± S.E.M.
Results: Before training the NK cell activity of the cancer patients was significant lower than in the healthy controls (25.2 ± 4 and 41.1 ± 4 respectively). Training increased NK cell activity of all cancer patients from 24.6 ± 6.4 to 35.5 ± 9.4, but data were only obtained from 4 patients who were able to sustain the training period. In contrast, the NK cell activity of the healthy controls (n=24) decreased significantly from 43.7 ± 4.7 to 31.4 ± 3.1. At baseline a significant correlation between NK-cell activity and VO2-max per body weight was found. Moreover, training related changes in NK-cell activity correlated with changes in VO2-max within the small group been analyzed.
Conclusion: These preliminary data from 4 cachectic cancer patients suggest, that controlled progressive resistance training seems to be a save, tolerable and effective method to stimulate the immune system of cancer patients by improving the activity of the NK cells. Furthermore this strength training program could improve endurance capacity in the patients, but failed to do so in the healthy controls. At the moment it remains unsolved whether the link between VO2-max and NK-cell activity may be a direct pathway or is simply coincidental or by cocorrelation. The results warrant further investigations.

THRESHOLDS OF PHYSICAL ACTIVITIES FOR NEEDED TO LIVING A SELF SUPPORTED LIFE FOR ELDERLY WOMEN

Hayato, N., Takahiro, Y., Tatsuya, M., Taketaka, H., Katsuo, N., Lixin, W., Takashi, S., Shigeo, F.

Graduate School of Medicine, Osaka City University, Japan

Purpose: To decide the thresholds of physical activities necessary for a self-supporting life using a discriminate analysis between community-dwelling elderly people and daycare service received elderly people in Japan.
Method: Total twenty-six elderly women, twelve elderly living a self-supported life (self-supporting elderly) and fourteen elderly using a daycare service (daycare elderly) were recruited in this study. The parameters of physical performance examined were grip strength, sit and reach, 10m obstacle walking, 6minutes walking distance (6MD), one leg balance with eye opened and functional balance. Isometric knee extension and flexion muscle forces measured by a handheld dynamometer and muscle mass measured by bioelectrical impedance analysis. And activities of daily living (ADL) score was evaluated by using the number of steps daily and ADL index concerning 12 items for daily living. Data analysis was used unpaired student-t-test and discriminate analysis for examined between self-supporting elderly and daycare elderly.
Results: Muscle masses, grip strength, knee extension/flexion muscle force, 6MD, 10m obstacle walking, one leg balance with eye opened and functional balance in elderly living a self supporting life were higher than those in using a daycare service elderly. In this study, we examined that thresholds of physical abilities for living a self-supporting life using the methods of discriminate analysis between self-supporting elderly and daycare elderly. The most clearly discriminated item of physical abilities parameters was 6MD, which the classifies point and classifies accurately were 313.01m, 100%. Furthermore, the second clearly discriminated item was 10m obstacle walking, which the classifies point and classifies accurately were 18.25 sec., 96.0%. These results indicate that gait abilities were important index for needed to living a self-supporting life by elderly people over 75 years old. And another items of classifies point better than 75% classifies accurately were knee extension force (257.10 N), total body muscle mass (14.27 kg), thigh muscle mass (4.58 kg), ADL index (23.21) and daily steps (2342 steps).
Conclusion: The present study indicates that thresholds of physical activities including gait abilities, muscle force and muscle mass were very important index to maintain a self-supporting life for elderly people. Especially, it was shown that gait abilities were necessary to recover a self-supporting life for daycare service received elderly people as well as recover the lower-extremities muscle force and muscle mass.

SPECIAL CHARACTERIZATION OF LINEAR CHANGE OF PLACE

Koltai, E., Szilagyi, T.

Semmelweis University, Hungary

Special characterization of linear change of place
E. Koltai–T. Szilagyi
Semmelweis University, Faculty of Physical Education and Sport Sciences
Dept. Biomechanics
Keywords: injuries of lower extremity, gait, out body aid equipment, animal movement, stability, rehabilitation
Human gait is connected to vertical body position. In case of physiological walking the advancement is resulted from coordinated movement of lower extremities. This type of movement may have two supports because it resulted from two mechanical apparatus. In reality, the sole provides three point support itself.

After an injury the joint/muscle coordination structure is damaged. The affected person has to use medical support equipment. Our previous analyses has been performed in four manner: without medical support equipment, with supporting stick, elbow crutch and walking frame. Results of using medical aids in these types of movement could be described with multi point support. As for conclusion the elbow crutch is the best supporting equipment.

Our previous studies investigated gait of different persons in cases of using different medical aids with fixed and free lower extremities. This study deals with linear movement phases of different living systems: healthy human movement, human movement with medical aid equipment, horse movement and insect movement. Our investigations tried to compare the similarities and differences between these movement types.

The main indication of application of a medical aid is that the most stable support is assured by three points. Using equipments external to the body can modify the dynamical stability and can provide the three point support. After injury the main purpose of the rehabilitation program is the stabilization of the gait mechanism to obtain the maximal safety and best similarity to physiological gait.

Our goal was analysing the effect of different medical aim equipments on the structure of gait and to compose some basic principles for helping the rehabilitation. It is important, because of sometimes the injuried persons are not informed properly on using the medical equipment but their effectiveness under medical processes is very important. The perfect explanation, interpretetion and control of practice increases the possibility of success.

For computerised analysis we used the APAS video system. The sampling frequency was 60 Hz. We used three cameras (2 JVC GR-DVL 9800 NTSC and 1 PANASONIC M10 PAL). Shutter speed was 1/100 sec.

The result of this investigation is that the use of medical aids effects the physiological gait from many points of view. The movement structure with medical aid differs from the structure of free movement. The results demonstrated that generally the three point support assures appropriate stability. In some cases more point support required. As for conclusion, it is possible to define the best medical aid equipment for the rehabilitation process and therapeutist can teach the patient to optimal movement with these equipment.

EXERCISE ACTIVITY DURING HAEMODIALYSIS - THE TOOL FOR BETTER QUALITY OF THE LIFE IN PATIENTS WITH CHRONIC RENAL FAILURE

Mahrová, A., Bunc, V.

Faculty of physical Education and Sports, Czech Republic

Introduction:Patients with chronic renal failure (CRF),treated with dialysis,are often polymorbid.They are characterised by sever functional limitations that leads to reduced physical activity and sedentary lifestyle preferences.Owing to hypokinesis,they lose physical fitness,which in turn,results in loss of self-sufficiency and self-reliance.Their quality of the life (QL) is getting worse together with the disease´s progression.

Aim:To evaluate the effect of regular application of the exercise activity during haemodialysis sessions on functional condition and on QL in patients with CRF.

Study population and methods:We observed the group of 23 patients. According to active focus for participating in the project,we separated the whole group on experimental (EG) and control group (CG).EG included 13 patients (mean age: 59,3±14,6 y.) that were interested in exercise program participation.CG included 10 patients (mean age:62,9±16,1 y.).For evaluation of the functional condition we used the„Senior Fitness Test Manual"(RIKLI – JONES, 2001).For evaluation of the QL we used standardized questionnaire tool SF-36.In consequence was the QL evaluated after an exercise intervention,separately in an EG and CG.Changes of variables in SFT tests within the groups at the start and the end of the study were evaluated using the Wilcoxon signed rank test.The Mann-Whitney U test was used to compare the results between groups.

Results:After 12-weeks exercise program we noted in EG statistically significant improvement above all in tests,which requiring for its implementation muscular strength of lower extremities and physical efficiency.According to exercise program contents,which was mostly specialized on lower extremities strength,we claimed,that expectant positive effect of regular physical activity on functional condition was proved.In CG we noted between measurements mostly inconclusive and statistically non-significant impairment of the performance.

We noted a positive effect on the QL in patients of EG.The QL in CG was getting worse,especially in physical function domains.

Conclusion:Results from our project confirmed the positive influence of regular exercise activity on the QL in HD patients.The improvement in physical functioning in CRF patients after exercise training is found to be accompanied by distinct psychosocial benefits, morbidity and mortality decrease,the quality of the life with dialysis is improving.An acceptable choice of regular exercise activity for patients with CRF together with another treatment methods is the best way of non-pharmacological character, that offers to the patient an opportunity to achieve an optimal functioning and psychosocial level for each one almost equal to premorbid state.

References:RIKLI,RE.,JONES,CJ.Senior Fitness Test Manual.Human Kinetics,2001.

A COMPARISON OF RANGE OF MOTION GAINS BETWEEN PNF PROTOCOLS

Wheeler, N., Fiolkowski, P., Paine, T.J., Sheard, P.W.

University of Luton, United Kingdom

Introduction: Proprioceptive neuromuscular facilitation (PNF) is a frequently used therapeutic intervention which has been demonstrated to increase range of motion (ROM) at the treated joint. While the positive outcomes of PNF in increasing range of motion (ROM) have been substantiated repeatedly, there is still no clear guideline as to the optimal protocol for this treatment. Many patients will receive a variety of PNF protocols, with one variable being the strength of the muscular contraction. While some protocols call for 100% maximal voluntary contraction (MVC) there are a variety of protocols that indicate differing intensities. The purpose of this project was to compare the ROM gains following PNF treatment using 2 different intensities of MVC.

Methods: Twelve healthy male adults with no history of injury to the lower extremity served as participants in this study. Participants' mean age was 23.17 +/- 2.92 years. All participants signed an informed consent prior to the start of data collection. Data collection consisted of 2 sessions in which participants performed a 5 minute warm-up on a stationary bicycle followed by the PNF protocol at 30% MVC or PNF at 100% MVC. The protocol consisted of repeated 10second isometric contractions after the limb had been moved to its end ROM. ROM at the hip with the knee fully extended was measured with a clinical goniometer (MIE Medical Research) following the warm-up massage and then again after each PNF treatment. All test sessions were completed 1 week apart. Treatment sessions were randomized using a Latin Square design and data were analyzed with a repeated measures ANOVA.

Results: The mean ROM gain following PNF at 30% MVC was 15.5 +/- 5.1 degrees. Mean ROM gain following PNF treatment at 100% MVC intensity was 14.4 +/- 5.0 degrees. The results indicate no difference in ROM gains when comparing the contraction intensity (p = 0.24).

Conclusion: There is a plethora of research to identify treatments for improving ROM, or restoring ROM following injury or immobilization. PNF has been studied for years, and the outcomes for both strengthening and flexibility are not in dispute. While 100% MVC is a common technique, this intensity of contraction may not be applicable in all situations, such as in rehabilitation from an acute injury or when it may be advisable to avoid systolic pressure rises. Anecdotal reports from the participants indicate that maximal intensity contractions can be quite uncomfortable, and 3 subjects reported cramping. The results of this study indicate that improvements in ROM are comparable whether the clinician is using a 30% or a 100% MVC. From a clinical standpoint, this may provide further guidelines for the planning of a safe and effective rehabilitation program.

PHYSICAL FUNCTION IMPROVED IN ELDERLY WOMEN ADMITTTED TO A REHABILITATION PROGRAMME

Juhl, C.

Gentofte Hospital / University of Copenhagen, Denmark

BACKGROUND AND PURPOSE:

The number of elderly patients in geriatric hospital departments is increasing, especially patients above the age of 90.The elderly patient's level of physical function at the end of the rehabilitation process is an important outcome to assess, since it often determines whether a patient can return to his or her own home. The aim of this study was to investigate the effect of a multidisciplinary rehabilitation programme on physical function in elderly women admitted to at Geriatric department.

MATERIAL: All women admitted to a geriatric department in 2005 were included: 228 women, mean age 85,8 years (CI 95% 73,8 – 97,9 years).

METHODS: Outcome measures were: Timed "up and go" (TUG), Guralnik's test of balance and a 30-sec. chair-stand test (sit-to-stand). Patients were tested within three days after admission and at discharge.

The multidisciplinary rehabilitation programme was individualised according to patient needs and consisted of medical care and treatment, physical therapy and occupational therapy.

ANALYSIS:

The data were analysed in three age groups 70 – 79, 80 – 89 and above the age of 90.

Pre and post in the three age groups was compared with Student's one sample t-test groups, and the Length of stay (LOS) between groups was compared with a two sample t-test.

RESULTS:

In the 3 age groups baseline for TUG was respectively 28,1 sec., 31,2 sec. and 48,1 sec. The TUG score improved to 17,8 sec., 24,4 sec. and 31,4 sec. at discharge. The improvement was significant in all three age groups (p= 0,002, 0,000 and 0,000). The Guralnik balance test improved in the three age groups from respectively 19,5sec, 17,1sec and 14,1sec to 22,7sec, 20,2sec and 17,2sec (p=0,088, 0,000 and 0,005). 30-sec. chair-stand test (sit-to-stand) improved significantly from 5,6; 5,2 and 4,2 times to 7,0; 6,5 and 5,4 times (p=0,027; 0,000 and 0,000).

Length of stay (LOS) was 17,1 days (18,2 days, 16,8 days and 17,0 days). No differences in LOS was found between the three age groups (p> 0,5 in all LOS comparisons).

DISSCUSSION:

Physical function can be greatly improved in elderly women participating in a multidiciplinary rehabilitation programme. Even in the very old (>90), an improvement in physical function, similar to that of women in their seventies and eighties, can be achieved during the same length of stay in hospital. Pre and post test were obtained in TUG, Guralnik and 30-sec. chair-stand test in approximately 85% of the included patients equal distributed to the age groups.

CONCLUSION: Multidiciplinary rehabilitation programmes help the elderly female patient maintain her level of physical function and independence and old age (>90) does not seem to limit the possibility of improvement of physical function.

HUMERAL AND HUMEROSCAPULAR ROTATIONAL MOTION CHANGES IN 14 TO 16 YEARS OLD VOLLEYBALLPLAYERS

Baeyens, J.-P., Cabri, J., Taeymans, J., Cattrysse, E., Meeusen, R.

Vrije Universiteit Brussel, Brussels Belgium - Hogeschool Antwerpen, Antwerp Belgium, Belgium

Introduction

Arthrokinematic range of motion characteristics were obtained from the dominant and non dominant shoulder in 32 male elite volleyballplayers from the Topsortschool Vilvoorde (Belgium) aged between 14 to 16 years (15.14 yrs SD 0.89) without history of shoulder problems. Their data were compared with an age-matched control group of non throwing (soccer playing) children (15.45 yrs SD 0.81).

Informed content was obtained.

Methods

Minitiarized (0.5 mm wide) electromagnetic tracking sensors (MiniBird -Ascension Technologies) were placed on humerus, scapula and sternum. A fourth sensor was used as a pointer to relate the sensors to anatomical frames following the ISB standards.

The motions investigated were exo and endorotation in 90° abduction, glenohumeral horizontal adduction (i.e. until the scaoula starts to move) and 90° horizontal adduction with endorotation.

Results

In the volleyballgroup, significant larger amplitudes of motion ($p<0.05$) were found in the dominant shoulder for humerosternal exorotation, humerosternal 90° horizontal adduction with endorotation and glenohumeral horizontal adduction for the humerus related to the sternum as well as the scapula.

In the controlgroup a significant ($p<0.05$) larger humeroscapular exorotation and humeroscapular horizontal adduction was observed in the non dominant arm.

Comparison between the volleyball and the controlgroup revealed significant ($p<0.05$) larger values in the dominant shoulder of the volleyballplayers for humerosternal 90° horizontal adduction with endorotation and humerosternal horizontal adduction.

Discussion

Literature accentuates an enlarged glenohumeral exorotation and diminished endorotation in throwing athletes (Meister et al.). In volleyballplayers, Wang et al. (2000 2001) found significant (p<0.01) lower endorotation in the dominant arm but n o significant difference in exorotation. Already at the young age of 14 to 16 years our data demonstrate range of motion limitations in the volleyballshoulder accentuating posterior capsule stiffness, without enlarged exorotation. This may mimick the specific loading of the shoulder complex related to volleyball.

References

Meister et al. Rotational motion changes in the glenohumeral joint of the adolescent/ little league baseball player. Am J Sports Med 33, 2005, 693-698.

Wang et al. Mobility impairment, muscle imbalance, muscle weakness, scapular asymmetry and shoulder injury in elite volleyball athletes. J Sports Med Phys Fitness 41, 2001, 403-410.

Wang et al. Isokinetic performance and shoulder mobility in elite volleyball athletes from the United Kingdom. British J Sports Med 34, 2000, 39-43.

MEASURING FREE LIVING DAILY ENERGY EXPENDITURE IN CHF WITH DOUBLY LABELLED WATER AND QUESTIONNAIRE: A PILOT STUDY

Garet, M. 1, Barthélémy, J.C. 1, Degache, F. 1, Normand, S. 2, Laville, M. 2, Roche, F. 1

1 Laboratory of Clinical and Exercise Physiology, PPEH, 2 CRNHL, France

Aim : The Daily Activity Questionnaire In Heart Failure (DAQIHF) allows quantitative and qualitative assessment of physical activity and daily energy expenditure (DEE) in patients with CHF along with an estimation of peak V'O2. This questionnaire has been validated against indirect measurements of physical fitness (peak V'O2, anthropometry, litterature...) bas has never been validated against a gold standard measurement of free-living energy expenditure. Therefore, this study aims to assess the validity of DAQIHF questionnaire against the doubly-labelled water technique.

Methods: Six patients with CHF (NYHA I to III, age: 58±15 ys, LVEF=38.4±4.3%) taking their habitual medication (diuretics, vasodilators, beta-blockade) performed an incremental symptom-limited V'O2(peak) test. Free-living DEE was estimated with the DAQIHF (DEEquest) and measured over 2 weeks using doubly labelled water (DEEdlw). Resting energy expenditure was measured by indirect calorimetry (REEcalo) after a 12-h overnight fast and body composition was assessed both from total body water (deuterium dilution) and 50-Hz bioelectrical impedance analysis (REEbia).

Results: At group level, there was no difference in DEEdlw and DEEquest (152.8±26.1 vs. 146.2±31.5 kJ.24h-1.kg-1 respectively; R=0.99, P=0.0002) nor in REEcalo, REEbia and REEquest (P=NS). Individual estimates of DEEquest ranged from –8.2% to +7.4% in comparison to DEEdlw. Peak V'O2 estimated from the questionnaire was similar to measured peak V'O2 (16.7±4.1 vs. 16.0±4.2 ml.min-1.kg-1; R=0.91, P=0.001) and both DEEdlw and DEEquest were correlated to measured peak V'O2 (R=0.82 and 0.96 respectively, P<0.05 both).

Conclusion: The questionnaire is valid for free-living DEE calculation both at the group and individual level in patients with CHF and confirms its previous concurrent validation. Peak V'O2 appears related to DEE and can be accurately estimated from the questionnaire in patients with CHF.

RISK FACTORS FOR CONTACT-NONCONTACT ANKLE SPRAINS IN AMATEUR SOCCER PLAYERS

Kofotolis, N., Kellis, E.

Aristotle University of Thessaloniki, Greece

Introduction

A large number of studies have investigated injury risk factors in professional soccer (Hawkins et al 2000, Ostenberg & Ross 2000, Woods et al 2003) whereas few studies have focused on amateurs' players (Junge et al 2002, Emery et al 2005). Although ankle sprains are very common in soccer, the role of various risk factors for this type of injury (Giza et al 2003) in amateur soccer players is rather unclear. The purpose of this study was to examine ankle sprain injuries, associated factors and mechanisms.

Methods

Nineteen amateur soccer (male) teams were observed during a two-year period. Ankle sprains injury incidents, participation time loss, injury mechanisms and ankle region injured were recorded in games and practice sessions using questionnaires.

Results

A total of 336 athletes who sustained 208 ankle injuries were recorded. Of these, 139 (66.8%) were ankle sprain injuries with over 62.5 % of sprains involving anterior talofibular. Ankle injuries led to a total of 975 training sessions lost, with an average time loss per injury equal to 7.0 sessions. There were 42.692 exposures, of which 29.485 (69.1%) were in practice and 13.207 (30.9%) in games. Most injuries occurred through contact than non-contact (p< 0.05). Player contact accounted for 78.4% of contact injuries and 49.6% of all injuries (p<0.05). For those injuries resulting in fewer than seven sessions lost, the rate of contact injuries was 21.0 times that of a non-contact injury. For those injuries resulting in seven or more sessions lost, the rate of non-contact injuries was 25.5 times that of a contact injury. Player to player contact was responsible for 63.3% of injuries whereas 36.7% were non-contact injuries. Further, 58.8% of non-contact ankle sprains occurred during landing, twisting and turning, and running.

Discussion

These results can be used to plan prevention strategies to reduce injuries. Once the risk factors for ankle ligament sprain are determined, future intervention studies can be performed to reduce the incidence and severity of ankle ligament trauma.

REFERENCES

Emery C, Meeuwisse W, Hartmann S. Am J Sports Med. 2005;33:1882–1891.

Giza E, Fuller C, Junge A, Dvorak J. Am J Sports Med. 2003;31:550–554.

Hawkins RD, Hulse MA, Wilkinson C, et al. Br J Sports Med. 2000;34:1-4.

Junge A, Rosch D, Peterson L, et al. Am J Sports Med. 2002;30:652–659.

Ostenberg A & Ross H. Scand J Med Sci Sports 2000;10:279-285.

Woods C, Hawkins RD, Hulse M, Hodson A. Br J Sports Med. 2003;37:233-238.

EFFECTS OF TWO PHYSICAL THERAPY PROGRAMS ON MUSCULAR AND FUNCTIONAL PERFORMANCE IN WOMEN WITH CHRONIC LOW BACK PAIN

Kofotolis, N., Kellis, E.

Aristotle University of Thessaloniki, Greece

Introduction

Exercise is one of the most frequently used modalities in the rehabilitation of patients with chronic low back pain (Kofotolis & Sambanis, 2005). Proprioceptive Neuromuscular Facilitation (PNF) techniques have been often used to improve the range of motion of the joint, and endurance as well as performance in vertical jump (Kofotolis et al., 2002; 2005). The purpose of this study was to examine the effects of two proprioceptive neuromuscular facilitation (P.N.F.) exercise programs on muscular and functional performance in patients with low back pain.

Methods

One hundred and eight women with chronic low back pain were randomly assigned into three groups: rhythmic stabilization training (RST), combination of isotonics training (COT), and control group (C). The program duration was 4 weeks and the main aim was to improve trunk muscle strength and stability of the trunk. Static and dynamic trunk muscle endurance and lumbar mobility were measured, prior to training, immediately after, and four and eight weeks following the end of the program. The Oswestry and back pain intensity indexes were also determined.

Results

Two-way analysis of variance designs indicated that both training groups demonstrated significant improvements in lumbar mobility, static and dynamic muscle endurance ($p<0.05$) and the Oswestry Index measurements while the highest improvements were observed following RST training.

Discussion

A treatment routine consisting of an isotonic program combined with alternating concentric, eccentric, and static contraction of agonists without relaxation for the trunk muscles seems to be an appropriate method for trunk muscular endurance development in chronic low back pain patients.

REFERENCES

Kofotolis N & Sambanis M. J Sports Med Phys Fitness 2005;45:84-92.

Kofotolis N et al. J Hum Mov Studies 2002;42:155-65.

Kofotolis N et al. Br J Sports Med 2005;39:11.

BILATERAL STRESS FRACTURE OF THE MALLEOLUS MEDIALIS OF A TEAM HANDBALL PLAYER – AN EXTRAORDINARY CASE REPORT

Weisskopf, L., Rist, H.J., Segesser, B., Martin, U.

Praxisklinik Rennbahn, Switzerland

Stress fractures in sports are very common. They sports specifically happen at typical anatomical locations. The involvement of the malleolus medialis is rare. Using instructive illustrations and pictures the interesting case of a bilateral stress fracture of the malleolus medialis of a 30 year old elite team handball player is described. The clinical history was documented by x-ray and computer tomography in such a way that the development of the fracture can be comprehended well. Furthermore, the surgery, the functional after treatment and possible aetiologies are discussed.

ATHLETE COMPLIANCE TO THERAPIST REQUESTED CONTRACTION INTENSITY

Sheard, P.W., Paine, T.J.

University of Luton, United Kingdom

Introduction Disputes over the efficacy of muscle energy techniques (MET) and proprioceptive neuromuscular facilitation (PNF) post-isomeric relaxation (PIR) techniques are premature in that they pre-suppose that the athletes can in fact produce the therapist requested intensity of contraction. Whilst there are many minor variations in application of PIR techniques, a survey of the literature shows that MET-PIR and PNF-contract/relax (CR) techniques vary primarily in intensity of contraction. This project aims to define the athletes' ability to comply with the requested contraction intensity.

Methodology A convenience sample of thirty-seven university athletes (male n=25, 20.7  0.8 years, 182.7  7.8cm, 83.5  14.2kg; female n=12, 20.5  0.8 years, 168.1  5.7cm, 65.4  9.3kg) was recruited from the student population at the University of Luton. After completing ethical consent and medical screening, maximal voluntary contraction (MVC) was established at one of three muscle groups: hip adductors, hip flexors or pectoral. The highest of two contractions, measured by a strain gauge dynamometer (ErgoMeter, Globus, Codogne, Italy), was taken to be representative of MVC.

Target PIR contractions were set at 20, 50 and 100% MVC, assigned via a Latin Square design, and monitored throughout the contraction with the dynamometer. The following PIR stretch protocol was used: active motion to first bind point; build to target contraction over 5 seconds; hold target contraction for 10 seconds; relax for 15 seconds; active re-set to new bind point; repeat sequence for 3 contractions. A 3x2, 2-way, repeated measures ANOVA with Bonferonni post-hoc analysis provided insight into the athletes ability to comply with the target contraction.

Results Post-hoc analysis indicated that athletes were not able to match the target contraction values at 20 and 100% MVC: $p = 0.001$; mean diff = 8.02%, 95% CI = 3.74 to 12.30%; and, $p < 0.001$; mean diff = -12.64%, 95% CI = -6.48 to -18.80%, respectively. At the 50% MVC athletes demonstrated an ability to match the target contraction ($p = 0.219$; mean diff = -3.15%, 95% CI = -8.26 to 1.96%). However, the above results are based on the mean contraction score of the three contractions within each of the three PIR stretch protocols. When examined for consistency across the three contractions the athletes demonstrated widely variable scores (CV = 19.12 to 25.92%, 95% CL = 14.50 to 55.28% at 20% MVC; CV = 22.90 to 35.90%, 95% CL = 17.61 to 83.94% at 50% MVC; and, CV = 8.53 to 10.30%, 95% CL = 6.23 to 19.12% at 100% MVC).

Discussion Without a method of quantifying and feeding back contraction effort to the athlete, athletes can not be expected to match and maintain a requested contraction effort. Until such a method is regularly used, the efficacy of any requested contraction level will remain unknown, as the athletes' level of contraction has been shown to be both inaccurate and inconsistent.

SCHOOLBAG WEIGHT AND SPINAL MOBILITY MEASURES IN SCHOOLBOYS: ARE THEY RELATED?

Kellis, E., Emmanoulidou, E., Kouvelioti, V., Kofotolis, N.

Aristotle University of Thessaloniki, Greece

Department of Physical Education and Sports Sciences at Serres, Aristotle University of Thessaloniki, Greece

It is often claimed that schoolbag carriage is related to excessive musculoskeletal loading and therefore leads to development of back-pain in children. This may also be linked to altered curvature of the spine across the range of motion. Spinal mobility is affected both by muscular and skeletal properties of the spinal column. Prolonged carriage of high loads (schoolbags) may be associated with alterations in spinal mobility in children. The purpose of this study was to examine the relationship between spinal mobility measures and schoolbag weight in primary and secondary education children.

Methods

Three hundred and eighty five (210 boys, 175 girls) students between the ages of 6 and 14 years (9.7 yrs) volunteered to participate in this study. Body weight and schoolbag weight were measured to an accuracy of 0.5 kg. Measures of spinal mobility were made using the Spinal Mouse system. The device was guided along the midline of the spine (or slightly paravertebrally in particularly thin individuals with prominent spinous processes) starting at the spinous process of C7 and finishing at the top of the anal crease (approximately S3); Two rolling wheels follow the contour of the spine, and distance and angle measures are recorded every 1.3 mm as the mouse is rolled along the spine. This information was then used to calculate the relative positions of the sacrum and vertebral bodies of the underlying bony spinal column using a recursive algorithm. Pearson correlation coefficients were used to examine the relationship between schoolbag weight, thoracic and lumbar mobility.

Results

The results indicated that the correlation coefficients between schoolbag weight and thoracic and lumbar mobility in flexion and extension ranged from 0.03 to 0.453. Most correlation coefficients were not significant.

Discussion/Conclusion

The present results demonstrated that schoolbag weight is not associated with reduced spinal mobility. It is suggested that the any schoolbag effects on musculoskeletal system may be due to other factors and do not necessary cause alterations in mobility of the spine. Further research is required to examine the above suggestion in a wider population.

This study is supported by an EC and Greek Ministry of Education (EPEAEK II) grant under the "Pythagoras II" program.

INFLUENCE OF STAGE OF READINESS TO ADOPT EXERCISE ON DAILY ACTIVITIES AND PHYSICAL PERFORMANCE IN PATIENTS WITH HEART FAILURE

Parish, T. 1, Kosma, M. 2, Moore, C. 3, Welsch, M.A. 2

1 Mississippi College, 2 Louisiana State University, 3 Univ. Medical Center, United States

The benefits of regular physical activity for patients with heart failure, are overwhelming. However, research indicates few heart failure patients engage in regular physical activity. As a result daily energy expenditures and physical performance scores are often low, increasing the patient's risk of complications. The problems may in part be because little attention has gone into assessing the motivation and readiness of patients to make necessary behavioral changes. PURPOSE: To examine the stages of readiness to adopt exercise as it relates to daily activities and physical performance. METHODS: One-hundred eleven heart failure patients (81 men and 30 women; Age: 53±14yrs) participated in this study. All patients were classified as Class II or III according to the New York Heart Association (NYHA), with an average left ventricular ejection fraction (LVEF) of 28.66±14.41%. Each participant's stage of change (SOC) for exercise adoption was assessed, using a previously published algorithm (Reed et al. 1997). Daily activities were determined from a modified and English translation of a published self-reported questionnaire thought to reflect habitual activities in heart failure patients (Garet et al. 2004). Physical performance was measured using a 6-min walk test in a hallway with maximum walking distance (MWD) as the dependent variable. RESULTS: The SOC algorithm revealed 12 patients in Precontemplation (PC), 29 in Contemplation (C), 30 in Preparation (PR), 20 in Action (A), and 20 in Maintenance (M). No differences in age, LVEF, nor NYHA class were noted among the SOC. Average MWD was 349±118m. A MANOVA revealed significant differences between the SOC ($p<0.05$) for daily activities over 3 METS (METs 3-5: PC,C,PR <A<M; METs > 5: PC,C<PR,A<M). An ANOVA indicated significant differences for MWD ($p < 0.01$) (PC,C<PR<A<M). Thirty-six percent of all the patients scored below 300m. More specifically, 34 of 71 patients in Pre-action scored below 300m versus only 3 of 40 from the A/M groups. Significant associations were noted for MWD and daily activities between 3-5 METs ($r = 0.52$, $p = 0.0009$), over 5 METs ($r = 0.56$, $p = 0.0001$), and total minutes of daily activity ($r = 0.32$, $p = 0.005$). CONCLUSION: Patients in pre-action stages of readiness to exercise report significant lower daily activities then those in A/M. Moreover, those in pre-action have significant lower physical performance scores. In fact, approx. 50% of patients in pre-action may be at even greater risk for complications and early mortality secondary to scoring <300m on the 6-min walk test (Cahalin et al. 1996). These data suggest the need to develop and deliver stage-matched exercise motivational programs to advance individuals from the early stages of readiness to exercise toward the A/M SOC.

ASSESSMENT OF LOWER EXTREMITIES FUNCTION IN ELDERLY PEOPLE WITH DYSFUNCTION

Kai, Y., Murata, S.

Technical School of Medical and Welfare Ryokuseikan, Japan

PURPOSE: To quantify the function of the lower limbs, the muscular strength and movement of the center of gravity in the standing position are generally measured using a cybex or a hand-held dynamometer. However, since apparatuses used for the measurement are generally expensive, clinical measurement is performed in limited institutions. In this study, we quantitatively examined the function of the lower limbs in elderly subjects with disorders using a commercially available scale, and evaluated the reproducibility and validity of measurements. RELEVANCE: Simple evaluation of function of the lower limbs in the elderly is important to support their health. SUBJECTS: The subjects were 43 elderly patients, consisting of 5 males and 38 females, with a mean age of 84.8 years. The patients had physical disorders, and those with mental disorders were excluded. Walking was possible in 25 patients and impossible in 18 pa-

tients. METHODS: The maximal force of pressing a scale by a lower limb was defined as the loading strength of the lower limb, and we examined the relationships between the measurements and the daily activity index (BI) or walking rate (5-m fastest walking on the flat ground). The roducibility of the loading strength of the lower limb was examined using the intraclass correlation coefficient (ICC) determined by the test-retest method, and its validity was examined using Pearson's correlation coefficient determined by evaluating the relationships between the measurements and the BI, or walking rate. RESULTS: The ICC was 0.823, indicating good reproducibility of the loading strength of the lower limb. There were significant positive correlations between the loading strength of the lower limb and the BI or walking rate, suggesting the validity of the loading strength. Discriminant analysis demonstrated that the discriminant ratio of the lower limb-supporting strength to the body weight between the walking and non-walking groups was 42.9%, and its accuracy was 86.0%. CONCLUSION: The lower limb-supporting strength measured in this study was useful for simple evaluation of function of the lower limbs in the elderly, suggesting that this parameter can be used for the evaluation of walking ability.

PHYSICAL AND COGNITIVE FACTORS ASSOCIATED WITH FALLS AMONG ELDERLY DISABLED AT HOME

Murata, S., Tsuda, A., Kumagai, S., Kai, Y.

Daiichi Welfare University, Japan

PURPOSE：There are several reports that falls in the elderly markedly reduces the quality of daily life and can be a cause of bed-confinement. It is very important for the clarification of risk actors to prevent the falls. There have been various studies on risk factors for the falls. These factors include the ability to stand on one leg, lower limb muscle power, and ankle mobility. Some studies have reported significant association between falls and cognitive function, especially attention. However, a little attention have paid for psychological problems at the time of the falls and the causes of the falls such as "stumbled" or "caught oneself", and few of them have been based on objective measures. Therefore, we evaluated the association between falls and attentiveness evaluated by using Trail making test - Part A（TMT-A）in the elderly with disabilities at home. RELEVANCE：This study can shows not only effect of physical fitness but also additive effect of cognitive function to the fall.

SUBJECTS：Among elderly people with disabilities living in home who visited in 4 different rehabilitation institutions, 110 persons without a diagnosis of dementia were selected as the subjects. Their ages were in a range from 69 to 94 years (the mean : 83.1±5.2 years old). Number of subjects in the falls and non-falls groups was 28 and 82, respectively. No significant difference was observed between 2 groups in age. METHODS：The presence or absence of the falls during the past 1-year period, Mini - Mental state examination（MMS）, and TMT-A were evaluated. As measurements of physical fitness, we evaluated the grip, foot-gripping forces, ankle dorsiflexion angle and flexibility of the body. In addition, the time to keep one-leg standing and walking speed were determined. The differences between two groups, the fallen group and the non-fallen group consisting of subjects with and without the experience of fall, respectively were analyzed by unpaired t-test and Mann-Whitney's U test ($p<0.05$) using SPSS for Windows. RESULTS： The result of the experiment was that we found differences between the group with and without falls. The TMT-A score was significantly higher in the non-falls group($p<0.001$), suggesting their higher attentiveness. The foot-gripping force($p<0.001$), ankle dorsiflexion angle($p<0.05$), time to keep one-leg standing($p<0.01$) and walking speed($p<0.05$) as parameters of physical strength were significantly higher in the group without falls. No significant difference was observed in age, MMS and grip. Logistic regression analysis indicated that falls group had less ankle dorsiflexion angle and foot-gripping force than Non-falls group, also lower TMT-A scores, these items were identified as factor associated with falls. CONCLUSION：This result suggested that impaired cognitive function in addition to reduction of physical fitness were candidate for the risk factor of the falls in the elderly persons.

Poster presentation (PP)

PP1-11 Biochemistry 1/1 - "Exhibition Hall"

ADIPOSE TISSUE TRIACYLGLYCEROL LIPASE ACTIVITY IN LEAN AND OBESE MEN DURING RESISTANCE EXERCISE

Chatzinikolaou, A., Fatouros, I., Petridou, A., Papassotiriou, I., Mastorakos, G., Mitrakou, A., Jamurtas, A.Z., Lazaropoulou, C., Taxildaris, K., Mougios, V.

Democritus University of Thrace, Greece

Introduction

Excessive body fat is associated with increased rates of systemic lipolysis and release of free fatty acids into the circulation contributing to insulin resistance, diabetes, and dyslipedemia (1). Triacylglycerol lipase, also known as hormone-sensitive lipase is an important enzyme in the control of adipose tissue lipolysis (2). Although resistance exercise (RE) can be used to reduce fatness, its effects on adipose tissue lipolysis have not been investigated so far. The purpose of the present investigation was to study triacylglycerol lipase activity (TGLA) in gluteal adipose tissue during an acute bout of resistance exercise in lean and obese men.

Methods

Seventeen healthy young men were assigned one of two groups (matched for age and cardiovascular conditioning): a) Lean (L, N=8, BMI<23 kg/m2, body fat <16%) and, b) Obese (O, n=9, BMI>30 kg/m2, body fat > 28%). After an overnight fast, subjects performed a 30-min resistance exercise protocol (3 sets, 10 exercises, 10-12 repetitions, 4-6 s/rep, 30-s pause between exercises, 2 min rest between sets 70-75% 1RM in a circuit training fashion). Gluteal adipose tissue biopsies and blood sampling were performed at baseline, at the 5th min of exercise and at the end of the first, second, and third set. VO2 and respiratory exchange ratio (RER) were monitored continuously throughout exercise via a portable gas exchange analyzer. Blood was analyzed for NEFA, glycerol, glucose, catecholamines, insulin, glycagon, cortisol, IL-6, and TNF-α. TGLA was measured in fat tissue (3). Differences were examined through MANOVA with re-peated measures on time ($P<0.05$).

Results

TGLA increased 6-fold by the 5th min of exercise in L and at the end of the 1st set in O and declined thereafter in both groups without reaching baseline until the end of exercise. Serum NEFA and glycerol increased by the 5th min in L and after the 1st set in O, maintaining a plateau thereafter. However, L and O reached similar peak levels in all of these variables. RE induced a relative hyperglycemia until the end of the 2nd set; serum glucose normalized thereafter. Catecholamines demonstrated a progressive increase throughout the exercise protocol in both groups. Insulin demonstrated a progressive decline which was delayed in O. Glucagon and cortisol increased similarly

by the end of the 3rd set in both groups. IL-6 and TNF-α did not demonstrate any significant changes during exercise. RER increased progressively increased until the end of 2nd set and declined slightly in the 3rd set.

Discussion

Our data indicate that RE does increase adipose tissue lipolysis. This increase seems to be related to changes in hormonal responses during exercise. However, lipolytic activity in obese non-diabetic men demonstrates a delay which may be related to the insulin response.

References

1. Haemmerle G et al. (2002) J Biol Chem 277:4806-4815.
2. Boden G (1997) Diabetes 46:3-10.
3. Petridou A & Mougios V (2002) J Lipid Res 43:1331-1344.

OXIDATIVE STRESS RESPONSES TO RESISTANCE EXERCISE OVERTRAINING

Margonis, K., Fatouros, I., Jamurtas, A.Z., Kouretas, D., Mastorakos, G., Mitrakou, A., Douroudos, I., Taxildaris, K., Papassotiriou, I.

Democritus University of Thrace, Greece

Introduction

Overtraining may lead to performance deterioration and significant physiological perturbations (1). Overtraining is associated with an acute inflammatory response (2) that includes muscle infiltration by neutrophils and macrophages (Evans, 1991) and free radical generation that promote postexercise inflammation, removal of damage tissue, and repair (Fielding, 1993). Although there have been many attempts, currently there is no single simple marker for diagnosis of overtraining. In this study we aimed to investigate the responses of selective oxidative stress and antioxidant status indices to a chronic resistance exercise protocol of progressively increased training volume.

Methods

Seventeen young men (21.3±2.3 yrs) participated in 12-wk resistance training consisting of five separate training periods (each lasting 3 wk) of progressively increased training volume. During T1 subjects trained 2 d/wk (2 sets/exercise, 10-12 reps/set, 70% 1RM). During T2 subjects trained 4 d/wk (4 sets/exercise, 6-10 reps/set, 75-85% 1RM). During T3 subjects trained 6 d/wk (6 sets/exercise, 1-6 reps/set, 85-100% 1RM). During T4 subjects trained 2 d/wk (2 sets/exercise, 10-12 reps/set, 70% 1RM). Subjects performed 8 resistance multi-joint exercises. Blood samples were collected at baseline (T0) and 96 hours following the last training session of each period. Samples were analyzed for total antioxidant capacity (TAC), catalase, reduced (GSH) and oxidized glutathione (GSSG), the ratio GSH/GSSG, TBARS, and protein carbonyls. Data were analysed by ANOVA repeated measures ($p < 0.05$).

Results

Performance increased after T2 and declined thereafter. Catalase (μmol/mL/min) increased ($P<0.05$) after T2 (29.4±0.8) and T3 (42.2±0.5) compared to baseline (22.7±0.6). GSH (mM) declined ($P<0.05$) following T3 (0.27±0.05 vs. 0.38±0.06 at baseline). GSSG (mM) increased ($P<0.05$) following T2 (0.096±0.01) and T3 (0.11±0.009) compared to baseline (0.088±0.02). GSH/GSSG declined ($P<0.05$) following T2 (3.9±0.6) and T3 (2.4±0.4) compared to baseline (5.08±1.09). TAC (mM DPPH scavenged) declined ($P<0.05$) following T3 (0.53±0.1 vs. 0.69±0.06 at baseline). TBARS (μΜ) and protein carbonyls (nmol/mg protein) increased only after T3 compared to baseline (11.8±3.4 vs. 7.9±1.7 and 0.54±0.13 vs. 0.39±0.09 respectively).

Discussion

Neutrophils and macrophages peak within 2 or as late as 7 days postexercise (5). Our results indicate that selective indices of oxidative stress and antioxidant status, measure as late as 4 days postexercise, are responsive to a significant increase in resistance training volume suggesting that oxidative stress markers may be useful in diagnosis of overtraining.

References

1. Kreider R et al. (1998) Overtraining in Sport. Champaign IL): Human Kinetics 47-66
2. Smith LL (1991) Med Sci Sports Exerc 23:542-551
3. Evans W et al. (1991) Exerc Sports Sci Rev 18: 99-125
4. Fielding R et al. (1993) Am J Physiol 265:R166 - 172
5. Tiidus PM et al. (1998) Can J Pharmacol 76:533-538.

PHARMACOLOGICAL AND TOXICOLOGICAL CHARACTERISATION OF "DESIGNER STEROIDS" AND "PROHORMONES" MISUSED IN DOPING

Friedel, A., Geyer, H., Kamber, M., Laudenbach-Leschowsky, U., Schänzer, W., Thevis, M., Vollmer, G., Zierau, O., Diel, P.

Center for Preventive Doping Research, Germany

Since the ban of anabolic steroids, athletes and their entourage have always tried to find new products and applications to evade the doping controls. Rumours of new steroids, produced and used specifically to escape doping tests in sport have been spread for more than 15 years. Over the last years several never-marketed steroids like tetrahydrogestrinone the first true "designer steroid", designed, synthesized and distributed solely as an undetectable doping agent were detected. This indicates the existence of alarmingly sophisticated and illicit manufacturing facilities and of an underground network to distribute these substances. There is an unknown number of abusers in sport, even though the substances' anabolic-androgenic potency and hormonal properties are not yet resolved. For doping prevention and control it is essential to know the effects and side effects of these "designer steroids" to plan informational and educational campaigns for athletes.

Therefore, the aim of our study was to further characterise the pharmacological profile of the "designer steroids" and prohormones androstenedione (AND), norandrostendione (NOR), norbolethone (NB), propyltrenbolone (Propyl), desoxymethyltestosterone (Madol, DMT), and 1-testosterone (1-Testo). Binding affinity of the substances to the androgen- (AR), glucocorticoid- (GR), progesterone- (PR) and mineralcorticoid receptor (MR) was tested. To determine the biological activity of the steroids a yeast AR-transactivation assay was performed.

In a classical hershberger assay the anabolic and androgenic action of the substances was determined in vivo. To characterise molecular and toxicological mechanisms the gene expression of the androgen receptor and myostatin (MSTN) in the gastrocnemius muscle and tyrosin aminotransferase (TAT) expression in the liver was analysed by real time PCR.

AND, NOR, NB and 1-Testo bind with high affinity and specificity to the AR. In contrast, Propyl turned out to bind with comparable affinity to the AR, GR and PR.
In vivo analysis indicated that 1-Testo has a similar anabolic and androgenic potency like Testosterone. Propyl in vivo displays a low androgenic and anabolic potency. Very surprisingly, DMT and NOR had only low androgenic but significant anabolic potency.
For DMT a slight induction of the TAT expression in the liver was detectable. Like testosteronepropionate (TP), administration of DMT resulted in a stimulation of IGF-1 and MSTN mRNA expression in the gastrocnemius muscle.
In summary, our data characterise 1-Testo as a typical androgenic and potent anabolic steroid, whereas Propyl in vivo has no significant anabolic and androgenic potency. In contrast, NOR and DMT show highly anabolic potency without effecting the seminal vesicle and the prostate weight. These Substances can be characterised as powerful anabolic steroids with SARM like properties and possible liver toxic side effects. Therefore, there is need for a strict control of possible misuse.

EXERCISE-INDUCED OXIDATIVE STRESS IN G6PD-DEFICIENT INDIVIDUALS

Nikolaidis, M.G., Jamurtas, A.Z., Paschalis, V., Kostaropoulos, I.A., Kladi-Skandali, A., Balamitsi, V., Koutedakis, Y., Kouretas, D.

University of Thessaly, Greece

Glucose-6-phosphate dehydrogenase (G6PD) deficiency is a common genetic disorder that can result in increased sensitivity of erythrocytes to oxidative stress which may lead to hemolytic anemia. Despite the existence of a theoretically sound background for diminished resistance of G6PD individuals to oxidative challenge, no controlled study has examined the antioxidant and oxidative stress responses to exercise in G6PD-deficient individuals. We examined the effects of acute high-intensity exercise to exhaustion on blood oxidative stress markers in G6PD-deficient individuals and matched controls. We also investigated whether the duration of exercise is an important determinant of the magnitude of the exercise-induced oxidative stress. Nine males with established G6PD deficiency and nine males with normal G6PD activity performed two exhaustive treadmill exercise protocols of different duration (the shorter one lasting ≈12 min and the longer one ≈50 min). Several hematological parameters, reduced glutathione (GSH), oxidized glutathione (GSSG), thiobarbituric acid reactive substances (TBARS), protein carbonyls, catalase and total antioxidant capacity (TAC) were measured in the blood before and immediately after each exercise bout. Both GSH and GSSG were significantly higher in the control group compared to G6PD-deficient group at baseline and, as a result, their ratio was not significantly different between the two groups. All other oxidative stress indices were not different between groups at rest. Exercise of short duration affected significantly the levels of all oxidative stress indices (except for GSSG and GSH/GSSG) either in G6PD-deficient group or in control group. Exercise of long duration affected significantly the levels of all oxidative stress indices in both groups. Heinz body formation was not seen in both groups either pre- or post-exercise in both protocols and both groups. To our knowledge, this is the first investigation of the effect of exhaustive exercise on the redox status of individuals with G6PD deficiency. G6PD-deficient individuals are able to perform short and long duration acute exercise without experiencing greater oxidative stress than non G6PD-deficient individuals (as indicated by the oxidative stress biomarkers used in the present study). The present findings illustrate that despite the theoretically lower capacity of G6PD-deficient individuals to resist perturbations in their redox status, they are not more susceptible to oxidative stress, probably because they have developed alternative protective mechanisms. On the other hand, the effect of exercise on glutathione status was dependent on duration, whereas exercise increased the levels of TBARS, protein carbonyls, catalase activity and TAC, independently of duration. Future studies should aim to delineate the mechanisms that enable G6PD-deficient individuals to adequately respond to an oxidant challenge, such as that imposed by an exhaustive exercise.

THE ASSOCIATION BETWEEN CIRCULATING LEPTIN, IL-6, TNF-α AND BODY COMPOSITION IN TRAINED AND SEDENTARY FEMALES

Zolnowska, M., Lutoslawska, G., Malara, M., Zuziak, S.

Academy of Physical Education, Poland

It is well known that circulating leptin, TNF-α and IL-6 correlate with measures of adiposity. Furthermore, many studies have examined the effects of exercise on their plasma levels and have revealed a decrease in circulating cytokines mostly due to exercise-induced reduced body fat [1]. In addition, there are data indicating that physical activity per se affects circulating leptin even in the lack of changes in body adiposity [2]. This study was undertaken to evaluate the relationships between selected cytokine plasma levels and body composition in sedentary and highly active young women. A total of 59 females volunteered to participate in the study - 29 students engaged in high-performance sports (18.4 h/week) and 30 sedentary students enrolled in 1.5 h/week of physical activity. All the subjects were regularly menstruating and none of them took oral contraceptives. The participants gave their written consent prior to the participation and experimental protocol was approved by the local Ethics Commission. Triceps, subscapular and abdominal skinfolds were measured to assess body fat [3]. Blood was collected from the antecubital vein after overnight fast between days 5-8 of the menstrual cycle into heparynized tubes. Plasma was separated by centrifugation (15 min/4000 rpm, 40 C) and stored at -700 until analyzed. Leptin, TNF-α and IL-6 were assayed by radioimmunoassay techniques using commercial kits containing monoclonal antibodies. The trained subjects were slightly younger and taller and were characterized by significantly lower fat mass, percent of body fat and higher lean body mass than their sedentary counterparts. Plasma leptin levels in sedentary females were significantly higher than in their trained counterparts. On the contrary neither IL-6 nor TNF-α plasma levels differed in trained and sedentary participants. Both in trained and sedentary subjects plasma leptin levels were significantly and positively correlated with fat mass and the percentage of body fat ($r=0.576$, $p<0.002$; $r=0.458$, $p<0.02$ and $r=0.521$, $p<0.004$ and $r=0.628$, $p<0.003$ in trained and sedentary women, respectively). In trained subjects a significant correlation was also noted between leptin plasma levels and lean body mass ($r=0.443$, $p<0.03$). Our results indicated important differences in the association between body composition and circulating leptin in trained and sedentary females. In both groups plasma leptin levels were significantly correlated with body fat. However, exclusively in trained women did lean body mass affect circulating leptin levels. It could be tentatively speculated that leptin secretion and its plasma levels were adjusted to training-induced elevated lean body mass.

1. Meier U., Gressner A.M. Clin Chem 2004;50:1511-25.
2. Pasman W.J., Wasterterp-Plantenga M.S., Saris W.H. Am J Physiol 1998;274:E280-6.
3. Durnin J.V., Womersley J. Br J Nutr 1974;37:77-95.

DICLOFENAC STRATUM CORNEUM RESERVOIR FORMATION AFTER IONTOPHORETIC DELIVERY

Clarys, P., Lambrecht, R., Clijsen, R., Barel, A.O.

Vrije Universiteit Brussel, Faculty of Physical Education and Physiotherapy, Belgium

Introduction: Several clinical studies claim and advanced healing process after iontophoresis of a certain drug while other studies indicate no effect of the applied current. However, the designs often lack solidity to ensure that the improvements were due to the used enhancement technique. In a previous study we reported that application of diclofenac (DF) under iontophoresis did not differ from DF application under occlusion as estimated in the stratum corneum 90 min after DF application. It was the aim of this study to determine the reservoir properties of DF after a single topical application with and without iontophoresis. The presence of DF in the skin can be estimated using the suppression of the response to a topically applied vasodilator (methyl nicotinate - MN).

Methods: Three different groups of 12 healthy volunteers (males and females, aged 18-24) entered the study. Volunteers were asked to omit swimming and extensive showering during the duration of the experiments. A MN test was carried out on skin regions (volar parts of the forearms) treated with DF under the following modalities:(a) cathodic iontophoresis of a 1% DF formulation (12mg/ cm2) at 0.2mA/cm2 during 20 min; (b) passive diffusion of a 1% DF formulation under a semi-occlusive iontophoresis sponge (without current application); (c) passive diffusion of a 1% DF formulation without occlusion. A MN test was carried out on an untreated skin region for the determination of the reference response.

The MN response was evaluated respectively 90 min (group 1), 6 and 24 h (group 2) and 32 and 48 h (group 3) after DF application. The erythema response was quantified measuring skin redness. Measurements were carried out before DF application, before MN application and every 5 up to 40 min post MN application.

Results: The MN response was suppressed at all measurement intervals (respectively at 1.5, 6, 24, 48 h). There was no difference between the MN responses at the DF pre-treated skin sites when comparing the different measurement times (1.5 versus respectively 6, 24 and 48 h) neither for the application under iontophoresis ($p > 0.05$) nor for the application under occlusion ($p > 0.05$) nor for the open application ($p > 0.05$). When comparing the application modalities at the respective measurement times only at 90 min post application a significant difference was detected between the open application and the two other modes of application, ($p < 0.05$).

Discussion: Even 48 h after a single 20 min application DF application we could not discriminate between the different application modalities. This may be an indication for the fact that there is no additional enhancement effect on the DF penetration of iontophoresis compared to occluded and open application.

Reference: Clijsen R., Taeymans J., Lambrecht R., Clarys P. "Iontophoresis assisted transdermal delivery of molecules in Physical Therapy "10th Annual Congress European College of Sport Science" July 13-17, 2005, Belgrade.

ACTUAL BLOOD TESTS TO DETECT BLOOD DOPING IN ATHLETES

Robinson, N., Sottas, P.-E., Bader, S., Kamber, M., Mangin, P., Saugy, M.

Laboratoire Suisse d'Analyse du Dopage, Switzerland

In the last 15 years, endurance sports have been taunted by EPO doping. The introduction of synthetic EPO in 1990 to fight patients with kidney damage was also the starting point of the misuse of EPO in endurance sports. To fight this development several international sport federations have introduced blood screening tests before competitions. These analyses are performed on a regularly basis for health purposes to avoid athletes competing with a haematocrit level well above normal and also to select and target athletes manipulating their blood formulae.

STATISTICAL DATA DURING BLOOD COLLECTION FOR DOPING CONTROL AT THE ATHENS 2004 OLYMPIC GAMES

Jamurtas, A.Z., Tsiokanos, A., Tsitsimpikou, C., Karachaliou, E., Schamasch, P., Valasiadis, D.

University of Thessaly, Greece

Doping control has been part of the major athletic events, including the Olympic Games since the 0olympic Games in Munich (1972). Doping Control Services of the Athens 2004 Organizing Committee (ATHOC) organised and implemented the most intensive and efficient Doping Control programme to date in Olympic Games. In a total of 10862 participating athletes there were 671 blood samples that were collected. Although Olympic Games are considered as the major event in sports, there is almost no data available regarding doping control, with the exception of one report describing the medication use by athletes in Sydney Olympic Games. Therefore, the purpose of this study was to derive statistical data that relates to blood sampling for doping control implemented for the first time as part of the official testing program in the Athens 2004 Olympic Games. Permission was granted from the International Olympic Committee to process the Doping Control Official Records (DCOR) that related to blood sampling. Data for blood samples from 37 sports were collected. The prohibited substances detected were human growth hormone (hGH) and hemoglobin based oxygen carries (HBOCs) in serum, along with the prohibited method of blood transfusions in whole blood. Blood collection had to take place within a maximum of 12 hours from completion of competition. The mean time needed for an athlete to report to the Doping Control Station for blood collection was 6.1 hrs. However, 26.6% of the athletes failed to appear within the 12-hrs time limit set. More than half of the serum samples collected were analyzed for hGH (54.8%). The highest percentage of serum samples analyzed for hGH per sport was observed in athletics (24.7%) and swimming (11.6%). Almost half of the athletes (47.7%) submitted to blood collection were tested for HBOCs. The highest percentage of serum samples analyzed for HBOCs was observed in athletics (20.0%) followed by rowing (18.3%). Whole blood was exclusively used for blood transfusions detection implemented for the first time in Olympic Games and in combination with HBOCs and EPO detection in urine consisted of the blood doping screening methods. The endurance sports, as defined by IOC Medical Commission and the respective International Federations, accounted for almost 80% of the whole blood samples collected. For the first time as part of the DCOR the athlete was asked to consent for the use of his/her sample for research purposes. Seventy five percent of the athletes consented, whereas only two athletes presented dissatisfactory comments on the blood sampling procedure. In conclusion, the majority of the blood and serum samples collected and analyzed were in athletics. Furthermore, almost half of the analysis for hGH and HBCOs in the Athens Olympic Games 2004 was accounted by three sports whereas the endurance sports covered almost all of the whole blood analyses performed.

CONTRACTILE ACTIVITY EXACERBATES SUPEROXIDE PRODUCTION FROM THE MUSCLE OF DYSTROPHIC MICE: IMPLICATIONS FOR THE DYSTROPHIC PHENOTYPE

Close, G.L., Baker, A.M., McArdle, A., Jackson, M.J.

University of Liverpool, United Kingdom

Duchenne Muscular Dystrophy (DMD) is an X linked fatal degenerative disease affecting 1 in 3500 male births in the UK. DMD results in rapid skeletal muscle wasting and by the age of 12 boys are often wheelchair dependent and die around the age of 30 [1]. The genetic defect has been identified and located to XP21 of the X chromosome [2]. The protein product of this gene (dystrophin) is absent in DMD patients [3]. In non-dystrophic muscle dystrophin is localised at the muscle membrane as part of a large glycoprotein complex known as the dystrophin-glycoprotein complex (DGC). Neuronal nitric oxide synthase (nNOS) is associated within the DGC, however nNOS is absent from the sarcolemma of muscle fibres in DMD patients. This loss of nNOS may be involved in the pathophysiology of DMD [4]. We hypothesise that the loss of nNOS in dystrophic mice (mdx) results in aberrant production of extracellular reactive oxygen species (ROS) at rest and during contractile activity.

Mice were anaesthetised and microdialysis probes were placed into the gastrocnemius muscle. Probes were perfused with either 50μM cytochrome c in 0.9% saline or 0.9% saline for analysis of extracellular superoxide and nitric oxide (NO) release respectively. Following 1 hour of baseline dialysis collections, hind limb muscles of mice were electrically stimulated to contract as previously described [5]. 1 hour following the contractions mice were killed and muscles removed for the analysis of NOS content. An additional group of mdx and WT mice were treated with the NOS inhibitor L-NAME (50mg/kg body weight) intravenously 30 minutes prior to the start of the experiment.

The expression of nNOS in muscles was reduced in mdx mice compared with WT. A significant increase in extracellular superoxide concentration was seen during the contraction protocol in microdialysates for both WT and mdx mice, although the contraction-induced increase was significantly greater in mdx mice compared with WT mice. Extracellular NO production was reduced at rest and during the contraction protocol in mdx mice compared with WT mice. Treatment of mice with L-NAME resulted in increased superoxide production at rest and during the contraction protocol in WT mice only.

Data indicates that the greater increase in superoxide release from muscles of mdx mice may be related to reduced extracellular NO caused by the loss of nNOS. This hypothesis was substantiated by the observation that inhibition of NOS by L-NAME resulted in increased extracellular superoxide production at rest and during the contraction protocol in WT mice but not in mdx mice. In conclusion, the aberrant production of superoxide in mdx mice may be implicated in the muscle degeneration in DMD.

[1] McArdle and Jackson (1998) Medical Biochemistry 3-17

[2] Monaco et al (1989) TIBS 412-415

[3] Hoffman et al (1987) Cell 919-928

[4] Disatnik et al (1998) J Neurol Sci 77-84.

[5] Close et al (2005) Free Radic Biol Med 1460-7.

Poster presentation (PP)

PP1-12 Molecular Biology 1/1 - "Exhibition Hall"

ASSOCIATION OF ACTN3 GENOTYPE WITH PHYSICAL PERFORMANCE AND RESPONSE TO POWER TRAINING

Druzhevskaya, A., Netreba, A., Popov, D., Lyubaeva, E., Astratenkova, I., Montgomery, H., Rogozkin, V.

St Petersburg Research Institute of Physical Culture, St Petersburg, SSC RF Institute for Biomedical Problems, Moscow, Institute for Human Health and Performance, UCL, London, UK., Russia

Alpha-actinin-3 (ACTN3) plays an important contractile role in the Z-line of the sarcomers, whose expression is limited to fast muscle fibers responsible for generating force at high velocity. C-to-T transition in exon 16 of the ACTN3 gene leads to a stop-codon (polymorphism R577X), which results in no ACTN3 protein detectable in muscle fibres [1]. A single previous study has suggested the X allele to be negatively associated with elite sprinting status [2]. The aim of this study was to extend these observations, examining the association between ACTN3 polymorphism and physical performance, muscle fibre composition and the muscle hypertrophic response.

Russian control subjects (n= 844, CG) were studied, as were athletes (n= 612, 14 kinds of sports) who were divided into four groups according to the nature of their physical activity. R577X ACTN3 genotype was determined by polymerase chain reaction amplification (PCR), restriction analysis, and fragment separation by 8% polyacrylamide gel electrophoresis. In a subgroup of 36 healthy young men, muscle fibre composition was defined in samples of m. vastus lateralis using immunoperoxidase immunohistochemical identification of myosin isoforms. Fiber distribution was described as a ratio of the number of fibers of each type in a section to the total number of fibers. Magnetic resonance imaging (MRI) was used for determination of muscle volume and other muscle characteristics of thighs of 7 athletes before and after 8-week resistance training.

Whilst the frequency for ACTN3 mutant XX genotype was significantly reduced in all four groups of athletes (8%) comparing with CG (13%) (P=0.005), there was no significant difference in allelic frequency between athletes and controls (X allele – 37% vs 38% respectively). The mean percentages of fast fibers in ACTN3 RR homozygotes (54.05±2.53%) were higher than in RX heterozygotes (49.09±2.18%), a difference which did not reach significance. Based on results of MR-images we revealed that the increment of volume of m. quadriceps femoris after 8-week resistance training was greater in RR homozygotes than in RX heterozygotes (P=0.048). Therefore the presence of R allele is associated with increased hypertrophy of muscle fibers which results in higher force muscle characteristics. Thus there is significant association between ACTN3 genotype and athletic performance.

Reference

1.Mills M.A. et al. J. Human Molecular Genetics 2001; 10(13): 1335-1346.

2.Yang N. et al. American J. Human Genetics 2003; 73: 627-631.

GDF8 IS MODULATED BY TESTOSTERONE AND ANABOLIC STEROIDS DURING MYOGENIC DIFFERENTIATION AND TRAINING INDUCED SKELETAL MUSCLE ADAPTATION

Schluepmann, K., Laudenbach-Leschowsky, U., Diel, P., Friedel, A.

Institute of Cardiovascular Research and Sports Medicine, Dept. Molecular and Cellular Sports Medicine, Germany

The process of muscle adaptation is controlled and modulated by growth factors like Myostatin (MSTN) – known to inhibit skeletal muscle growth –but also by male sex steroids. In our studies we investigated the effects of Testosterone and anabolic steroids like tetrahydrogestrinone (THG) on MSTN expression during myogenic differentiation and training induced skeletal muscle adaptation.

In vitro, C2C12 myoblastoma cells (cultivated in fetal calve serum = FCS) were treated with dihydrotestosterone (DHT) and THG in doses of [10-6 M] and [10-9 M], differentiation serum (DS), and DS + DHT. Expression and localisation of myostatin protein was detected by immunofluorescence using confocal microscopy and western blotting.

In vivo, orchiectomised (ORX) and intact (INT) rats were treated with different doses of testosterone propionate (TP) in doses of 1 mg/kg/BW/d (ORX) and 10 mg/kg/BW/d (INT) and absolved a swim training over 3 days. Treated but untrained animals served as control group.

MSTN mRNA levels were determined in vitro and in vivo using quantitative real time RT-PCR.

In C2C12 cells, application of DS and DS + DHT resulted in a stimulation of mRNA expression of MSTN. Treatment with THG also resulted in a modulation of MSTN mRNA expression. Analysis of CK expression revealed that the increase of MSTN expression correlates with an induction of differentiation. Protein data show that MSTN can be detected in C2C12 after treatment with FKS+DHT, FKS+THG, DS, DS+DHT by immunofluorescence.

In previous studies a downregulation of myostatin mRNA expression could be detected after different endurance training methods (long term wheel running, swim training over five days) .

In our in vivo experiments MSTN expression was downregulated in intact trained animals and in intact trained animals treated with TP. Treatment with TP in the absence of training did not effect MSTN expression. In ORX rats, training resulted in a dramatic up-regulation of MSTN expression, interestingly this effect could be antagonized by TP. Treatment with TP in the absence of training resulted in significant stimulation of MSTN expression.

In summary, our results clearly demonstrate that TP alters the expression of MSTN in vivo and in vitro. Our in vitro results implicate a MSTN function during satellite cell differentiation on mRNA and protein level.

Interestingly, a modulation of MSTN mRNA expression in INT rats could only be observed when treatment was combined with training. These results can be taken as a hint that molecular mechanisms of the anabolic action of testosterone include the modulation of MSTN expression.

The observation that training in the absence of TP results in an enormous increase of MSTN expression, a growth factor known to inhibit muscle growth, may have implications with respect to the phenomenon of age-related loss of muscle mass (sarcopenia) which has to be investigated in future studies.

REACTIVE OXYGEN SPECIES DETERMINE SKELETAL MYOBLAST ADAPTATION TO OXIDATIVE STRESS THROUGH NFKB ACTIVATION AND EXPRESSION OF PROTEIN INVOLVED IN CELL SURVIVAL AND DNA REPAIR

de Perini, A., Dimauro, I., Bonini, S., Parisi, P., Caporossi, D.

University Institute of Movement Sciences (IUSM) , Italy

During physical activity, changes in body demands involve modifications in cellular and subcellular structure and components, which determine the up- or downregulation of specific genes. As a results, body muscles, metabolism, defenses, and also neurological functions, will adapt to the new situation. The aim of our study was to utilize a cellular model represented by L6C5 rat skeletal myoblasts to investigate the molecular mechanisms which determine the positive adaptation of the skeletal muscle to Reactive Oxygen Species (ROS). It is well documented that the response of L6C5 rat myoblasts to ROS largely depends on the intensity of the oxidative stress applied, since enhancement of cell survival and cell proliferation, as well as resistance to ROS-induced apoptosis, have been described following a pretreatment with very low ROS (H2O2 1-10 μM) concentrations (Caporossi et al., 2003).

The first aim of this study was to verify if the peroxide radical had a direct role in the activation of the adaptive response to oxidative stress of L6C5 myoblasts and to determine the time course for the activation of the cellular systems involved in this process. Adding exogenous ascorbic acid (AsAc, 100 μM) during the adaptive treatment, we noted the complete disappearance of the anti-apoptotic response (frequency of nuclear fragmentation) when AsAc was added from the beginning of adaptation, but no effects when it was added only during the final stage of the conditioning (last 8 hr), indicating that the up-regulation of adaptive genes is an early event during adaptation and specifically requires low ROS concentrations. To detect which cellular systems could have a leading role in the L6C5 myoblasts adaptation to ROS, we checked for the expression of several anti-apoptotic and survival genes. We found that ROS preconditioning increases the expression of both the Bcl2 and the αB-crystallin genes: the Western Blot analysis showed that αB-crystallin increased up to 6 hr from the end of adaptive treatment, returning to basal levels after 12 hr. Instead, the product of the Ref-1 gene, an endonuclease which plays a central role in repairing the DNA damage caused by ROS, increased only after 12 hr from preconditioning, in association with the induction of chromosomal breakages. Since L6C5 cells develop apoptosis resistance during differentiation through changes in the levels of antioxidants directly or indirectly regulated by the redox-sensitive transcription factor NFkB (Catani et al., 2004), we analyzed the modification of this factor activity under the adaptive treatment (H2O2 5-10 μM). Our results demonstrate a strong enhancement (8-fold increase over the control) of the NFkB activity after 24 hr of preconditioning with low ROS concentration, suggesting a central role for this transcription factor in the activation of the specific adaptation of skeletal muscle cells to oxidative stress.

AUTOCRINE ROLE OF VASCULAR ENDOTHELIAL GROWTH FACTOR IN PROTECTING SKELETAL MUSCLE CELLS FROM CELL DEATH INDUCED BY OXIDATIVE STRESS AND SIMULATED HYPOXIA

Mercatelli, N., Ciafrè, S.A., Farace, M.G., Caporossi, D.

University of Tor Vergata, Italy

It is presently recognized that survival and regeneration of muscle cells depends on several different endogenous and exogenous molecules. Among these, Vascular Endothelial Growth Factor-A (VEGF-A) is particularly relevant, as it is well known that in conditions of

"physiological stress", such as hypoxia and exercise, skeletal muscle cells express and release VEGF (Ameln et. Al., 2005). Indeed, the expression of VEGF-A, originally described as an endothelial-specific growth factor, was shown in hypoxic muscle fibers, satellite cells, and in regenerating fibers during ischemia. (Germani et al., 2003). Moreover, the expression of the VEGF main receptors Flt-1 (VEGFR-1) and KDR/Flk-1 (VEGFR-2) is not restricted to vascular endothelial cells, but it is widely distributed in a variety of cell types, including osteoblasts, cardiac myocytes and regenerating myotubes (Arsic et al., 2004).

In search for a physiological autocrine protective role of VEGF-A in skeletal muscle cells, we stably transfected C2C12 skeletal myoblasts with a vector expressing the major VEGF165 isoform and we studied the effect of VEGF expression and release on cell survival and apoptosis induced by oxidative stress (exposure to different concentrations of H2O2) and simulated hypoxia (exposure to CoCl2). Both hypoxia and oxidative stress are generated during physical exercise and, if not properly counteracted by cellular defense mechanisms, can contribute to development of muscle fatigue, inflammation and degeneration.

Here we show that C2C12 myoblasts transfected with the VEGF165 cDNA express and secrete large amounts of VEGF into culture medium, in turn yielding a strong increase in cell growth, cell survival and resistance to apoptosis after exposure to cytotoxic concentrations of H2O2 and CoCl2. Indeed, if compared to the control, empty vector-transfected C2C12/pSV2neo myoblasts, C2C12/VEGF165 showed a 20-30% increase in cell survival and a 50-70% lower incidence of cellular apoptosis, with a lower degree of caspase-3 activation. We also demonstrate that these processes are correlated to enhanced VEGFR-2 activation, suggesting that the VEGF released by skeletal muscle cells, beside the well known angiogenic property, can also exert an autocrine effect. Finally, we investigated the molecular mechanisms mediating VEGF protection, and we determined that C2C12/VEGF165 myoblasts showed an enhanced expression of the Hsp27-related small protein αB-Crystallin, known to play a specific anti-apoptotic role during differentiation of skeletal muscle cells.

Our findings suggest that in the future, a therapeutic use of VEGF gene could be proposed to reduce skeletal muscle cells loss in acute and chronic muscular diseases of diverse origins, including traumatic injury or muscular dystrophies.

Ameln et al., FASEB, 2005

Arsic et al., Molecular Therapy, 10:844-854, 2004

Germani et al., Am J Pathol, 163: 1417-1428, 2003.

AN ATTEMPT TO MODEL THE ADAPTATION OF THE OXIDATIVE SYSTEM TO ENDURANCE TRAINING IN MEN – AN EMPIRICAL-BIOLOGICAL APPROACH

Weber, S., Gehlert, S., Bloch, W., Platen, P.

German Sport University Cologne, Germany

Introduction

It is suggested that the performance of a biological system (BS) is in general determined by its functional load (FL). Such BS are e.g. mitochondria whose performance can be estimated in vivo by measuring VO2max or in vitro e.g. by measuring the activity of citratsynthase (CS). According to Taylor et al. (2005) the adaptation of CS to a given training load is thereby related to AMPKK, while the activity of AMPKK is considered to be a function of AMP (Hurst et al. 2005).

Methods

Nine male subjects (25 ±3 yrs., 182 ±7cm, 72.6 ±3.6 kg) performed a cycling training period (TP) of 12 weeks. VO2max, maximum lactate production rate (VLamax) and anaerobic threshold (AT) were measured before, after and once per week during the TP. The power output of each subject was measured during TP using SRM powermeters. The training intensity was set to a constant load of 60% of the AT ensuring a predominant use of ST fibres. The overall training volume varied in a range of 6-22h/week. Muscle biopsies were taken from the M. vast. lat. before and after the training. Based on the recorded power data of each training session, the amount of consumed O2 per week was calculated to estimate the FL of the aerobic metabolism (Barstow et al 1991). The weekly consumed volume of O2 was then related to the corresponding VO2max, expressing FL as a percentage of the chronic use of VO2max (FL%). Finally, VO2max, VLAmax and training data were used to estimate the total amount of produced AMP during the training sessions (Mader 2003).

Results

VO2max, VLamax and AT before TP were: 68.8±6.0 ml/min/kg, 0.63±0.1 mmol/l/s, 307±36 Watt. All subject showed different time courses in the development of their VO2max with a time lag of one week to FL% as well as to AMP. In five subjects two sectors of FL% could be identified which led either to an increase or decrease of VO2max (r=0.88±0.1, respectively r= -0.55±0.35). Individual differences of the adaptation could be found in different slopes of the regression line (0.06–0.27), as well as in different maximum values VO2max (68.9–78.0) within the TP. The amount of built AMP in relation to the percentage of ST fibres (AMP/ST) during the training in the week before the second biopsy appears however to be related to the activity of CS in all nine subjects.Two sectors of AMP/ST values were identified: one related to increase CS activity (r=0.94, n=6) and one for decreasing CS activity (r=-0.98, n=3).

Discussion

The results of this pilot study suggests that the adaptation of the aerobic system to training loads can be described with the FL% and especially with AMP. It seems however necessary to consider other, highly individual parameters such as the fibre type distribution as well. This might allow better predications of the reaction of the aerobic system to a training load.

Barstow et al. J. Appl. Physiol. 1991

Mader A. ur J Appl Physiol. 2003

Taylor et al. Am J Physiol Endocrinol Metab. 2005

Hurst et al. Am J Physiol Endocrinol Metab. 2005.

Poster presentation (PP)

PP1-13 Sociology 1/1 - "Exhibition Hall"

COMPARATIVE STUDY ABOUT OLYMPIC AND PARALIMPIC GAMES

Kälbli, K., Rigler, E., Gita, S.

Semmelweis University , Hungary

Introduction

Nowadays one of the most prestigious sport events is the Olympic Games. After the Olympic Games, at the same place of a similarly prestigious event passes which gives possibility for people with disability to compete. The name of this event – because of its parallelism with the Olympics - is Paralympic Games.

The goal and the methodology of the research

The goal of our research is to compare the Olympic and Paralympic Games from the aspect of numbers. We tested with the method of Spearman correlation: the correlation between the ranks of the countries in these two events, and the relationship between the rank of the countries at the Olimpics and Paralympics, and the actual economic condition of the countries.

Results

The development and conformation of the number of the competitor, participating countries and sports

The first modern Olympic Games were held in 1896 in Athen. The Paralympics have been formally listed since 1960. The number of athletes, who competed in the Olympics, is forty times more than at the first games (from 245 athletes to 10500), and the number of the athletes parcitipating the Paralympics to ten times more. In Athens 202 nations took part in olympic games (in per cent mostly from African countries), and in Athens at the paralympic games 135 nations took part (Mostly –33%- countries from Europe.)

It is demonstrable that while the number of the sports has increased in the olympic games, the number of the events has widened in the paralimpic games. The reason is simple; the offer of sports can't be expended ad infinitum for people with disability, while the categories established for the sake of the even chance effect the rise of the sport events.

It is remarkable, that the "aesthetic-sports" are fully missing from the programme of the summer paralympic games. In our opinion we can correlate this fact with the people of the 21st century, who aspire to perfection, health and soundness.

About the background of the olimpic and paralimpic results

As a result of our comparative study which we made with the Spearman correlation method we can assume:

• There is significant, linear correlation between the Olympic and in Paralympic rank of the countries. The countries which has better place in the Olimpic rank, has also better place in the paralimpic rank as well.

• Neither the olympics rank nor the paralimpics rank is correlated with the actual economic condition of the countries.

Summary

The quantitative growth can't be the most important purpose in the sport for people with disability. Towards the successful selection of talented disabled athletes the goal is to improve the condition of the sports activity and with its help to offer magnetic alternatives which encourages disabled people to be active.

Literature

1. Nádas Pál (szerk.) (2005): Paralimpiai történetek. Hetvenöt esztendő hazai és nemzetközi történései. MPB, Budapest

2. Tóth Emese (2004): Olimpiai játékok Athéntől Athénig. 1986-2004, Kossúth Kiadó, Budapest

3. www.mob.hu

4. www.hparalimpia.hu

5. www.ipc.org.

WATER SAFETY AND BABY-SWIMMING

Magini, V., Di Fiore, V., Dapretto, L., Robert, P., Andreana, G.

University Institute for Movement Sciences, Rome, Italy

INTRODUCTION

Baby-swimming represents an activity which positively influences the child's psycho-physical development, gaining benefits in growth for psychological, emotional and physical aspects; in fact, it allows the newborn to improve his/her self-receptivity.

Practising baby-swimming enhances newborn's ability to perceive the positions of his/her body and all its components in space, strengthens relationship with his/her parents and predisposes the baby to learn swimming in the future.

Baby-swimming occurs in the presence of at least one parent in the swimming pool.

This survey aims to evaluate the possible social value this activity could represent; in particular, if and how baby-swimming could affect parents' level of surveillance and awareness towards their children, near aquatic environments, such as private and public swimming pools, rivers, lakes, seas, etc…

MATERIALS AND METHODS

An anonymous questionnaire was distributed to 30 parents who participated in a baby-swimming course with their children.

The questionnaire proposed the following questions:

- Child's sex and age;
- If the parent involved in the lesson had a past swimming experience, or still has;
- If he did (or still does), for how long;
- If the baby-swimming course has developed in the parent a major sensibility towards safety in water and baby's safeguard and protection.

RESULTS

The questionnaire gave the following results:

- Children were between 6 months and 3 years old, 40% boys and 60% girls;

- Among 30 parents interviewed, 24 (80%) attended a swimming course in the past, of varying duration, while 6(20%) have never attended one;
- All parents replied that, after attending a baby-swimming activity, they acquired greater awareness, attention and sensibility towards safety in water and protection of their children.

DISCUSSION AND CONCLUSION

Children who are less than 3 years old are exposed to death risk due to accidental drowning. The main cause of fatal accidents in water during the first years of life is a lack of surveillance which adults should provide. During this period, differently from other age groups, there is no difference of percentage between boys and girls; however, at a higher age group, there appears to be a difference, with statistics showing 75-80% male and 20-25% female.

Data obtained through this questionnaire show how baby-swimming activities can raise security levels in water for new-borns and children in the 0-3 age group.

A desirable and major diffusion of this activity represents an effective tool in fighting against accidental drowning, with relevant social consequences.

ACKNOWLEDGMENTS

The Authors thank "Euromar" Sporting Center for its kind collaboration.

REFERENCES

Austswim "Teaching infant and preschool aquatics" 2001

Hunt Newman V. "Teaching an infant to Swim" 2002

La Torre G, Sabatini A. et al. "Epidemiologia dell'annegamento accidentale in Italia nei bambini di età inferiore a 5 anni" - Annuali di Igiene Medicina e di Comunità – Vol. 15/5 2003, pp. 521-528.

DISCOURSES OF DIFFERENCE: WOMEN'S EXPERIENCES OF FOOTBALL UNDER FA GOVERNANCE

Welford, J., Kay, T.

Loughborough University, United Kingdom

This paper reports on a qualitative study of women's involvement in football in the UK, in the context of the rapidly developing female game under Football Association governance. Women's football has always been very closely associated with the male structure of football, from being banned by the FA in 1921, through the struggles without male structural backing, through the FA takeover in 1993 to today where most women's teams, especially at the highest level, play under the shadow of male clubs as a way to access facilities and support. This study looks at the current situation and evaluates the role of these male structures in shaping the development of women's football as a whole but also as impacting individual experiences.

The study uses qualitative data gathered from interviews with women involved in football to demonstrate, through the experiences of those involved, how the close association with the male structure of football is influencing their experiences. This involves not just players but also female coaches and administrators. In addition to close ties with the male structure, women's football is also growing both within and outside a traditionally male dominated culture of football in the UK, which is simultaneously enabling and constraining its development, demonstrated through the conflicting discourses that have emerged from the data. The paper utilises a feminist post-structuralist framework in an attempt to gain a greater understanding of these complexities that surround women's involvement in what is a traditionally male preserve of football.

The research was driven by a feminist-influenced methodology which encouraged a reflexive, open and woman-centred approach to data collection and analysis, the significance of which will be acknowledged throughout the paper. Twelve in-depth interviews were undertaken with females involved at the grassroots level of women's football, both as players and coaches. A further methodological consideration to be discussed is that of 'insider' research; the author has been involved in women's football as a player for the last fifteen years; the strengths and weaknesses of this factor will also be examined. The paper concludes by considering how the recent rapid development of women's football in the UK has been experienced at the individual level and makes recommendations for future developments in order to meet the needs of those involved in the game.

PLAYING THE GAME (PLAN): A SOCIOLOGICAL ANALYSIS OF SPORTS DEVELOPMENT OFFICERS

Bloyce, D., Mead, R., Morris, J.

University of Chester, United Kingdom

Introduction

Sports Development (SD) is a growing field within local authorities in England. Despite this, sports development is difficult to define. SD is seen by some as a tool to develop social inclusion and to contribute to a wider feeling of community, for example, while for others it is seen as a tool for promoting participation and international success. Indeed, recently, increasing numbers of stakeholders have taken an interest in sports development, as the UK government promotes its 'joined-up thinking' agenda. It is also a growing area of concern in terms of academic study (Green and Houlihan, 2005; Houlihan and White, 2002; Hylton et al 2001). However, very little has been written about the SD field from a distinctly sociological perspective. In this paper we wanted to examine the 'reality' of the job for SDOfficers (SDOs) on the ground from a figurational perspective.

Methods

The study was based upon semi-structured interviews with sixteen SDOs from ten different local authorities in the west-midlands and north-west of England. The local authorities examined were a mixture of large, medium and small urban areas, and large and small rural areas.

Results/Discussion

Several themes emerged from the interview data. These include: a concern for the lack of resources available in local authority SD work; that there was an increasing bureaucratic aspect to the job; the increased need (and some considered this additional 'bureaucracy') to establish partnerships with a range of organizations; a growing focus on SDOs developing sport in their area for essentially 'extrinsic' factors, such as health promotion, crime reduction, social inclusion and other priorities on the national and local government agenda. In this regard, we argue that the SDOs were all largely constrained by the national agenda set by the government – especially in their policy document Game Plan (2002). Whilst, it could be argued, the SDOs are constrained in this regard, it became clear from the interviews that this also enabled them to develop for themselves a more secure position insofar as they were able to 'offer' something more to their

employers, by utilising sport as a tool for delivering wider social goals. Or, at least, that is the claim that is made. There is very little evidence to suggest that sport can play a part in reducing crime or contributing to social inclusion. As such, SDOs are likely to find themselves in a double-bind, in that their job will increasingly be measured by the wider benefits that are accrued from sport, but that, at least current research suggests, this is likely to be difficult for them to prove.

References

Green, M. & Houlihan, B. (2005). Elite Sport Development. Policy learning and political priorities. Routledge: London.

Houlihan, B. & White A. (2002). The politics of Sport Development. Development of sport or development through sport? Routledge: London.

Hylton et al (2002). Sports Development: Policy, Process & Practice. Routledge: London.

EATING DISORDERS OF TOP-LEVEL SPORTSWOMEN OF AESTHETIC SPORTS

Zurc, J.

University of Primorska, Science and Research Centre of Koper, Slovenia

The driving force of every sport activity is achievement. Those sports where appearance and body weight are very important (gymnastics, rhythmic gymnastics, figure skating and dance, esp. ballet) are based on values, standards and rules of behaviour representing pressure for unnecessary control of body weight. This is one of the so-called sociological factors which help develop eating disorders.

In the research carried out on a sample of Slovenian sportswomen with diagnosed eating disorders we focused on the problem of eating disorders from the point of view of personal characteristics (perfectionism), attitude to their body, menstrual cycle, attitude to food and connection between characteristics of practising a certain sport or pressure in a sports environment for controlling body weight and development of eating disorders.

It was found that the values, standards and rules of behaviour in these sports represent external views of obsession with appearance. There was constant pressure for weight watching and in consequence the presence of fear of being overweight was always noticed. The sportswomen who took part in the research had a highly developed characteristic of perfectionism. The stated relates to being unhappy with their own body through to harmful behaviour and symptoms of eating disorders.

Behaviour of individuals or their perception of accepted behaviour (part of superego) develops under influence of punishment for behaviour not according to the standards of the social environment. If slimness is important for success in a sport and the trainer, the judges and the other competitors admire and demand it, the sportswoman will internalise such ideal, based on punishment, as her standard behaviour. Slimness will become her value, a part of her personality. If her actions will be rewarded (e.g. praise from her trainer, her partner, medal), these actions will continue. However, the line between diets and eating disorders is very thin and very soon someone can be on the wrong side. Similar studies dealing with this problem in different groups of sportsmen also confirmed the presence of eating disorders in sportswomen in the sports mentioned (Taylor & Ste-Marie, 2001; Williams, 1999).

To answer the question if aesthetic sports could influence the occurrence of eating disorders more accurate and longitudinal studies on the groups at risk should be carried out, based on the experimental method. Two areas should be studied, that is why eating disorders occur in the first place and secondly, what personal profiles the involvement in »aesthetic sports« creates.

References

Taylor MG, Ste-Marie MD (2001). International Journal of Sport Psychology, Vol 32: 21-28.

Williams S (1999). Mission Health: Nancy Thies Marshall has dedicated herself to making the sport a safer place, http://www.intlgymnast.com/features/marhall.html.

Poster presentation (PP)

PP1-14 General II (Ethics, History, Law, Communication, Economics) 1/1 - "Exhibition Hall"

OPTIMIZATION OF THE PLANTAR VIEW FOOT GEOMETRY ANALYSES USING A COMPUTERIZED SYSTEM

Sarabon, N., Grcar, M., Starc, G., Labrovic, J.

University of Ljubljana, Slovenia

Introduction

Measuring foot geometry is of a great importance in medicine, footwear industry and sport science. Past analyses were usually done by hand, using a leaf of paper, ink and rulers. This kind of print acquisitions and analyses have several shortcomings such as time-consumeness, subjection to errors, vaguely defined measures. The aim of our work was to develop computerized acquisition and analyses system for countering the mentioned shortcomings. We tested its repeatability and compared it to those of conventional procedures.

Methods and Materials

10 subjects (5♂, 5♀; age 30.8+13.4 yrs; body height 168.7+7.11 cm; body weight 61.2+8.8 kg) volunteered for the study. We first took 10 consecutive foot prints and contours of each subject using pencil, ink and paper. Then, we repeated the same number of measurements using our computerized system. For the purpose of foot print acquisition Vaseline was applied to subject's foot which was then pressed against the mirror; the latter was scanned and thus the footprint digitized. On the other hand, the foot contour was taken by directly scanning the plantar view of the foot. Altogether 20 quantities were computed. For the purpose of statistical analyses these were divided into three groups of measures: angular, transversal, and longitudinal measures. Differences in variability between the two procedures (manual vs. computerized) were tested using paired t-test.

Results

Differences in intra-subject standard deviations between the two tested measurement procedures for all three groups of measures were statistically significant (P<.05). Using the computerized system the longitudinal measures had stdevs 1.23 % of the average mean (the mean values were (in mm): print length 1sttoe-heel (233.4+.9), print length 2ndtoe-heel (231.8+1.2), print length without toeprints (199.8+1.2), print length to the 1st metatarsal joint (170.6+1.8), print length to the 5th metatarsal point (146.9+2.4), contour length (245.8+1.8), contour length to the 1st metatarsal joint (179.6+1.8), contour length to the 5th metatarsal joint (155.9+2.5)), transversal measures 1.15 % of the average mean (the mean values were (in mm): orthogonal print width (80.9+1.7), anatomical print width (91.8+1.0), inner anatomical print width (40.9+0.8), print heel width (49.4+1.0), inner print heel width (23.8+0.6), orthogonal contour width (88.9+0.5),

anatomical contour width (94.6+0.8), inner anatomical contour width (42.4+0.7), contour heel width (58.9+0.4), inner contour heel width (28.9+0.7), contour mid-width (76.3+0.7)) while those of the angular measures were 3.84 % of the mean (Clark's angle (47.3+1.8°)).

Conclusion

The study presents footprint analyses software and furthermore argues its supremacy over the manual procedure. It has been made faster and the human factor has been eliminated up to a certain point. Additionally mathematical and/or algorithmic formalisms were used to define quantities which are computed by the application.

HEALTH ECONOMIC EVALUATION OF CONTROLLED AND MAINTAINED PHYSICAL EXERCISE IN THE PREVENTION OF PROSPERITY DISEASES

Vandenabeele, E., Annemans, L., Lamotte, M., Clarys, P.

De FitnessOrganisatie; Vrije Universiteit Brussel, Belgium

Introduction

Besides a cooperation with the medical sector (prescription of health related physical activity) the Belgian Fitness industry started a policy to negotiate a more beneficial financial climate with lower VAT and tax deductible memberships. To support these efforts a system was developed to improve and control client compliance to regular controlled activities. Additionally a method was developed to estimate the economic impact of maintained physical exercise in different age- and risk categories.

Several studies and reports support the health benefits of frequent physical exercise, on the condition that this exercise is controlled and maintained.

Given the scarce resources that can be spent on health and health care, the objective of this study was to predict the long-term health and economic outcomes of controlled and maintained physical exercise in a fitness setting.

METHODS

A 25-year Markov model with a 12-month cycle-length and states representing diabetes, coronary heart disease, stroke, colon cancer and breast cancer was developed to predict cumulative costs and Quality Adjusted Life Years (QALYs) for 3 defined virtual cohorts, of different risk levels. The risk for evolving to the disease states is dependent on the followed strategy: physical exercise versus no intervention. Reduced risks associated with physical exercise as well as cost of diseases and loss in quality of life if diseases were obtained from published literature. Cost were taken from a societal perspective; Belgium was selected as setting. One way and probabilistic sensitivity analyses were carried out.

RESULTS

For each of the cohorts, physical exercise is predicted to increase the QALYs and to off-set a large part of the initial investment. The cost per QALY varies from 2000 to 15000 per QALY depending on the risk levels, which is better compared to a majority of secondary preventions which are currently publicly financed.

CONCLUSION

Controlled and maintained physical exercise is projected to be very cost-effective, which is likely to be explained by its effect on several diseases and the associated weight loss which affects quality of life positively.

THE ELECTRONIC ATHLETE'S RECORD FOR CONTINUOUS RECORDING AND MONITORING OF ATHLETIC PERFORMANCE

Bang, A., Seifriz, F., Mester, J.

German Sport University Cologne, Germany

Performance in elite sport is a complex phenomenon where the number of influencing factors is high but where at the same time the interindividual longitudinal variability may be very small. For a better understanding of the intraindividual variance of performance modern diagnostics and various scientific approaches with a large amount of information have to be managed. The amount of this data has been growing for the past years and still it is because the number diagnostic methods have increased and the measurement devices offer a huge amount of parameters. For further analysis of the data, they have to be stored and managed as efficiently as possible. Local PC-storage in many cases is not sufficient any longer.

Here special database management systems (DBMS) are the state of the art with appropriate web-based system architectures and database (DB) models.

For the "Electronic Athlete's Record" a client-server architecture with three levels has been chosen: (1) user interfaces, (2) content management system and (3) a database. This architecture ensures fast data transfer, secure data administration and a comparatively quick and easy way to make changes to the system.

The DBMS architecture is designed at three levels. The first level covers three user interfaces, one for the automatic import of data from diagnostic devices, another for the possibility to manually enter data, and the last one is a web-enabled client to view the information. The second level consists of a content management system (CMS). This system makes it possibly to make changes to the DBMS, such as adding new diagnostic devices, without direct user interventions at the DB-level or in the user interfaces. This system also ensures secure authentification and authorization of the users, comparable to banking industry standards (IBM, 2003).

The third level, the data model of the DB (type DB2) is designed to avoid negative, duplicate data. It is possible to use structured query language (SQL) to execute any queries to the DB. Thus, necessary statistics can be produced on demand.

With the current version of the "Electronic Athlete's Record" and through the web interface athletes and authenticated other persons, such as coaches, can directly access data and thus monitor the variability of performance. Moreover data bases of this kind can solve prevalent data management problems within sport organizations. With this system, reliability of data is improved and extraction of statistic parameters is simplified.

To optimize the system, further tests and extended versions are in progress. The trend with ever-growing quantities of data will be even stronger in the future. So DBMS will be a necessity.

IBM (2003). IBM DB2 Content Manager for Multiplatforms, System Administration Guide, Version 8 Release 2. Zugriff am 02.02.2004 unter http:\\www-306.ibm.com\software\data\cm\cmgr\mp\library.htm\c2713354.pdf.

DOPING SCANDALS AND ANTI-DOPING DEVELOPMENT IN THE 20TH CENTURY

Mavrek, S.

Karl-Franz-University Graz, Austria

In today's sporting context, doping refers to the use by athletes of banned substances or methods that may enhance performance. While the term 'doping' first appeared in an English dictionary in 1879, the use of use of drugs is evident throughout the history of sport.

The purpose of this study was to examine and to describe relationships between the biggest doping scandals and development of anti-doping in the 20th century.

The sources of data (public records, books, journals, newspapers, as well as related web contents) were processed by historiography.

The first recorded death due to the use of a drug occurred already in 1886, when English cyclist Linton died from an overdose of trimethyl. In 1928 the International Amateur Athletic Federation (IAAF) became the first International Sport Federation to ban the use of doping (use of stimulating substances). In spite of further escalation of doping abuse and historical argument that doping is incompatible with the ethical nature of sport, the most significant international anti-doping developments occurred just after the biggest doping scandals: 1960 - Council of Europe tabled a resolution against the use of doping after the death of Danish cyclist Knud Enemark Jensen at the Olympics in Rome, 1967 - the Medical Commission of the IOC was established after the death of another English cyclist Tom Simpson in the Tour de France and 1999 - the World Anti-Doping Agency was established as a direct result of the 1998 Tour de France doping scandal. In 1966 UCI (cycling) and FIFA (football) were among the first International Federations to introduce doping tests in their respective World Championships. In the next year, newly established International Olympic Committee (IOC) Medical Commission set up its first list of prohibited substances. The first drug tests were conducted at the Grenoble and Mexico Games in 1968. It is evident that the use of doping increased parallel with advances in technology combined with social, economic and political changes and that the effects of these factors influenced to the development of anti-doping programs during different time-ordered events in the 20th century. Of particular importance in this context was the development of communist regimes in many parts of Eastern Europe and the emergence of the Cold War and of superpower rivalry. Within this context, international sporting competition took on a significance going far beyond the bounds of sport itself, for sport became an extension of the political, military and economic competition which characterized relationships between the superpowers and their associated blocs.

The most important anti-doping event in the last century was the World Conference on Doping in Sport held in Lausanne on 2-4 February 1999, which produced the Lausanne Declaration on Doping in Sport. According to the terms of the Lausanne Declaration, the World Anti-Doping Agency (WADA) was established on 10 November 1999 in Lausanne to promote and coordinate the fight against doping in sport internationally.

EVIDENCE-BASED PRACTICE IN THE SPORT AND EXERCISE SCIENCES: A META-EVALUATION OF METHODS

Weed, M.

Loughborough University, United Kingdom

INTRODUCTION

Evidence-based approaches have played a key role in determining policy and practice in the health and medical sciences. Supporting the use of such approaches are two 'libraries' that act as clearing houses and depositories of best practice. The clinical sciences are supported by the Cochrane Collaboration (www.cochrane.com), and the social sciences by the Campbell Collaboration (www.campbellcollaboration.com). In the sport and exercise sciences, evidence-based approaches have been utilised by researchers in sport and exercise psychology (eg, Feltz & Landers, 1983, on mental practice), physical activity and health (eg, Hagger, et al, 2002, on physical activity behaviour), and sport management and policy (eg Weed, et al, 2005, on voluntary sport administration). The approaches comprise: meta-analysis, systematic review, better-practices frameworks, and narrative review.

METHODS

This paper reviews the range of evidence-based approaches used in the sport and exercise sciences, and conducts a meta-evaluation of methodologies. Meta-evaluations examine the validity and usefulness of methods, and the extent to which, regardless of internal consistency and validity, the methods used result in findings that have any broader utility in the field. Therefore, this meta-evaluation will evaluate the methodologies used and the utility of findings of evidence-based approaches in the sport and exercise sciences.

RESULTS/DISCUSSION

Issues to be discussed in the meta-evaluation include:

1) How various evidence-based approaches judge what counts as 'evidence', and the criteria by which 'evidence' is included or excluded in evidence-based approaches.

2) What weighting is given to various 'categories' of evidence.

3) How qualitative and quantitative studies are reconciled and/or synthesised.

4) The underlying assumptions of the various evidence-based approaches and the outputs produced.

5) The basis on which 'evidence-based' status is ascribed to the conclusions of such approaches

CONCLUSION

As the tradition of evidence-based approaches has emerged from the medical and policy fields, it is largely the psychology, physical activity and policy/management areas of the sport and exercise sciences that have embraced such approaches. However, the issues discussed in this meta-evaluation will show that there is a legitimate concern that an evidence-based model that is derived from clinical practice and policy evaluation may not be suitable for application without modification across the broad spectrum of disciplines in the sport and exercise sciences, and that this has affected the quality of some outputs that claim to be contributing to 'evidence-based practice'.

REFERENCES

Feltz DL & Landers DM (1983), J.Sp Psych,5: 25-57.

Hagger MS, Chatzisarantis NLD & Biddle SJH (2002), J. Sp & Ex Psych, 24:3-32.

Weed ME et al (2005), ISLP (Lboro): Report to Sport England.

COMPREHENSIVE STUDY ABOUT ICAS-CAS AND COURT OF SPORTS ARBITRATION OF HUNGARY

Nagyreti, J., Nemes, A.

Semmelwies University Faculty of Sport Sciences, Hungary

At the beginning of the 21 century sport has become from a hobby of citizens or a folksy – childish entertainment an important factor of social culture. To sport science, sport life pertain such traditional foreign sciences as economy and law. And in the case of sport – as by every other social activity conflicts are avoidless.

Only a definite part of the jural conflict cases manifests itself and becomes a legal regulated judicial combat. In the case of manifest and legal regulated jural conflicts there is some regulated procedure in which the solution procedure of conflict has some formal and legal regulated way.

Every Hungarian citizen has the constitutional right to go to law – court. At the same time the most important requirements of jural processes are their simplicity, celerity, cheapness and the special expertise of the proceeding judges. These demands will be provided by the arbitration court.

As one of the most typical tendencies of sport life in the middle of the nineties an evolving of a special jural sport related background has began in Hungary. Though the main part of jurists doesn't acknowledge the existence of sport law as an autonomic science till today, sport law as a specialistic law study has both his extent and quality considerable literature.

The origination of the sport permanent arbitration court is a consequence of in the former section submitted tendency. About the work of the sport permanent arbitration court there is only few to know. Its origination was an important step and it fills deficiency, that's true. I feel the Hungarian sport society is waiting for intervention to solve its problems. It is such an organization which help by conflicts can be solved in professional communities, while procedures of jural and professional expert judiciary.

I have written in the first paragraph the change of importance and thatness of sport is an international change. Establishing the jural background of sport is not only a problem of the hungarian law – makers. For example big international institutions of sport also have to create a sport jural regulation answering to the problems of today. International sport competitors has become sporting millionairs from sporting amateurs, the relaying fees have grown severalfold. With the growing importance of the role of sport conflicts in connection with sport have mulitplied so qunatitatively as qualitatively and have become deeper and complicated.

Discoursing about arbitration court in international fields the one arbitration court is unambigous to analyze.lit is the most important arbitration court, the doubled institution working as one organization the International Council of Arbitration for Sport (ICAS) and the Court of Arbitration for Sport (CAS) In my presentation I compare the process regularization, methods and working of the SÂV , ICAS-CAS And the presentation have a specially intresting: the city of conference is the seat of ICAS-CAS too.

SPORT AND CIVIC IDENTITY IN THE UNITED STATES

Gems, G.

North Central College, United States

In his landmark book, From Ritual to Record, Allen Guttmann identified several characteristics of modern sports: rationalization, secularization, bureaucratization, quantification, and specialization. This study argues that commercialization has evolved as the most important factor in the modernization process, having become the engine that drives urban sport.

It endeavors to show, through a hegemonic theoretical framework and an historical explication, how capitalists usurped play and transformed it into a commercial and civic enterprise. They did so by forging an American sporting identity distinct from its British antecedents, professionalizing team sports to supersede commercial rivals, seizing control of the labor process from athletes, marketing sport as part of a new culture of consumption that garnered social capital, and eventually promoting civic teams as a tourist attraction, and fueling the gentrification of neighborhoods and urban redevelopment.

15:15 - 16:45

Invited symposium (IS)

IS1-11 Sudden cardiovascular death and sports (SGSM symposium 1) - "Lausanne"

IN FAVOUR OF OBLIGATORY SCREENING: THE ITALIEN EXPERIENCE

Corrado, D., IT

Without abstract submission.

OBLIGATORY SCREENING - CRITICAL REVIEW: THE UK EXPERIENCE

McKenna, W.

The Heart Hospital, London, United Kingdom

Individuals with inherited cardiomyopathy and arrhythmia are potentially at risk from disease complications, most notably sudden death. The vast majority of patients with these conditions, however, remain asymptomatic throughout life, and do not die suddenly. Indeed, data for hypertrophic cardiomyopathy suggests that 80% or more of individuals who fulfil stringent diagnostic criteria go undiagnosed. Current recommendations for athletic participation in cases of cardiomyopathy range from legislated prohibition (Italy), conservative restrictions (USA and ESC) to individualised recommendations (UK). Current guidelines have a limited evidence base and present recommendations that make no distinction in relation to heterogeneous disease expression, ignore the clinical ability to stratify disease severity and risk and make no attempt to determine the level of risk that is acceptable to the athlete, family or team. A revisit of our current approach incorporating the views of athletes and sporting bodies is warranted, particularly as there is an increasing impetus for screening programs which will increasingly identify asymptomatic athletes, the vast majority of whom will not have severe disease markers or be at significant risk of disease complications.

LOOKING AT SPORTS: DEATH IN SPECTATORS FROM A PUBLIC HEALTH PERSPECTIVE

Katz, E.

Centre Hospitalier Universitaire Vaudois, Switzerland

Sudden cardiac death (SCD) is a natural death due to cardiac causes, heralded by abrupt loss of consciousness within one hour of the onset of symptoms. The incidence of SCD in Europe is of 1 per 1000 persons/year and the estimated number of SCD varies from 184'000 to 450'000/year in the USA. The causes of SCD differ before and after 35 years. In young athletes common SCD causes are hypertrophic cardiomyopathy, coronary artery anomalies and right ventricular dysplasia. After 35 years coronary artery disease (CAD) is the first cause of SCD. The mechanism of 80% of SCD is that of ventricular tachycardia or ventricular fibrillation, 20% are due to bradycardia or asystole. For 50% of victims SCD is the first manifestation of CAD; 15%-20% of SCD occurs in public places (airport, shopping mall, stadium), but most (70-80%) happen at home. Currently reported survival rates are poor (near 5%).

Risk factors for SCD are nearly the same as that for CAD. Anger, mental stress, cocaine and marijuana use, heavy exertion and, exceptionally, sexual activity were described as initiating events (triggers) of myocardial infarction and SCD. It was suggested that the emotional intensity of sporting events and behaviors associated with spectating such as smoking and binge drinking could trigger SCD. Soccer has often been the focus of such studies since the intensity of football games is arguably unmatched by few other sporting events. The significant increase in cardio-vascular mortality on the day of important matches have been shown in the Netherlands and Great Britain. Our group confirmed the increase of SCD in Switzerland during major soccer tournaments.

The survival in SCD is dependent of a series of critical interventions including early defibrillation. Recently automated external defibrillator (AED) for laymen use was developed and AED deployment encouraged in public places and private homes. Public Access Defibrillation (PAD) initiatives promote basic life support (BLS) and defibrillation by laymen. The survival doubled in the PAD trial and tripled in Piacenza, where public initiative was limited to defibrillation. Studies from Germany and Spain confirmed the interest of early defibrillation programs on soccer stadiums. Spectators suffering from SCD were immediately treated – this resulted in impressive survival rates (up to 62% in Germany)!

We also advise general practitioners to inform their patients and their families before major sporting events about the risks of medical non-compliance, decreased physical activity and increased alcohol and tobacco consumption. More information has to be provided by physicians and the media about practical measures to adopt in case of chest pain or cardiac arrest. Information about how to reach Emergency Medical Service (EMS) and how to perform BLS has to be broadly advertised. The reinforcement of the EMS systems and PAD development should be proposed in order to reduce the burden of SCD during major sporting events.

THE LAUSANNE RECOMMENDATIONS AND BEYOND

Meijboom, E.J., Bille, K., Figueiras, D., Schamasch, P., Brenner, J.I., Meijboom, F.J.

Centre Hospitlier Universitaire Vaudoise (CHUV), Switzerland

Introduction: The incidence of sudden death(SD) in athletes is higher (~2/100000/year) than in non-athletes (RR 2,5:1), the cause is cardiovascular in over 90%. This study reports on SCD in sport and aimed at achieving a generally acceptable PPSP endorsed by the consensus meeting(CM) of, and recommended by the IOC.

Methods: A systematic review of the literature identified causes of SCD, gender, age, underlying cardiac disease and type of sport. Methods to detect pre-existing cardiac abnormalities were discussed to formulate a feasible and safe PPSP for the CM of the IOC. (http://www.olympic.org/uk/organisation/commissions/medical/full_story_uk.asp?id=1182)

Results: SCD occurred in 1101(1966-2004) reported cases in athletes under 35 years, 50% had congenital anatomic heart disease and cardiomyopathies and 10% had early onset athero-sclerotic heart disease. 40% occurred in athletes <18 yrs, 33% <16 yrs; female/male ratio was 1/9. Sports most frequently involved were soccer(30%), basketball(25%) and runnig(15%). PPSPs, if present at all, were of varying quality and content.

Invited symposium (IS)

IS1-12 VO2 Kinetics - "Innsbruck"

VO2 KINETICS: OLD AND RECENT LESSONS FROM EXPERIMENTS ON ISOLATED MUSCLE IN SITU

Grassi, B.

Universita' degli Studi di Milano, Italy

In "normal" conditions (e.g. normoxia, absence of pathological conditions) convective and diffusive O2 delivery to skeletal muscle fibers do not seem to represent important determinants for the kinetics of adjustment of oxidative phosphorylation following increases in metabolic demand. Whereas a limiting role by pyruvate dehydrogenase (PDH) has not been experimentally confirmed, inhibition of mitochondrial respiration by nitric oxide (NO) might be partially responsible for the inertia of oxidative phosphorylation at exercise onset. The main determinants of skeletal muscle O2 uptake (VO2) kinetics, however, likely reside in the intricate interplay between the various mechanisms of energy provision at exercise onset. By acting as high-capacitance energy buffers, phosphocreatine (PCr) hydrolysis and anaerobic glycolysis would delay or attenuate the increase in [ADP] within the cell following rapid increases in ATP demand, thereby "buffering" a more rapid activation of oxidative phosphorylation. The "PCr-Cr shuttle" concept of a regulatory role of PCr or of the products of PCr hydrolysis on oxidative phosphorylation provides a mechanism which couples VO2, which occurs in mitochondria, with PCr hydrolysis occurring in the cytoplasm.

REGULATION OF VO2 KINETICS AND ITS FUNCTIONAL CONSEQUENCES

Hughson, R.L.

University of Waterloo, Canada

Our daily lives are filled with constantly changing energy demands going from rest to moderate or heavy work loads. Therefore, it is critical that we understand those factors that can limit the rate at which the energy supply system adapts to the demands. The study of

oxygen uptake (VO2) kinetics provides insight into the mechanisms regulating the oxidative supply of ATP to working muscle. The supply of O2 to skeletal muscle and the utilization of O2 is a tightly coupled process controlled by complex, and at times controversial, mechanisms. At the onset of exercise, cardiac output and local muscle blood flow increase rapidly in response to both feed forward and feedback mechanisms. Yet, the fine regulation of O2 supply is dependent on the need for precise spatial distribution within a muscle in which recruited muscle fibers are adjacent to non-recruited fibers. The increase in metabolic substrate in the active fibers must be met by appropriate O2 supply to permit oxidative phosphorylation. A new model of the interactions between metabolic substrate, O2 and enzyme activity will be presented to yield a coherent view of the complex interactions that regulate VO2 at the onset of exercise. The model will be discussed with respect to recent controversies in the literature regarding whether VO2 is controlled exclusively by O2 supply, O2 demand determined by enzyme activity and/or metabolic substrate, or some interaction between supply and demand. There are frequent observations of slower VO2 kinetics under conditions such as hypoxia that point to the important role of O2 supply in regulating kinetics, but the difficulty in showing accelerated VO2 kinetics when O2 supply is increased has caused some researchers to propose that O2 is not limiting under conditions of moderate or even very heavy exercise. Details about the supply of blood flow and O2 to working muscles of humans are becoming available with techniques including Doppler ultrasound and near infrared spectroscopy. New results concerning O2 supply again provide evidence of the tight link between supply and demand. Determining factors that limit the rate of increase in VO2 is important to athletes and to patients with cardiovascular disease because of the impact on intracellular energy state, lactic acid production and the sensations of muscle fatigue that can influence performance and daily life.

COMBINED IN SITU DETERMINATION OF METABOLIC AND MYOELECTRIC CHANGES ASSOCIATED WITH O2 UPTAKE KINETICS DURING HIGH-INTENSITY EXERCISE IN HUMANS

Perrey, S.

UFR STAPS, France

Volume of oxygen uptake (VO2) is an indirect measure of cellular respiration and energy expenditure. The abrupt rise in VO2 when moving from a resting to a dynamic exercise steady-state has been identified as VO2 kinetics. When exercise intensity is above the blood lactate threshold, the attainment of a steady-state is either delayed or may not occur, and a secondary, slowly-developing component of increasing VO2 that appears to be linked in some way to the fatigue process, is observed. The purpose of this presentation was to provide some range of perspectives concerning the muscle contractile properties and the regulation of oxidative metabolism during the slow phase of the VO2 dynamics to exercise that still remains to be explained. Combined in situ approaches in our understanding of the plausible mechanisms for the VO2 slow component seem necessary.

In an effort to gain insight into the underlying mechanism(s) mediating the slow component, a number of studies have used electromyography (EMG) as a non-invasive tool to assess muscle fibre recruitment patterns during heavy exercise. Some studies demonstrated no change in EMG parameters (Scheuermann et al., 2001), whereas others have shown that integrated EMG (Perrey et al., 2001) and the mean power frequency of the EMG (Borrani et al., 2001) may reflect changes in muscle fibre recruitment pattern during the VO2 slow component. This suggests caution in the use of EMG as a quantitative tool for assessing muscle fibre recruitment patterns during dynamic exercise. Collectively, these studies indicate however that the increased recruitment of less efficient type II muscle fibers is a major cause of the VO2 slow component. The incorporation in our lab of non-invasive muscle function tests such as the measurement of force profiles to electrical stimulation to characterise better the pattern of activation of different ﬁbre types in humans seems promising compared to biopsy samples but is rather scarce (Garland et al., 2004).

Understanding the physiological mechanism responsible for the appearance of the slow component of VO2 kinetics requires also to considere both the factors involved in the decrease of the efficiency of the ATP-producing system, and the factors involved in the decrease in the efficiency of the contractile machinery using ATP. In this way, Rossiter and colleagues (2001) proposed that ATP splitting increases during the slow component phase, causing ADP to increase and PCr concentration to fall. The observation of a slow component of PCr hydrolysis during heavy exercise suggests an increase over time in the phosphate cost of force production, whereas the O2 cost of ATP production stays the same. This issue deserves more attention in the next future for our understanding of the decreased active locomotor muscle efficiency during high intensity exercise.

Invited symposium (IS)

IS1-13 Transendothelial transport limitations in insulin resistant skeletal muscles (sponsored by Astra Zeneca) - "St. Moritz"

INSULIN AND EXERCISE INDUCED MUSCLE CAPILLARY RECRUITMENT

Rattigan, S., Kolka, C.M., Ross, R.M., Bradley, E.A., Richards, S.M., Clark, M.G.

University of Tasmania, Australia

The vascular system controls the delivery of nutrients and hormones to muscle and a number of hormones may act to regulate muscle metabolism and contractile performance by modulating blood flow to and within muscle. Development of two new techniques to investigate microvascular blood flow within muscle in vivo has provided new insights into the action of insulin and contraction in the muscle vasculature. The first technique is based on the metabolism of an exogenous substrate, 1-methylxanthine (1-MX), for the enzyme xanthine oxidase that is found predominately in the capillary endothelial cells of skeletal muscle. The amount of 1-MX metabolism determined by arterio-venous sampling across a muscle bed reflects the degree of capillary perfusion and is suitable for animal experimentation. The second technique involves contrast-enhanced ultrasound imaging of muscle using perfluorocarbon gas-filled albumin or phospholipid microbubbles. This method can provide estimates of microvascular blood volume and velocity and has been used in studies in experimental animals and in human subjects.

Results from in vivo studies using these techniques have demonstrated that insulin mediates its own access and that of glucose to muscle by capillary recruitment and an increase in bulk blood flow. The capillary recruitment however is independent from the total blood flow and is an early and highly sensitive effect of insulin. Insulin resistance of muscle may result in part from an impaired hemodynamic action of insulin. Many factors associated with the metabolic syndrome result in inhibition of the insulin-mediated capillary recruitment and include hypertension, obesity, elevated fatty acids, inflammatory cytokines, and endothelin.

Muscle contraction also leads to a rapid recruitment of microvascular flow but the mechanisms that contraction uses appear to be different from insulin. Muscle contraction can overcome the impairment of insulin-mediated capillary recruitment in obesity and cytokine induced insulin resistance. However exercise training leads to an enhancement of insulin-mediated capillary recruitment suggesting there is interaction between the processes. Further elucidation of the mechanisms and interactions between contraction- and insulin-mediated capillary recruitment will be important to provide insight into how insulin resistance can be overcome.
Neither the mechanism of insulin- or contraction-mediated capillary recruitment has been fully elucidated, but insulin action may involve endothelial factors such as nitric oxide (NO) and endothelial derived hyperpolarizing factors (EDHFs). The involvement of these factors in endothelial dysfunction associated with the metabolic syndrome provides a link between insulin resistance and cardiovascular disease.

REDUCED MUSCLE PERFUSION IN THE OBESE ZUCKER RAT

Frisbee, J.

West Virginia University School of Medicine, United States

The obese Zucker rat is a model of the metabolic syndrome, with its genesis in a leptin receptor deficiency resulting in chronic hyperphagia. Ensuing from this chronically elevated food intake, the obese Zucker rat (OZR) rapidly becomes obese, developing an increasing insulin resistance and impaired glycemic control, and a profound elevation in plasma triglyceride levels. Additionally, the OZR, following sexual maturity also develops a moderate, clinically-relevant degree of hypertension. As has been repeatedly demonstrated in human subjects afflicted with the metabolic syndrome, a crucial developing condition in these animals is a reduction in volume perfusion of skeletal muscle, both under resting conditions and in response to controlled elevations in metabolic demand. This presentation will discuss distinct elements underlying the progressive impairments to resting skeletal muscle perfusion and active hyperemia. We have previously demonstrated that the OZR exhibits a series of impairments in the ability of skeletal muscle resistance arterioles to dilate in response to both pharmacological and physiological stimuli. Further we have determined that, under reduced conditions, imposed improvements in vascular oxidant tone can ameliorate many of these constrained responses. However, the extent to which impairments to endothelium-dependent dilator reactivity contribute to reductions in skeletal muscle perfusion, or whether acute improvements in dilator responses improve muscle blood flow remain unclear. Vasoconstrictor responses, most notably in response to adrenergic stimuli, certainly appear to constrain muscle perfusion, both at rest and in response to mild elevations in metabolic demand; although metabolic influences can override adrenergic constraint on perfusion, this process is simply right-shifted to higher degrees of metabolic demand. Perhaps most compelling may be the contribution of progressive alterations to microvascular structure, at both the individual vessel and intact network levels of resolution, to the genesis of an ischemic condition, as individual resistance arterioles suffer reductions in wall distensibility and the microvessel network experiences a profound rarefaction in the OZR afflicted with the metabolic syndrome. This presentation will also encompass the effects of interventional strategies targeted at ameliorating these microvascular impairments and, by extension, the compromised perfusion levels. Specifically, these discussions of interventional strategies will focus on the effects of chronic reductions in vascular oxidant tone, treatments of hypertension and insulin resistance, and the beneficial impact of a chronic exercise regimen in OZR prior to the development of the full metabolic syndrome.

MICROCIRCULATORY FUNCTION AND INSULIN RESISTANCE

Stehouwer, C.

University Hospital Maastricht, Netherlands

Microcirculatory function and Insulin Resistance
C.D.A. Stehouwer, MD, PhD, Professor of Medicine
Department of Medicine, University Hospital Maastricht and Maastricht University, PO Box 5800, 6202 AZ Maastricht, the Netherlands. E-mail: csteh@sint.azm.nl
Abstract
Insulin resistance, hypertension and microcirculatory dysfunction are interrelated phenomena, which all, in addition, have several determinants in common, notably ageing, smoking, obesity, inflammation, and low birth weight. We propose that microvascular rarefaction and microvascular endothelial dysfunction explain in part why insulin resistance is linked to hypertension. On the one hand, there is evidence that microvascular dysfunction increases peripheral vascular resistance and thus, other things being equal, blood pressure. On the other hand, microvascular dysfunction decreases insulin-mediated glucose uptake in muscle, the latter by impairing the timely access of glucose and insulin to target tissues such as muscle. We suggest that any condition that impairs microvascular function will predispose to both insulin resistance and hypertension.

Invited symposium (IS)

IS1-14 ICSSPEE moral development in sport - "Albertville"

MORAL DEVELOPMENT RESEARCH IN SPORT: SOME PHILOSOPHICAL REFLECTIONS

Jones, C.

University of Wales Institute Cardiff, United Kingdom

The fairly gloomy conclusions of moral psychological research in sport are by now reasonably familiar. Shields' and Bredemier's early findings in particular painted a pessimistic picture of sport' affect on the moral character of those who play it. There has been much criticism of the attempts to describe empirically the relationship between sport and morality. The focus of the criticism has concentrated on a few key issues. It has been argued that all "scientific" research into morality is wrongheaded and can never achieve scientific objectivity given the inescapably normative nature of the subject under scrutiny. Other criticisms have focused on the normative commitments to deontological ethical theory implicated in the evaluations made. In this paper I aim to focus specifically on the conceptualisation of moral character implicitly and explicitly implicated in the research into sport and morality. Drawing on the valuable insight of Shields and Bredemeier, I will argue that moral character is significantly more complex than is often acknowledged. I will also argue, following Flanagan (1991) that an account of moral character, including a sport specific account, must be realistic and not compromised by opera-

tional considerations. I will sketch an alternative, non-reductive, virtue theoretically informed account of moral character and identify the implications for playing sport in a morally appropriate way.

MORAL FUNCTIONING, MORAL ATMOSPHERE, AND YOUTH SPORT: THE IMPACT OF COACH-CREATED MOTIVATIONAL CLIMATE

Miller, B.W.

Norwegian School of Sport Sciences, Norway

Most research from a sport social-psychological perspective has focused on the individual agent when pursuing questions regarding character aspects in sport (i.e., Bredemeier & Shields, 1986; Dunn & Causgrove-Dunn, 1999; Kavussanu & Roberts, 2001). The present study deviated somewhat from this perspective in that the perceptions of the coach's motivational cues were of central interest regarding moral functioning and moral atmosphere among youth football players. Participants for the study were 366 youth football players (n=242 males, n=124 females) from 34 teams in and around greater Oslo, Norway. A Norwegian version of the PMCSQ-2 (Newton et al., 2000) was used to measure perceived motivational climate. Scenario-based measures (Kavussanu & Roberts, 2001; Shields et al., 1995; Miller, 2004) were used to examine moral functioning according to Rest's (1984) model of moral action (e.g., moral judgment, reasoning, intention, and behavior) as well as both teammate and coach influenced moral atmosphere. Factor analysis of the PMCSQ-2 revealed four distinct subscales representing both mastery and performance climates: cooperative learning and important role (mastery), and unequal recognition and punishment for mistakes (performance). Canonical correlation analyses were employed to examine associations between the climate perceptions as predictor and the moral variables as criterion variables, respectively. A significant overall statistic revealed that moderate cooperative learning and important role, coupled with both high unequal recognition and punishment for mistakes was associated with overall low moral functioning and both teammate and coach influenced low team moral atmosphere. These results indicate how important coaches can be regarding youth interpretation of what is moral and non-moral in competitive sport, and how specific motivational cues perhaps may or may not affect moral functioning and team moral atmosphere. Moreover, the present findings may also be interpreted in a different manner than arguments posed by Shields and Bredemeier (1995) in that a mastery climate emphasis is essential if sport morality is desired. Specifically, it may not only be a strong mastery emphasis that is key to higher sport morality, but instead (or at the very least in conjunction with a mastery emphasis) a conscience decision on downplaying a "win at all cost" performance climate by the coach is what is needed.

References

Bredemeier BJ & Shields DL (1986). J Genetic Psych 147: 7-18.

Dunn JGH & Causgrove-Dunn J (1999). The Sp Psych 13: 183-200.

Kavussanu M & Roberts GC (2001). J Sp & Ex Psych 23: 37-54.

Miller BW (2004). Unpublished doctoral dissertation, ISBN nr 82-502-0376-3.

Newton M et al. (2000). J Sp Sci 18: 275-290.

Rest JR (1984). In WM Kurtines & JL Gewirtz (Eds) Morality, moral behavior, and moral development 25-39.

Shields DL et al (1995). Soc Sp J 12: 324-336.

Shields DLL & Bredemeie BJL (1995). Character development and physical activity.

DISAFFECTED YOUTH AND PHYSICAL ACTIVITY PROGRAMMES

Armour, K., Sandford, R.

Loughborough University, United Kingdom

Youth disaffection is a complex phenomenon that can manifest itself in numerous ways including disengagement from mainstream activities, engagement in disruptive or antisocial behaviour and involvement in petty crime. Disaffection is currently identified as a particular problem within schools, where it is reported that increases in the numbers of disaffected young people has resulted in higher levels of disruptive behaviour, truancy and exclusions, and low academic standards (Steer, 20000). Remedial programmes for disaffected youth tend to have broad aims that are focussed around reducing deviant behaviour, raising aspirations and promoting pro-social development (Merton & Parrott, 1999). Within this broad framework, there is an enduring belief in the value of physical activity programmes to secure a wide range of benefits for disaffected or disengaged young people (Miller, Bredemeier & Shields, 1997). Indeed, one of the key ways in which the UK government is attempting to tackle youth disaffection is through the provision of additional opportunities and facilities to enhance participation in physical education, physical activity and community sport. Yet, although high aspirations are held for the benefits of youth physical activity programmes, empirical evidence is comparatively sparse (Long & Sanderson, 2001; Morris, Sallybanks, Willis & Makkai, 2003). One of the reasons for this might be that the task of collecting credible research evidence to support claims made for individual sport and physical activity programmes is daunting. Nonetheless, there is a strong theoretical foundation underpinning the physical activity/positive youth development field, largely emanating from a number of key authors in the US, for example Burt (1998), Lawson (1995, 1997, 1999) and Hellison (1988, 1995). What is required, therefore, is longitudinal and systematic evaluation research that can build on those foundations (Sandford, Armour & Warmington, 2006). This paper, therefore, has three key objectives:

· To summarise the existing evidence base on the benefits of physical activity and sport programmes for disaffected or disengaged youth

· To report illustrative data from the first three years of a longitudinal evaluation (five years) of two corporate-sponsored programmes in the UK, both of which are seeking to use physical activity as a vehicle for enhancing young people's personal and social development

· To explore some of the methodological challenges faced in undertaking research in this field.

Invited symposium (IS)

IS1-15 Running biomechanics (sponsored by Nike) - "Berlin ABC"

EFFECT OF FASCICLE LENGTH CHANGES ON THE ESTIMATION OF VOLUNTARY ACTIVATION DURING ISOMETRIC CONTRACTIONS

Arampatzis, A., Mademli, L., De Monte, G.

German Sport University Cologne, Germany

The activation level (AL) during isometric contractions has been often estimated by the interpolated twitch technique [1,2]. In this method the evoked interpolated twitch torque (ITT) normalized to the resting twitch torque (RTT). However this normalization postulate that the potential of the examined muscle to generate force in the rest and during the contraction is the same. During a contraction the fascicle length do not remain constand [3] and so the above postulation is not given. Therefore the aim of this study was to examine the influence of the fascicle length changes during an isometric contraction on the estimation of voluntary activation (VA).

Twelve subjects participated in the study. All subjects performed isometric maximal voluntary contractions (MVC) at two different ankle angle positions (75 and 90° ankle angle, knee fully extended) on a Dynamometer. Additional at each position four submaximal voluntary isometric contractions (20, 40, 60 and 80% of the preexamined MVCs) were recorded. The twitch (triple twitches) interpolation technique was used to determine the VA of the triceps surae muscle during the contractions. Further the MVCs and the twitches were repeated for 6 other ankle positions. The ankle angle was changed from 85° to 115° in 5° intervals keeping the same knee angle. The kinematics of the leg were recorded using the vicon system (8 cameras 120 Hz) to calculate the resultant moment at the ankle joint. Two ultrasound probes were used to determine the fascicle length of gastrocnemius medialis, gastrocnemius lateralis and soleus muscles at rest and during the contractions. The AL were calculated using the RTT (a) at the same ankle positions (traditional method) and (b) at an ankle position where the weighted fascicle length of the triceps surae between ITT and RTT showed the minimal differences (fascicle length consideration method).

As expected fascicle length and ITT reduced as a the level of voluntary contraction increases. At different ankle angles the fascicle length at rest and the RTTs showed also different values. From 75° to 95° ankle angle the RTTs increases and from 95° to 115° decreases. The two methods showed statistically significant differences ($p<0.05$) in the estimation of the AL wich are depended on the ankle angle. The absolute differences of the AL estimated by the two methods to the actual voluntary activation were also depended on the ankle angle and showed lower values by the fascicle length consideration method.

The changes in fascicle length during isometric contractions influence the estimation of the VA. The amount of influence is ankle angle depended. The consideration of the fascicle length changes reduce the absolute differences to the actual level of the voluntary contraction. However the differences remained in average between 3 and 8%.

REFERENCES

1. Merton PA. J Physiol 518, 867-882, 1954.
2. Todd G. et al. Muscle Nerve 29, 834-842, 2004.
3. Kawakami Y. et al. J Appl Physiol 85, 398-404, 1998.

BIOMECHANICAL VARIABLES IN RUNNING AND ITS RELATION TO SPECIFIC OVERUSE INJURIES

Grau, S., Maiwald, C., Krauss, I., Mauch, M., Horstmann, T.

University Clinics Tübingen, Germany

The objective clinical and biomechanical classification of overuse injuries, such as iliotibial band syndrome (ITB) and patella tendon syndrome (PTS) is of great interest to provide important information in the development of running shoes and orthotics, as well as in the understanding of overuse injuries in general. Over the years, many authors (Fredericson 2000, Orchard 1996, Khaund 2005) assumed that overuse injuries are caused by different biomechanical variables, such as the extent of pronation, increased hip adduction as well as varus forefoot and valgus leg axis. Nevertheless, scientific proof was rather poor.

Healthy male and female runners (COm, COf) and runners with ITB and PTS overuse injuries were biomecanically analyzed. The biomecanical measurements included 3-D kinematics of the lower extremity (6 camera Vicon System, 250 Hz), as well as plantar pressure distribution (emed-xt, 100Hz, 4 sensores/cm2) in barefoot running (overground) at 12km/h. 3-D kinematics was used to describe segmental frontal and sagittal plane movements. Pressure distribution evaluations included path of center of pressure (COP) in addition to loading patterns of specific anatomical regions of the foot. Statistical analysis was based on descriptive statistics as well as on ANOVA ($\alpha = 0.05$) and Tukey Kramer´s Test ($\alpha = 0.05$).

Results showed different patterns (PTS: over-pronation and medial kollapse; ITB: over-supination at stance and push-off) of overuse injuries. Moreover, kinematic variables showed more distinct differences than pressure distribution variables.

Results indicate the need for additional running shoes (besides stability and neutral shoes) to control (reduce) amount of supination, especially at push-off.

Fredericson M, et al. Hip abductor weakness in distance runners with iliotibial band syndrome. Clinical Journal of Sports Medicine 10 (2000), 169-175.

Khaund R, et al. Iliotibial band syndrome: a common source of knee pain. American Family Physician 71 (2005), 1545-1550.

Orchard J.W., et al. Biomechanics of iliotibial band friction syndrome in runners. American Journal of Sports Medicine 24 (1996), 375-379.

AGE-RELATED ADAPTATIONAL PHENOMENA WHILE RUNNING ON DIFFERENT SURFACES

Karamanidis, K., Brüggemann, G.P., Arampatzis, A.

German Sport University Cologne, Germany

The goals of the study were (i) to investigate whether older adults modify their running task execution to compensate for the degeneration in their leg extensor muscle-tendon units (MTUs), and (ii) to examine whether modifications in surface condition affect age-related changes in running mechanics. The investigation was executed on 30 older (aged 60-69 years) and 19 younger (aged 21-32 years) adults. In a previous study [1] we documented that the older had lower muscle strength and lower tendon stiffness in their leg extensor

MTUs. In the current study ground reaction force ([GRF] Kistler, 1080Hz) and kinematic data (Vicon, 120Hz) were recorded as the same subjects ran at 2.7m/s over three surfaces having different compliance. To calculate the rate of force generation (Fgen) we divided the average vertical force per kg body weight divided by the ground contact time [2]. The proportion of the centre of mass (COM) transport during stride cycle whilst the subjects have contact with the ground was calculated as the ratio between anterior COM displacement during ground contact and anterior COM displacement during stride cycle (Ratiodis). The gear ratio of the leg extensor muscles was calculated as the ratio (R/r) of the moment arm (R) of the GRF acting about the joint to the agonist tendon moment arm (r) [3].

Older adults had higher duty factor, lower flight time, higher Ratiodis, lower Fgen and lower maximal moment and mechanical power at the ankle joint compared to the younger ($p<0.01$). Further, older adults showed lower gear ratio at the ankle joint during the mid part of the contact phase (from 26% to 58%) by means of lowering the moment arm of the GRF acting about the ankle joint. Surface condition did not affect detected age-related changes in COM trajectory, duty factor or joint kinetics ($p>0.01$). However, when running on the soft surface, the gear ratio at the ankle joint was lower during the mid part of the contact phase (from 42% to 58 %) than on the hard surface ($p<0.01$) but these changes did not depend on subjects age.

We concluded that the older adults react to the reduced MTUs capacity by increasing safety while running (higher duty factor, higher Ratiodis, lower flight time) and benefit from a mechanical advantage for the triceps surae MTU and a lower rate of force generation. Moreover, the improvement in running mechanics and safety of the aged musculoskeletal system while running was present for all surface conditions. We suggested that older adults are able to reorganize their running strategy to adjust the task effort to their reduced MTUs capacities for a variety of mechanical environments. It appears, further, that the changes in the musculoskeletal system over human lifespan has a essentially higher effect on running mechanics than changes in surface characteristics.

References

[1] Karamanidis and Arampatzis (2006) J Biomech,Vol 39:406-17

[2] Kram and Taylor (1990) Nature, Vol 346:265-7

[3] Carrier et al. (1994) Science, Vol 265:651-3.

MECHANICAL LOADING, RUNNING RELATED INJURIES AND FOOTWEAR CONSTRUCTION: WATH DID WE LEARN IN THE LAST THIRTY YEARS?

Segesser, B., Brüggemann, G.P., Kälin, X.

Praxisklinik Rennbahn, Switzerland

During the last decades biomechanics had a strong influence on the functional design of sport shoes. The decrease of impact forces was predominant for a long time in sport shoe research. The soft cushioning materials, however, increased the instability of the rear foot and was one of the reasons for overpronation causing typical overuse problems at the runner's lower leg and Achilles tendon. The control of overpronation by different materials and techniques was basically a compensation of the problems induced by overdimensioned cushioning systems. The medial support elements themselves lead to a lateral shift during take-off which needed to be compensated as well. Hence, the philosophy of "Cushioning –Control – Guidance" was born as a compensation strategy of different errors. It influenced sport shoe design in all brands for decades and was not able to reduce injuries effecively. Therefore, new strategies should allow natural foot movements by avoiding additional levers of the shoe in all directions. In addition to this such a new concept should support the neuromuscular informations and functions using technologies influencing muscular function optimisation (TIMO®).

Oral presentation (OP)

OP1-11 Physiology 3/10 - "Oslo"

LEUKOCYTE INFILTRATION IS NOT RELATED TO DELAYED ONSET MUSCLE SORENESS AFTER HIGH-FORCE ECCENTRIC EXERCISE AND INHIBITION OF COX-2 DOES NOT ATTENUATE LEUKOCYTE INFILTRATION

Paulsen, G., Fjeld, J.G., Hallén, J., Raastad, T.

Norwegian School of Sport Sciences , Norway

The mechanisms behind delayed onset muscle soreness (DOMS) after unaccustomed, high-force exercise are elusive; muscle damage and subsequent inflammation is regarded as the main culprit. Inflammation includes infiltration of leukocytes, release of numerous chemical substances and tissue swelling. This is believed to hypersensitize nociceptors and cause muscle soreness (Connolly et al., 2003). The main purpose of this study was to investigate the significance of leukocyte infiltration on DOMS.

Seventeen subjects (25 ± 2 yr, 176 ± 8 cm, 73 ± 8 kg; mean ± SD) performed 70 unilateral maximal eccentric repetitions with their elbow flexors. The subjects were divided into two groups: The Celebra group (n = 8) received celecoxib (an anti-inflammatory drug; COX-2 inhibitor; 2 x 200 mg per day for ten days), whereas the Placebo group (n = 9) received lactose pills. Medication started one hour before exercise. Infiltration of transfused, autologous radiolabelled leukocytes was measured with a gamma camera six and 20 hours after exercise. Maximal voluntary isometric torque was measured before and regularly for ten days after exercise. A visual analogue scale was used to measure DOMS, and tape circumference measurement was used to detect swelling.

Six hours after exercise the concentration of leukocytes was 43 ± 10 vs. 45 ± 11 % higher in the exercised arm than in the control arm in the Celebra and Placebo group, respectively (mean ± SEM; $p < 0.05$). Twenty hours after exercise this difference was increased to 82 ± 28 % in both groups. Immediately after exercise isometric force-generating capacity was reduced by 48 ± 4 and 52 ± 4 % for the Celebra and Placebo group, respectively. After nine days isometric force-generating capacity was still 14 ± 5 and 25 ± 5 % below pre exercise value for the Celebra and Placebo group, respectively. Two days after exercise, the Placebo group reported higher DOMS values than the Celebra group (6.4 ± 0.6 vs. 4.1 ± 0.7 mm; $p < 0.05$). The circumference of the upper arm peaked three and four days after exercise, 3.6 ± 1.1 and 2.4 ± 1.2 % above pre exercise value, for the Placebo and Celebra group, respectively. No correlations were found between the infiltration of leukocytes and DOMS, nor were there any relationships between changes in muscle function and DOMS.

DOMS does not seem to be related to neither changes in muscle function nor infiltration of leukocytes in a dose-dependent manner. The anti-inflammatory drug celecoxib was not effective in reducing leukocyte infiltration, but attenuated DOMS. Since celecoxib inhibit the COX-2 enzyme, this may indicate that COX-2 is involved in DOMS. Surprisingly, the magnitude of infiltration does not seem to be signifi-

cantly affected by the COX-2 inhibitor. However, similar findings are reported by Peterson et al. (2003) after administrating other types of anti-inflammatory drugs.

Connolly et al. (2003). J.Strength.Cond.Res. 17, 197-208

Peterson et al. (2003). Med.Sci.Sports Exerc. 35, 892-896.

TIME-COURSE AND DIFFERENTIAL EXPRESSION OF HEAT SHOCK PROTEINS IN HUMAN SKELETAL MUSCLE FOLLOWING NON-DAMAGING TREADMILL EXERCISE: IS HEAT A MECHANISM OF ACTIVATION?

Morton, J., MacLaren, D.P., Cable, T., McArdle, A., Drust, B.

Liverpool John Moores University, United Kingdom

The exercise-induced expression of heat shock proteins (HSPs) as a cellular stress response in rodent models is relatively well defined (McArdle et al., 2001). Comparable data from human studies, however, are limited and the mechanisms contributing to the exercise-induced production of HSPs are far from understood. Although exercise-associated hyperthermia is routinely cited as a possible signal responsible for inducing an increased production of HSPs following exercise, this hypothesis has not been formally tested in human skeletal muscle. The aim of the present study was to therefore characterise the time-course of response of the major HSP families in human skeletal muscle following a running exercise protocol and to test the hypothesis that increased muscle and core temperature mediate the increased production of HSPs following exercise.

Eight healthy active males performed 45 min of running exercise at a treadmill speed corresponding to their lactate threshold. Muscle biopsies were obtained from the vastus lateralis muscle immediately prior to and at 24 h, 48 h, 72 h and 7 days post-exercise. Seven healthy active males also underwent a passive heating protocol of 1 h duration in which one leg was immersed in a tank containing hot water (45 °C). The contra-lateral limb remained outside the tank and was not exposed to heat stress thus serving as a control leg. Muscle biopsies were obtained from the vastus lateralis of both legs immediately prior to and at the time of peak HSP expression induced by exercise (observed to be at 48 h and 7 days post-heating). The exercise and heating protocol induced significant increases ($P<0.05$) in rectal (1.7±0.3 and 1.5±0.2 °C, respectively) and muscle temperature (3.8±0.8 and 3.7±0.6 °C, respectively). Muscle temperature of the control leg showed no significant change following heating (pre: 36.1±0.5, post: 35.6±0.4 °C). Exercise induced a significant ($P<0.05$) but variable increase in HSP70, HSC70 and HSP60 expression with peak increases (typically occurring at 48 h post-exercise) of 210±70%, 170±75% and 139±23% of pre-exercise levels, respectively. In contrast, heating failed to induce a significant increase in muscle content of these proteins. Neither heating nor exercise induced a significant increase in HSP27, αB-crystallin, MnSOD protein content or the activity of superoxide dismutase and catalase.

This study is the first in which the time-course and extent of HSP production in human skeletal muscle have been characterised following a moderately demanding running exercise protocol. Data demonstrate that the skeletal muscle of healthy active young males adapts to such stresses via an increased production of several HSPs (predominantly HSP70) where peak responses typically occur at 48 h post-exercise. We conclude that increases in both systemic and local temperature per se appear not to be mediating this response.

McArdle, A. et al. (2001). Am J Cell Physiol, 280: C621-C627.

EFFECT OF A FED OR FASTED STATE ON THE SALIVARY IMMUNOGLOBULIN A RESPONSE TO EXERCISE

Allgrove, J., Geneen, L., Latif, S., Gleeson, M.

Loughborough University, United Kingdom

It has been previously suggested that the nutritional status of an individual can influence the levels of salivary immunoglobulin A (s-IgA) at rest, yielding higher and more variable concentrations in fasting saliva compared to non-fasting saliva (Gleeson et al., 2004). Prolonged, strenuous exercise has been associated with changes in the levels of this antibody (Gleeson et al., 2003) however, the influence of the fed or fasted state on the s-IgA response is unknown. Thus, the present study investigated the effect of a fed or fasted state on the s-IgA response to prolonged cycling. Using a randomised cross-over design, 8 males and 8 females of mixed physical fitness, mean (SEM) age 22 (1) years, performed 2 hours cycling on a stationary ergometer at 65% of their maximal oxygen uptake on one occasion following an overnight fast (FAST) and on another occasion following the consumption of a 2.2 MJ high carbohydrate meal (FED) 2 hours before. Timed, unstimulated whole saliva samples were collected immediately before ingestion of the meal, immediately pre-exercise, at 5 minutes before cessation of exercise, immediately post-exercise and at 1 hour post-exercise. The samples were analysed for s-IgA concentration, osmolality and cortisol and saliva flow rates were determined to calculate the s-IgA secretion rate. Salivary data were analysed using a two factor repeated measures ANOVA and post hoc t-tests with Holm-Bonferroni adjustments were applied where appropriate. Carbohydrate oxidation was significantly higher ($P<0.05$) and fat oxidation tended to be lower ($P=0.06$) in FED compared to FAST. Saliva flow rate decreased during exercise from 0.50 (0.04) mL/min to 0.37 (0.03) mL/min ($P<0.05$), s-IgA concentration increased during exercise from 163 (20) to 232 (24) mg/L ($P<0.05$) but the s-IgA secretion rate remained unchanged, pre-exercise: 79 (11) µg/min, post-exercise: 74 (9) µg/min. There was a significant reduction in the s-IgA:osmolality ratio from 2.3 (0.2) pre-exercise to 1.5 (0.1) post-exercise ($P<0.05$). Salivary cortisol increased from 9.9 nmol/L (1.6) pre-exercise to 16.7 (2.9) nmol/L post-exercise ($P<0.05$). There was no effect of FED versus FAST on these salivary responses. The immediately pre-exercise values of s-IgA were 165 (27) and 161 (27) mg/L in the FED and FAST trials, respectively. The s-IgA concentration and secretion rate were found to be significantly lower in females than in males across all time points ($P<0.05$); however, there was no significant difference between genders in the saliva flow rate or the s-IgA:osmolality ratio. These data demonstrate that the nutritional status does not influence resting s-IgA or the s-IgA response to prolonged exercise. Furthermore, these data suggest a significant effect of gender on resting s-IgA levels without affecting the acute response to exercise.

Gleeson, M. et al. (2003). Int SportsMed J 4:http://www.esportmed.com/ismj/frames.asp

Gleeson, M. et al. (2004). Exerc Immunol Rev. 10: 107-128.

HEART RATE VARIABILITY THRESHOLDS AND HEART RATE DEFLEXION POINT DURING MAXIMAL RUNNING EXERCISE IN CIRCUMPUBERTAL BOYS: ACCURATE METHODS TO ASSESS VENTILATORY THRESHOLDS?

Buchheit, M., Solano, R., Millet, G.P.

Laboratoire de Recherche Adaptations Réadaptations (APS et conduites motrices), France

Together with maximum oxygen uptake, ventilatory thresholds (VT1 and VT2) are the physiologic measures the most used to characterise aerobic fitness. To approach VTs without gas analysis, some authors have proposed to use the heart rate profile during exercise, while

determining either the so-called heart rate deflexion point (HRDP) or, more recently, the two HR variability (HRV) thresholds (HRVT1 and HRVT2). The purpose of this study is to verify the accuracy of using heart rate alone to assess ventilatory thresholds in circumpubertal boys during running exercise. 79 adolescents (aged 13.4 ± 1.3, 159.2 ± 1.41 cm and 46.8 ± 11.2 kg) took part in the study and underwent a graded treadmill test where all ventilation parameters and beat to beat HR were continuously recorded. Ventilatory thresholds were first determined from ventilatory equivalents (VE/VO2 and VE/VCO2) curves vs speed [3]. HRV thresholds were determined from the fHF.HF index (high frequency (HF) power density multiplied by the HF frequency) curve vs. speed [1]. HRDP was determined by the successive slopes methods [2]. Results show that mean HR at VT1 and HRVT1 was not significantly different (160.3 ± 12.4 vs 159.0 ± 14.5 bpm), whereas speed was higher at VT1 than at HRVT1 (8.7 ± 1.3 vs 8.4 ± 1.3 km.h-1). Coefficient correlation between speeds at VT1 and at HRVT1 was moderate (r=0.62) although significant (P<0.001). The speed difference between VT1 and HRVT1 was higher than 5% in 67.1% of the subjects. HR was significantly lower at VT2 than at HRVT2 and HRDP (185.9 ± 8.3 vs 188.7 ± 9.0 and 188.0 ± 7.4 bpm). Speeds were similar between VT2 and HRDP (11.9 ± 1.4. and 11.9 ± 1.8 km.h-1), and were significantly lower than the speed at HRVT2 (12.3 ± 1.6 km.h-1). Coefficients correlation between speeds at VT2 and at HRVT2 and HRDP were significant (P<0.001) but moderate (r=0.62 and 0.56). Compared to speed at VT2, 60.8% and 74.7% of the adolescents displayed speed differences higher than 5% at HRVT2 and HRDP. To conclude, the present study suggests that HR monitoring during running exercise in circumpubertal boys could be an interesting alternative way to approach HR and running speeds at VT1 and VT2, but, as we observed very accurate assessments only in a small proportion of the subjects, we can not recommend to replace usual VTs determinations by HRV thresholds or HRDP observation.

References

1. Cottin, F., P. Leprêtre, P. Lopes, Y. Papelier, C. Médigue, and V. Billat, Assessment of ventilatory thresholds from heart rate variability in well-trained subjects during cycling. Int J Sports Med 2006; In press

2. Grazzi, G., N. Alfieri, C. Borsetto, I. Casoni, F. Manfredini, G. Mazzoni, and F. Conconi, The power output/heart rate relationship in cycling: test standardization and repeatability. Med Sci Sports Exerc 1999; 31: 1478-1483.

3. Wasserman, K., B.J. Whipp, S.N. Koyl, and W.L. Beaver, Anaerobic threshold and respiratory gas exchange during exercise. J Appl Physiol 1973; 35: 236-243.

RELATED TRENDS IN LOCOMOTOR AND RESPIRATORY MUSCLE OXYGENATION DURING EXERCISE

Legrand, R., Marles, A., Prieur, F., Mucci, P.

Université de Lille 2, France

In healthy young subjects, the high metabolic demand of respiratory muscles could affect blood flow redistribution to these muscles, to the detriment of locomotor muscle[1]: it induce reduced leg blood flow associated with preserved O2 extraction by the muscle, leading to reduced leg muscle VO2. This "steal" phenomenon has been demonstrated in endurance trained athletes with high minute ventilation level (VE). One may wondered if respiratory muscle work could also alter locomotor oxygen delivery and utilization in non-endurance trained subjects. Although, these peoples presents lower VE and lower O2 cost of hyperpnea than endurance athletes, they have also lower cardiac output that could led to a respiratory "steal" phenomenon. One other concern is that the intensity at which this phenomenon could occur is still controversial.

Thus we investigated the potential effect of respiratory muscle work on leg muscle oxygenation in non-endurance trained subjects and searched for the range of intensity when this effect could occur.

Accessory respiratory and leg muscle oxygenation patterns were monitored continuously with near infrared spectroscopy (NIRS) in 15 healthy young men performing maximal incremental exercise on a cycle ergometer. Pulmonary gas exchanges were collected. Respiratory compensation point (RCP) was determined. Oxygenation (RMO2) and blood volume (RMBV) of the serratus anterior (accessory respiratory muscle) and of the vastus lateralis (LegO2 and LegBV) were monitored with NIRS. The breakdown point of accessory respiratory muscle oxygenation (BPRMO2), the accelerated (BP1LegO2) and attenuated fall (BP2LegO2) in leg muscle oxygenation were detected.

BPRMO2 occurred at ~85% VO2max and was related to RCP ($r = 0.88$, $P < 0.001$). BP2LegO2 appeared at ~83% VO2max and was related to RCP ($r = 0.57$, $P < 0.05$) and with BPRMO2 ($r = 0.64$, $P = 0.01$). From BP2LegO2 to maximal exercise, LegBV was significantly reduced ($P < 0.05$).

The appearance of the accelerated drop in accessory respiratory muscle oxygenation – associated with high ventilatory level - was related with the attenuated fall in leg muscle oxygenation detected with NIRS. This suggests that the high oxygen requirement of respiratory muscle leads to limited oxygen utilization by locomotor muscles as demonstrated in endurance trained subjects. The observed phenomenon was associated with reduced leg blood volume supporting the occurrence of leg vasoconstriction. These events appeared not only at maximal exercise but onward above the respiratory compensation point.

References

Harms, C.A., et al. Respiratory muscle work compromises leg blood flow during maximal exercise. J Appl Physiol; 1997. 82(5): 1573-83.

Oral presentation (OP)

OP1-12 Training and Testing 1/7 - "Turin ABC"

CHANGE TO ANAEROBIC TRAINING IMPROVES RUNNING ECONOMY AND HIGH INTENSITY EXERCISE PERFORMANCE IN ENDURANCE RUNNERS

Iaia, F.M. 2,1, Kolding, H. 1, Gunnarsson, T. 1, Wendell, J. 1, Rostgaard, T. 1, Nybo, L. 1, Krustrup, P. 1, Bangsbo, J. 1

1 Institute of Exercise and Sport Sciences, University of Copenhagen, 2 Faculty of Exercise Sciences- State University of Milan, Italy, Denmark

INTRODUCTION

Skeletal muscles have a great ability to adapt to changes in physical activity. Recently, Burgomaster et al. (2005) have reported a marked increase in muscle oxidative potential and cycle endurance capacity of untrained males after only six session of sprint interval training. The aim of the present study was to examine the physiological response to exercise and changes in performance as a result of a change to high-intensity training in trained endurance runners.

METHODS

Fifteen sub-elite endurance runners (mean±S.E.M; age: 34.4±1.5 yrs; body mass: 74.0±2.3 Kg; height: 180.4±2.0; experience: 6.3±1.2yrs; VO2 peak: 54.2±1.4 ml/kg/min) were matched and randomly assigned to either an experimental (EG, N=8) or control group (CG, N=7). The CG continued the training as during the period prior to the study (mainly aerobic moderate intensity training, 3-4 times a week), while the EG for a 4-wk period replaced their normal training by performing 3-4 sessions a week of high-intensity intermittent exercise (HIT) each consisting of 8-12 repeated 30-s supra-maximal running efforts separated by 3 min of rest. Before (PRE) and after (POST) the 4-wk period the athletes completed: 1) four 6-min sub-maximal treadmill running stages followed by an incremental test to exhaustion to determine VO2 max (T1); 2) Two supra-maximal intense exercise bouts to exhaustion on a treadmill (T2), 3) a 10,000-m race on a track (10K); 4) the Yo-Yo intermittent recovery test - level 2 (Yo-Yo IR2); 5) a 30-s "all out" running effort. Heart rate and pulmonary oxygen uptake were measured and blood samples were collected frequently during T1 and T2.

RESULTS

In T1, EG improved (P<0.05; Students Paired t-test) running economy (ml/kg/km) at speeds of 13.0, 14.5 and 16.0 km/h (7.3%, 5.2% and 6.4% respectively), whereas no significant changes were observed in CG at either speeds. For EG, time to exhaustion in the 1st and 2nd bout of T2POST were 24.6% and 18.0% longer (P<0.05), respectively, than T2PRE. No changes were observed in CG. Furthermore, in EG the Yo-Yo IR2 performance was 18.2% better (P<0.05) after HIT, with no significant change for CG (+4.3%). In EG the distance covered during the 30-s all-out test was 6.8% longer (P<0.05) after the training period. VO2 peak and 10K performance remained unaltered in both groups.

CONCLUSION

The present study showed that the anaerobic training improved performance during supra-maximal and intermittent exercise, and maintained the aerobic fitness and endurance performance of trained runners. Furthermore, running economy at medium and high sub-maximal intensities was enhanced. These changes occurred despite a dramatic reduction in training volume.

REFERENCES

Burgomaster KA, Hughes SC, Heigenhauser GJ, Bradwell SN, Gibala MJ. Six sessions of sprint interval training increases muscle muscle oxidative potential and cycle endurance capacity in humans. J Appl Physiol. 98(6): 1985-1990, 2005.

COMPARISON OF A MODEL PREDICTED MAXIMAL LACTATE STEADY STATE POWER OUTPUT TO A MEASURED MAXIMAL LACTATE STEADY STATE POWER OUTPUT IN ATHLETES

Neupert, E., Smith, D.J., Norris, S.R.

University of Calgary, Canada

Maximal lactate steady state (MLSS) is an important measure of athletic performance. It is defined as the the highest intensity of a constant load exercise that elicits an equilibirum between lactate accumulation and removal. Currently no consensus exists regarding the test duration of MLSS, or the criterion change in blood lactate [BLa-] that constitutes MLSS. However a minimum test duration of 30 min at the highest intensity where [BLa-] does not increase above 1 mmol/L during the final 20 min of exercise has previously been cited (1) Theoretically the attainment of MLSS could be mathematically defined as a slope of zero when [BLa-] or [HCO3-] is expressed as a function of time. The aim of this pilot study was to evaluate the observed power output at MLSS (MLSSw) in comparison to a mathematical model predicting MLSSw. Observations from a previous training study in this laboratory generated these proposed models: for [BLa-] (a) (%MLSSw = 47.393*[BLa-] slope + 100) and for [HCO3-] (b) (%MLSSw = 56.211* [HCO3-] slope – 100). The calculated slope of [BLa-] or [HCO3-] against time in a constant load ride above the lactate minimum power output (LMPO) was substituted into these equations. From these predicted results the wattage at 100% of MLSSw was calculated. Seven male trained cyclists performed an incremental VO2max test to determine maximum aerobic power (MAP) (mean MAP = 5.1 W/kg and VO2max = 60.2 ml/kg/min) a lactate minimum test to determine LMPO and three 20 - 45 min constant load rides individualized to 100 – 110% of LMPO on a Velotron Pro (Racermate Inc, Seattle). Venous blood from an indwelling catheter was sampled every 5 min during the constant load rides and analysed for [BLa-] and [HCO3-]. The hypothesis was that the slope of [BLa-] or [HCO3-] as a function of time would be zero at MLSSw. As hypothesised no significant differences at the observed MLSSw were seen (a) [BLa-] (p = 0.22) and (b) [HCO3-] (p = 0.70). Mean values of [BLa-] and [HCO3-] at the observed MLSSw (269 +/- 21W) were (5.1 +/- 0.4 mmol/L) and (20.7 +/- 0.4 mmol/L) respectively. Predicted MLSSw from the rides at >100% LMPO were 273 +/- 21W (model a) and 272 +/- 22W (model b). No significant differences were found between the observed or predicted MLSSw values for models a or b (p>0.05), R2 = 0.9485 and 0.9199 respectively. These initial findings suggest that the models for (a) [BLa-] and (b) [HCO3-] could be used for predicting MLSSw in trained cyclists.

(1) MacIntosh, B. R.et al. (2002).Can. J. Appl. Physiol 27: 232-249.

EFFECT OF SAMPLING PROTOCOL ON RESPIRATORY DATA AND INDIRECT CALORIMETRY

Alkhatib, A., Beneke, R.

University of Essex, United Kingdom

Incremental exercise test protocols combined with measurements of oxygen uptake (VO2) and carbon dioxide (VCO2) production are widely used for performance testing and indirect calorimetry. Depending on testing equipment, VO2 and VCO2 are often sampled or averaged over 0.5 min or up to 1.0 min periods. The onset kinetics of the VO2 depends on exercise intensity (Ozyener et al. 2001). Therefore, depending on exercise intensity and sampling or averaging period, different VO2 results and a corresponding effect on VCO2 can be expected. We tested whether and how sampling or averaging of respiratory data over 0.5 min or 1.0 min affect assumptions and results of indirect calorimetry in an incremental exercise test.

METHODS: 21 healthy male subjects (age: 26.3 ± 6.0 yrs, height: 179.4 ± 8.1 cm, body mass: 74.9 ± 12.5 kg) completed an incremental load cycling test to exhaustion at 50 rpm. Starting with 1 W.kg-1 body mass power output was increased by 0.5 W.kg-1 body mass every two minutes. Three intensity domains were investigated: light 20-39 %, moderate 40-59 %, and heavy 60-85 % (ACSM Guidelines, 2000). VO2 and VCO2 data were averaged for the last 0.5 and 1.0 min of every stage of the incremental exercise test. All data are presented as Mean ± SD and tested using a repeated measures ANOVA model with averaging period as within factor and exercise intensity domain as between factor, Tukey post hoc and paired t-test. The level of significance was set at $p < 0.05$.

RESULTS: VO2 was higher ($p < 0.05$) when averaged for 0.5 than 1.0 min at heavy (3303.4 ± 650.1 vs. 3280.7 ± 643.2 ml.min-1) but not at light (1477.2 ± 207.5 vs. 1472.1 ± 195.6 ml min-1) or moderate intensity (2119.2 ± 313.5 vs. 2116.9 ± 301.6 ml.min-1). VCO2 was higher ($p < 0.05$) when averaged for 0.5 than 1.0 min at all intensity domains (light: 1204.9 ± 195.6 vs. 1172.9 ± 182.2, moderate: 1894.8 ± 317.5 vs. 1873.7 ± 305.9 ml.min-1, and heavy: 3453.3 ± 850.3 vs. 3400.7 ± 839.8 ml.min-1).

CONCLUSION: Increasing the period of averaging from 0.5 to 1.0 min resulted in an underestimation of the metabolic rate at moderate and heavy exercise intensity in the magnitude of approx. 0.1 and 0.6 %, respectively, which may be practically irrelevant. However, the latter is combined with a significant underestimation of the reliance on carbohydrate combustion of approx. 9.2 % in the light and approx. 4.9 % in the moderate intensity domain.

REFERENCES:

Ozyener F, Rossiter HB, Ward SA, and Whipp BJ (2001) Influence of exercise intensity on the on- and off- transient kinetics of pulmonary oxygen uptake in humans. J Physiol. 533.3;891-902

American College of Sports Medicine (2000) ACSM's guidelines for exercise testing and prescription. 6th Ed. USA, Lippincott Williams & Wilkins.

RELATIONSHIP BETWEEN OXYGEN UPTAKE AND OXY-HEMOGLOBIN SATURATION ON GLUTEUS MAJOR AND RECTUS FEMORIS DURING GRADED AEROBIC EXERCISE ON A NEW CARDIOVASCULAR EQUIPMENT PERFORMED IN DIFFERENT POSITIONS

Zanuso, S., Benvenuti, P., Cecchinelli, F., Ferrari, M., Quaresima, V.

Technogym , Italy

Cardiovascular machines require muscle activation that depends on movement patterns, exercise intensity and body positions. The aim of this study was to investigate the relationship between oxygen uptake and oxy-hemoglobin saturation on Gluteus Major (GM) and Rectus Femoris (RF) during graded aerobic exercise performed on a new cardiovascular equipment (CardioWave, Technogym, Italy). CardioWave machine allows a new multi-planar movement that combines hip extension, abduction and external rotation.

Local GM and RF oxidative activity has been monitored by a non invasive tissue oximeter (1) based on near infrared spectroscopy (NIRS).

Methods. Six physically active subjects (3 men) participated at the study; their mean age, height, and body weight were 37.5 ± 2.4 years, 176.8 ± 8.7 cm, 67.1 ± 11.6 kg, respectively. Adipose tissue thickness of GM and RF were 3.0±0.7 and 2.4±0.3 mm, respectively. Oxygen uptake (VO2) was continuously measured at the mouth on a breath-by-breath basis by a computerized system (Cosmed, Italy). Right RF and GM oxy-hemoglobin saturation was measured as tissue oxygenation index (TOI, %) simultaneously by a two-channel four-wavelength tissue oximeter (NIRO-300, Hamamatsu Photonics, Japan). Subjects warmed up for 10 min on a cycle ergometer (50 W; 60 rpm). Each subject performed 5 steps (Step I-V) of 6 min duration at increasing intensities defined as steps per minute (spm). Intervals of different duration (between 3 and 7.5 min) separated each step. At the end of step V, subjects performed an incremental exercise up to exhaustion (step duration:1 min; increment: 10 spm). The same protocol was performed in two positions in different days: day one (CW_1) subjects standing with trunk in neutral position; day 2 (CW_2) subjects standing with trunk in flexion.

Results and Discussion. As expected, TOI decreased in RF and GM (more consistently in RF) upon increase of spm. A high correlation was found between ΔVO2 and ΔTOI of RF (CW_1, p<0.001; CW_2, p< 0.04) and GM (CW_1, p<0.002; CW_2, p<0.01).

The pre-exercise TOI was 66.7±5 and 84.0±1.8 % in RF and GM, respectively; at exhaustion TOI was 44.5±19.1 and 74.8±6.1 % in RF and GM, respectively. The consistent TOI decrease (de-saturation) during exercise supports the hypothesis that RF and GM are actively working during aerobic exercise on CardioWave.

Acknowledgements. University of L'Aquila was supported in part by Hamamatsu Photonics, Japan.

Reference 1) Ferrari et al. Can J Appl Physiol. 29:463-487, 2004.

COMPARISON OF THE RELIABILITY OF OPEN- VERSUS CLOSED-LOOP TREADMILL RUNNING TESTS IN WELL-TRAINED RUNNERS

Laursen, P., Francis, G., Abbiss, C., Newton, M.

Edith Cowan University, Australia

Both time-to-exhaustion (Tlim) and time trial (TT) exercise tests, also referred to as open- and closed-loop exercise protocols respectively, are commonly used to examine the influence of experimental interventions on endurance performance ability. While a meta-analysis examining the reliability of open- vs. closed-loop exercise tests suggests that closed-loop reliability is reduced when compared with open-loop reliability, there are no known studies directly comparing the reliability of open- vs. closed-loop exercise tests of similar intensity and duration. The purpose of the study was to compare the reliability of open- vs. closed-loop treadmill running tests of high and moderately-high exercise intensity in well trained male distance runners. Following familiarisation tests, eight well-trained male distance runners (age 31±6 y; mass 70.4±6.9 kg, VO2max 61±8 ml.kg-1.min-1) performed in a randomised counterbalance order, eight trials in total consisting of two 1.5km TTs and two 5km TTs, and four runs to exhaustion at a speed equivalent to the average speed attained during both the 1.5km and 5km TT distances. During the TT tests, subjects were able to adjust their speed and were asked to run the distance in the fastest time possible, while during the Tlim tests subjects were asked to run for as long as possible at the prescribed running speed; reference to time was not given to the subjects in any of the trials. Reliability was assessed through calculation of the coefficient of variation (CV = SD/mean x 100%) between each of the two respective tests, while Student's t-test for pairwise samples determined differences between the test protocols and test intensities/distances. There were no significant differences between the first and second tests of the 5km TT (1167±103 vs. 1184±102s), 5km Tlim (1085±213 vs. 1086±197s), 1.5km TT (312±25 vs. 316±33s) and 1.5km Tlim (411±55 vs. 371±74s; all p>0.05). However, the CV for the 5km TT test (2±1%) and 1.5km TT test (3±2%) were significantly less than their respective 5km Tlim (11±7%) and 1.5km Tlim (10±10%) values; no differences in CV were apparent with differences in test duration or distance using the same protocol. While the mean 5km TT time (1175±101s) was significantly greater than the 5km Tlim time (1085±175s), the mean 1.5km TT time (314±29s) was significantly less than the 1.5km Tlim time (391±58s; p<0.05). In conclusion, the reliability of the time trial or closed-loop exercise test was significantly greater compared with similar time-to-exhaustion or open-looped treadmill protocols; exercise intensity or duration did not appear to markedly influence the reliability. Future studies should attempt to examine the reliability of open- vs. closed-loop tests following an exercise intervention so as to determine the type of exercise protocol that exhibits the greatest signal-to-noise ratio.

EFFECTS OF DRY-LAND VS. RESISTED- AND ASSISTED-SPRINT EXERCISES ON SWIMMING SPRINT PERFORMANCES

Girold, S., Maurin, D., Dugue, B., Millet, G.

Faculty of Medicine Jean Monnet, Saint-Etienne, France, France

This study was undertaken to compare the effects of dry-land strength training and combined resisted- and assisted-sprint exercises on 50 m freestyle swimming performance and technical parameters. Twenty-one swimmers, (10 males, 11 females), (mean ± SD, age 16.5 ± 3.5 years, height 170 ± 9 cm, weight 62 ± 7 kg, arm span 175 ± 11 cm), from regional to national level, were randomly divided into three groups: Strength (S), Resisted- and Assisted-Sprint (RAS) and Control (C). During 12 weeks, all swimmers trained six days per week, with two strength dry-land or two RAS sessions for S and RAS respectively, and a cycling training session for C. Barbells were used in strength training and elastic tubes were used to generate over-strength and over-speed in RAS training. Prior, during (6th week) and after the training period, strength of the elbow flexors and extensors was measured with an isokinetic dynamometer and speed, stroke rate, stroke length and stroke depth were recorded using an underwater video system during a 50 m sprint. After the training period, we observed a significant increase in swimming velocity in both S and RAS groups (2.8 ± 2.5%, 2.3 ± 1.3%; P<0.05; respectively), elbow flexors (39.5 ± 32.4%, 17.6 ± 13.8%; P<0.05; respectively) and extensors strength (45.5 ± 38.7%, 12.4 ± 18.7%; P<0.05, respectively). However, stroke depth decreased in both S and RAS groups (-3.5 ± 1.1%, -2.5 ± 1.2%; P<0.05; respectively). In addition, stroke rate increased in RAS (2.7 ± 0.2%; P<0.05) but not in S group. However, only slight differences between S and RAS methods were observed despite the greater specificity of RAS in swimmers. No increase in swimming velocity was observed in C. Programs combining swimming and dry-land S or in-water RAS led to a similar gain in sprint performance. This study confirmed also that these described methods are more efficient than traditional swimming methods alone.

Oral presentation (OP)

OP1-13 Health and Fitness 1/4 - "Berlin DE"

PHYSICAL FITNESS OF DRAFTEES COMPARED WITH THEIR HABITUAL PHYSICAL ACTIVITY

Wyss, T., Marti, B., Mäder, U.

Federal Institute of Sports, Magglingen, Switzerland

Physical Fitness of draftees compared with their habitual physical activity

Thomas Wyss, Bernard Marti, Urs Mäder

Swiss Federal Institute of Sports, Magglingen, Switzerland

INTRODUCTION: The fitness test battery of the Swiss Army recruitment (TFR) is used to assign the conscripts appropriate tasks and allows monitoring of fitness development among Swiss males 19-20 years old. The TFR consists of four performance tests and a questionnaire aiming at physical activity behaviour and motivation of sport. The purpose of this study was to determine the relationship between physical fitness objectively measured by the TFR and the habitual physical activity registered by self-report questionnaire.

METHOD: 1444 draftees (19.47 ± 0.99y, 177.94 ± 6.47cm, 72.69 ± 11.74kg) performed in summer 2005 the TFR and completed the questionnaire. The TFR consisted of a progressive endurance run, standing long jump, seated shot put, and a trunk muscle strength test. For further analysis the total score, scores for each test and a dichotomous categorisation ("high-performance" versus "lower fitness level") were built. The questionnaire included 6 questions on self-reported habitual physical activity and allowed to classify the respondents as "trained", "regularly active", "irregularly active", "partially active" and "inactive". Spearman correlation coefficients were calculated to establish the relation between physical activity behaviour and the results of each of the four TFR tests. The Kappa value was calculated to quantify the magnitude of agreement between the categorisation "high performance" and "trained".

RESULTS: Draftees classified as trained (n=694) achieved 63.1, regularly active (n=127) 56.9, irregularly active (n=305) 57.3, partially active (n=238) 52.0 and inactive (n=80) 48.9 TFR-scores on the average. The total score of the TFR and the scores for each test were positively related to the habitual physical activity level, respectively (r=0.40, progressive endurance run: r=0.39, trunk muscle strength test: r=0.29, standing long jump: r=0.23 and seated shot put: r=0.20, p<0.0001). 68% of the high-performance draftees (n=519) were classified as trained by the questionnaire. 37% of the draftees with lower fitness level (n=925) were classified inconsistently as trained (Kappa = 0.284, p<0.0001).

DISCUSSION: These results suggest that in young men habitual physical activity has some promoting effects on physical fitness. Kushima et al. (1) found similar coherences in middle-aged men. As expected, the aerobic endurance is stronger related to the habitual physical activity level then explosive muscle power. Fair agreement was observed between the classifications "high performance" and "trained"; however, there seems to be a need for both assessments.

REFERENCE:

1. Kushima K, Ohtaki M, Fukuba Y, Takamoto N, Une S, and Munaka M. [Effect of habitual physical activity on physical fitness and serum cholesterol in middle-aged male workers].

THE VALIDITY OF PREDICTING MAXIMAL OXYGEN UPTAKE FROM PERCEPTUALLY-REGULATED GRADED EXERCISE TESTS OF DIFFERENT DURATIONS

Faulkner, J., Eston, R., Mason, E., Parfitt, G.

University of Exeter, United Kingdom

The strong positive relationship between the ratings of perceived exertion (RPE) and oxygen uptake is well established. Eston et al. (2005) provided evidence that a sub-maximal, perceptually-guided, graded exercise protocol could provide acceptable estimates of maximal oxygen uptake (VO2max), which are improved with practice in physically active young males. Their study used repeated, 4-min bouts which were self-regulated at predetermined RPEs of 9,11,13,15 and 17 (Borg, 1998) in that order. However, Eston et al. did not account for the duration of the perceptually-regulated trials or indeed the influence of gender on the validity of predicting VO2max from sub-maximal VO2 values elicited at the above RPEs. An assessment of the usefulness of shorter durations of sub-maximal exertion is considered to be of practical value with regards to the time, cost and effort of such a procedure. The purpose of this study was to assess the validity of predicting VO2max from sub-maximal VO2 values elicited during perceptually-regulated exercise tests of 2- and 4-min durations. Nine-

teen physically active men and women (10 men, 9 women, age 19-23 years) volunteered to participate in two graded exercise tests to volitional exhaustion (GXT) to measure VO2max (VO2maxGXT), at the beginning and end of a two-week period. They performed four incremental, perceptually-regulated tests to predict VO2max in the intervening period. Perceptually-guided tests comprised 2 x 2-min and 2 x 4-min bouts on a cycle ergometer, regulated at intensities of 9, 11, 13, 15 and 17, in that order. Individual relationships between RPE : VO2 for RPE ranges of 9-17, 11-17 and 9-15 were extrapolated to RPE 20 to predict VO2max. For the prediction of VO2max from RPE 9-17, the trial 1 value of the 2-min protocol (mean (SD) = 43.9 (7.2)) was significantly lower (P<0.05) than the first and second VO2maxGXT values (47.2 (10.2) and 48.2 (9.4), respectively). Although predicted VO2max values from both 4-min trials were not significantly different from VO2maxGXT, the value from the second trial of the 2-min protocol (48.7 (8.1)) was a more accurate prediction of VO2maxGXT. The intraclass correlation coefficient (R) was also higher between VO2maxGXT and VO2max predicted from trial 2 of the 2-min protocol compared to both trials in the 4-min protocol (R=0.95 and 0.88 and 0.79, respectively). These results were not moderated by gender. Similar results were observed for RPE ranges 9-15 and 11-17. In conclusion, practice of a sub-maximal, perceptually guided, graded exercise protocol, particularly of a 2-min duration, provides acceptable estimates of maximal aerobic power, which are not moderated by gender.

References

Borg, G. (1998). Borg's perceived exertion and pain scales. Leeds: Human Kinetics.

Eston, R. G., Lamb, K. L., Parfitt, G., & King, N. (2005). The validity of predicting maximal oxygen uptake from a perceptually-regulated graded exercise test. European Journal of Applied Physiology, 94, 221.

MULTIPLE SHORT-TERM EXERCISE SESSIONS ARE SUPERIOR TO A SINGLE SESSION IN EFFECTS ON GLUCOSE HOMEOSTASIS IN TYPE 2 DIABETES MELLITUS

Eriksen, L., Dahl-Petersen, I., Haugaard, S.B., Dela, F.

Department of Medical Physiology, Denmark

Introduction

Physical training is highly recommended in the treatment of type 2 Diabetes Mellitus (T2DM). The general advice is to exercise 30 min/day at a moderate intensity. It is not known whether this amount of exercise should be performed as multiple short-term training sessions (i.e. accumulated over the day) or as a single session. Such information is important for future exercise recommendations to patients with T2DM. We tested the effect on glucose homeostasis and insulin secretion in two different exercise protocols.

Design

Eighteen male patients with T2DM (age: 59 ± 1.5 yrs (mean ± SE); BMI: 32.5 ± 1.1 kg/m2; time since diagnosis: 6.5 ± 4.3 yrs) participated in a 5-week home-based, and partly supervised (heart rate (HR) was recorded during all exercise sessions) endurance training program using bicycle ergometers. Ten patients served as a time-control group before starting the training program. Subjects were randomly assigned to a training program at 60% of VO2max for 10 min 3 times per day (3x10) or 30 minutes once a day (1x30). VO2max was determined for each subject by a stepwise incremental bicycle test. Plasma insulin, C-peptide and glucose concentrations were measured during a 3-h oral glucose tolerance test (OGTT) and insulin sensitivity was estimated using a composite measure index (ISI composite) of whole-body insulin sensitivity and HOMA (Wallace et al 2004). β-cell function was estimated by HOMA. Pre-hepatic insulin secretion rates (ISR) were indirectly estimated using C-peptide concentrations from the OGTT (Hovorka et al 1996).

Results

With both training regimens an improved aerobic capacity was observed. At each submaximal workload HR and blood lactate concentrations were decreased (P<0.01) after the training program in both training groups. In group 3x10 fasting plasma glucose (f-GLU) and 120 min GLU decreased significantly (P=0.01 and P=0.04, respectively)including a significant lower plasma glucose concentration during the OGTT measured by area under curve (AUC) 120 minutes (P =0.04) and a tendency towards a decrease for AUC 180 min (P=0.07). In group 1x30 neither GLU nor AUC improved with training. β-cell function improved by 19% (P=0.01) in group 3x10 on a background of unchanged insulin sensitivity. Both these parameters remained unchanged in group 1x30. No significant changes were found in ISR in either of the training groups. No change in any of the variables was seen in the time-control group (data not shown).

Conclusions

Based on our data, moderate intensity training performed as 3x10 min is superior to 1x30 min in effects on glycemic control in patients with T2DM. This was the case in spite of the fact that aerobic capacity increased similarly in the two groups. A possible mechanism for this finding may be that the energy expenditure associated with multiple short-term sessions may be greater than that of a single session.

ONE HOUR CYCLE TIME TRIAL PERFORMANCE IMPROVED WITH CARBOHYDRATE MOUTH RINSE: A CENTRALLY-MEDIATED MECHANISM?

Chambers, E., Bridge, M., Jones, D.A.

The University of Birmingham, United Kingdom

It has been suggested that there are oral receptors for complex carbohydrates which, when stimulated, can improve 1-h cycle time trial performance (Carter et al., 2004). To clarify and extend these observations, six male and two female endurance trained cyclists (VO2max 61.5 + 6.5 ml.kg-1.min-1; mean + SD) completed two time trials performing a fixed quantity of work (837 + 68 kJ; mean + SEM) as fast as possible. On one occasion a 6.4% maltodextrin solution (CHO) was rinsed around the mouth for 10-s every 12.5% of the trial completed while on the other occasion, a placebo (PLA) was swilled. Artificial sweetener and flavour were added to both mouth rinses to make them indistinguishable in terms of taste and texture.

Performance time was significantly improved with CHO compared to PLA (62.61 + 1.67 min and 64.67 + 1.74 min, respectively, p = 0.016) giving a significantly higher average power output with CHO (225 + 20 W and 217 + 19 W, respectively, p = 0.013). There were no differences in perceived exertion, mean heart rate or sweat loss between the two trials (p > 0.05).

The results support the previous observation that a CHO mouth rinse has a positive effect on 1-h cycle time trial performance and demonstrate that this improvement is not related to sweetness. It appears that a CHO mouth rinse enables subjects to maintain a greater power output with the same perception of effort as reported during the PLA trial. A central mechanism is proposed in which stimulation of oral CHO receptors results in activation of hedonic networks in the brain influencing central fatigue mechanisms.

Reference:

Carter, J. M., Jeukendrup, A. E., & Jones, D. A. (2004). The effect of carbohydrate mouth rinse on 1-h cycle time trial performance. Med.Sci.Sports Exerc. 36, 2107-2111.

EFFECTS OF MUSIC ON CEREBRAL AND MUSCLE OXYGENATION PATTERNS DURING MAXIMAL WHEELCHAIR EXERCISE

Bhambhani, Y., Malik, R.

University of Alberta, Canada

It has been well documented that listening to music during dynamic exercise such as cycling and running significantly enhances the maximal exercise responses including exercise time and maximal oxygen uptake. It is postulated that the physiological factors that cause these increases could be those that initiate motor stimulation in the cerebral motor cortex, overall oxygen transport by means of the central circulation, or peripheral factors located within the exercising muscle. In this study we used near infrared spectroscopy (NIRS) to examine the effects of music on the cerebral and muscle oxygenation responses during wheelchair exercise in order to identify whether alterations in cerebral activation or muscle oxygen extraction were responsible for the postulated improvement in peak exercise responses. Twenty healthy male volunteers (mean ± SD for age, height, body mass, and peak oxygen uptake were 24.6 ± 3.2 yrs, 169 ± 5.3 cm, 71.4 ± 5.6 kg, and 28.5 ml/kg/min respectively) completed a familiarization protocol, followed by two wheelchair exercise sessions under the following conditions: no music (control) and listening to self selected music at a tempo above 124 beats/min. Each subject downloaded music of his own choice from his personal music collection or from music websites on to an MP3 player prior to the exercise sessions. The wheelchair exercise was performed on a standard wheelchair mounted on frictionless rollers. During the test, cardiorespiratory responses were continuously monitored using a wireless metabolic cart (VMaxST, Sensormedics, CA). Cerebral oxygenation and blood volume were recorded from the left frontal lobe and muscle oxygenation and blood volume were recorded from the right biceps and triceps using dual wave NIRS instruments (MicroRunman Inc., PA). The difference in hemoglobin absorbency between the 850nm and 760nm wavelengths was an indication of oxygen extraction, while the sum of the absorbencies was an index of the total blood volume. Dependent 't' test results indicated that listening to music resulted in significant improvements ($P<.05$) in the peak values of exercise time (10%), absolute oxygen uptake (9%), heart rate (6%), ventilation rate (4%) and oxygen pulse (6%) when compared to the control condition. These changes were accompanied by increases ($P<.10$) in: cerebral oxygenation (7%) and blood volume (6%), biceps oxygenation (8%) and blood volume (7%), triceps oxygenation (9%) and blood volume (10%). The improvement in the peak oxygen uptake during the music condition was significantly correlated ($P<.05$) to the change in cerebral oxygenation but not the alterations in biceps or triceps oxygenation. These findings suggest that the improvement in peak wheelchair exercise performance as a result of listening to music is most likely centrally mediated by enhanced neuronal activation of the cerebral motor cortex.

Funding: Support for the Advancement of Scholarship, University of Alberta.

Oral presentation (OP)

OP1-14 Motor Learning 1/2 - "Turin DE"

THE INFLUENCE OF STRESS AND MUSCLE FATIGUE ON IMPLICIT AND EXPLICIT MOTOR LEARNING

Tallir, I., Lenoir, M., Musch, E., Valcke, M., Raab, M.

Ghent University, Belgium

According to Beek (2000), disturbing causes at the upper level of action (i.e. stress) and at the lower level of control (i.e. muscular fatigue) might result in different effects on performance when comparing implicit and explicit learning. In the present experiment an errorless/errorfull learning paradigm was used to enable the implicit/explicit acquisition of a dart throwing skill. After a pretest, the errorfull group (N=23) throwed from a progressively decreasing distance (from 317 to 257 cm), while the inverse procedure was used for the errorless group (N=21) (from 157 to 217 cm). One week after the four-day learning period (400 trials) both groups performed a transfer test, a fatigue test and a stress test (all from 237 cm). The fatigue test was preceded by a double Wingate protocol on an arm ergometer. At the beginning of the stress test participants were told they could win a significant financial reward in case of a good performance. Retrospective self-report of nervousness was administered under stressed and unstressed conditions. Hitting accuracy of the errorfull group improved from M=5.38 (maximum=15) in the first learning block to M=7.71 in the final learning block, while the errorless group evolved from M=9.67 to M=8.71, which is typical for an errorless/errorfull learning paradigm. In comparison to the scores at the pretest both groups performed equally (learning increase of 35%) at the transfer test. Performance of both groups decreased at the fatigue test, but this decrease was much less in the explicit group (5%, ns) as compared to the implicit group (20%, $p<.001$). Stress manipulation resulted in an increase of self-reported nervousness (35%, $p<.001$) and a decrease in performance (5%, $p<.05$) compared to the transfer test. However, stress did not have a differential impact on performance in both groups. Our results of the fatigue test confirmed the hypothesis of robustness of explicit motor learning to physiological fatigue, meaning that success depends on the person's ability to circumvent the (temporary) impairment induced by muscular fatigue, and thus develop alternative strategies based upon explicit knowledge. The contradiction with the findings of Poolton et al. (2005) may be due to task specificity, which calls for further research on this topic. Our results of the stress test do not show the superiority of implicit or explicit learning when performing under stress.

Beek, P.J. (2000). Toward a theory of implicit learning in the perceptual motor domain. International Journal of Sport Psychology, 31, 547-554.

Masters, R.S.W. (1992). Knowledge, knerves and know-how: The role of explicit versus implicit knowledge in the breakdown of a complex motor skill under pressure. British Journal of Psychology, 83, 343-358.

Poolton, J.M., Masters, R.S.W, & Maxwell, J.P. (2005). Implicit motor learning confers robustness to physiological fatigue. Oral presentation at the ISSP 11th World Congress of Sport Psychology, 2005 Sydney.

SPATIAL AND TEMPORAL ADAPTATIONS ACCOMPANYING INCREASING CATCHING PERFORMANCE DURING LEARNING

Mazyn, L.I., Lenoir, M., Montagne, G., Savelsbergh, G.J.

Ghent University , Belgium

Catching performance and kinematic changes were investigated across an extensive two-week training program. Participants had to catch tennis balls, approaching at a velocity of 13.1 m/s with their preferred hand in a pre, post and retention design. Compared to a control group (CoG, N=9) that not received any practice, the participants from the training group (TrG, N=8) evolved from poor to sub-expert catchers ($F2,30 = 24.261$, $p < .001$).

A permanent gain in performance outcome of the TrG (from 13% to 70% and 66% successful catches at respectively pre, post and retention test) was accompanied by some subtle changes at kinematic level. (1) Temporal consistency, i.e. within subject variability on movement time, increased together with catching performance ($F2,30 = 8.007$, $p < .005$), a finding that is characteristic to learning. (2) The interception point shifted away from the body ($F2,30 = 7.100$, $p < .005$), and hence the ball was caught more in the central visual field. According to earlier studies, such strategy is beneficial for catching performance in non-experts (see Savelsbergh & Whiting, 1988, for an overview). (3) Peak wrist velocity tended to increased as well with training ($F2,30 = 3.173$, $p = .056$), indicating a more ballistic transportation of the hand to the future interception place. This leaves more time for implementing on-line adjustments and therefore enhances the fine-tuning of the catch. These scant kinematic adjustments were argued to reflect the all-or-none characteristic of the one-handed catching task: only a minor refinement in one variable could be sufficient for enabling successful performance. Since participants already possessed some basic coordination pattern before entering the training program, this explains how only few subtle adaptations still engenders a relatively large gain in performance outcome.

The broad spectrum of individual performance curves that was found throughout the training sessions, points to the individual character of the learning process. However, it was established that novice catchers generally first adjust spatial characteristics of the catch, while a fine-tuning of temporal features occurs only later during learning. This finding of a sequential order in acquiring spatial and temporal aspects of the movement in line with earlier work (e.g. Marteniuk & Romanow, 1983) and entails relevant implications towards training methodology in sports.

Savelsbergh, G.J.P. & Whiting, H.T.A. (1988). The effect of skill level, external frame of reference and environmental changes on one-handed catching. Ergonomics, 31, 1655-1663.

Marteniuk, R.G., & Romanow, S.K.E. (1983). Human movement and learning as revealed by variability of movement, use of kinematic information, and Fourier analysis. In R.A. Magill (Ed.), Memory and Control of Action (pp. 167-197). Amsterdam: North-Holland.

DEPENDENCE OF TARGET MUSCLE ACTIVATION ON MOTOR CORTEX EXCITABILITY CHANGES

Mrachacz-Kersting, N., Sinkjaer, T.

The University of Auckland, The University of Aalborg, New Zealand

Persistent changes in synaptic efficacy (long-term potentiation – LTP) is one of the candidate mechanisms underlying motor cortex plasticity (Sanes & Donoghue, 2000). Paired associative stimulation (PAS) is a methodology that has been demonstrated to induce long lasting increases in cortical excitability through an LTP-like mechanism in the upper extremities of humans (Stefan et al., 2000; 2002; Kujirai et al., 2002).

There were two aims to this study. Initially we sought to investigate if changes following PAS can be induced in human lower limb muscles and if these changes depend on the activation state of the target muscle. Secondly we wanted to determine the time-course of this effect. This is the first study in the human lower extremity investigating PAS at both rest and in active muscles.

In 14 sitting able-bodied subjects, PAS was applied as a peripheral electrical stimulus at the common peroneal nerve (1 × motor threshold), combined with a magnetic stimulus over the area of the motor cortex associated with the tibialis anterior (TA) (120% rest threshold). The timing of the magnetic stimulus coincided with the arrival of the peripheral afferent volley at the motor cortex. Three conditions were examined; PAS at 0.2 Hz for 30 minutes while the subjects were relaxed (Condition 1) or commencing a dorsi-flexion movement (Condition 2). During Condition 3 no PAS was applied and the subjects were asked to perform dorsi-flexion movements at 0.2 Hz for 30 minutes. Sixteen motor evoked potentials (MEPs) were elicited in the TA prior to, during (at 15 min) and following the intervention and the peak to peak size of the TA MEP extracted.

The TA MEP size increased significantly (by 87%) only for the PAS intervention in the dorsiflexion condition ($p = 0.001$). PAS delivered during the relaxed condition or dorsiflexion performed on its own resulted in a slight and non-significant ($p = 0.238$) increase in TA MEP size. No significant changes in the MEP size occurred in the antagonist soleus muscle. The optimal interstimulus interval (ISI) between the peripheral and the cortical stimulus was 55 ms, though ISI's of 45ms and 50ms also produced a significant increase in the TA MEP amplitude. This is in agreement with in Vitro studies on rat hippocampal slice preparations which have indicated that there is an approximate 20 ms time window between the arrival of the afferent volley at the postsynaptic cell until the second stimulus has to be elicited (Bi & Poo, 1998).

In conclusion, results confirm that cortical excitability can be increased following a bout of PAS delivered to lower limb muscles. The effects of PAS were dependent on the order of the two stimuli, evolved rapidly and persisted after the cessation of the stimulation. As compared to hand muscles studied previously, the effects of PAS seemed to require an increased number of paired stimuli and more importantly a pre-activated motor cortex to show a significant effect.

REPROGRAMMING OF INTERCEPTIVE ACTIONS: TIME COURSE OF CORRECTIVE RESPONSES TO LARGE-SCALE PERTURBATIONS

Teixeira, L.A., Chua, R., Nagelkerke, P., Franks, I.M.

University of São Paulo, Brazil

When large-scale errors are made in the execution of an intended movement, feedback-based mechanisms are activated with the purpose of producing adjustments to the original motor program, leading to a modification in the regular pattern of limb displacement. This process has been called motor reprogramming. The time course of motor reprogramming was investigated here in an interceptive task in conditions requiring large-scale movement corrections at different moments before interception. Male and female university students (n = 24) took part in the study. They performed a task that consisted of performing a planar horizontal arm movement to intercept a top-down moving target on a monitor screen. The target was moved at a constant velocity of 8 cm . s-1, and in part of the trials,

unexpectedly for the participants, target velocity was either increased to 12 cm . s-1 or decreased to 4 cm . s-1. Target velocity was modified at different moments during stimulus displacement, producing times-to-arrival after velocity change from 100 to 800 ms. This procedure allowed us to observe the process of reacquisition of temporal accuracy from very short to long periods of time available for movement adjustments. Participants were assigned to four groups: Uni25 group, 25% probability of velocity change in a single direction (increment or decrement of velocity); Bi25 group, the same probability but uncertainty about direction of velocity change; and the other two groups were similar to the first two with the exception that they faced 50% of chance of target velocity change. With these comparisons we assessed the effect of probability of target velocity change, uncertainty about direction of velocity change, and the particular direction of velocity change on movement reprogramming, on temporal error and kinematic landmarks at the due interception moment. Analysis of movement acceleration showed that significant modifications to kinematic profile took place between 100 and 200 ms after target velocity change similarly for all groups. Analysis of temporal error indicated that the combination of high probability of target velocity change and certainty on direction of target velocity change led to improved movement reprogramming. For the other experimental conditions temporal accuracy was still poor when a period of 800 ms was allowed for correction. Movement reprogramming was observed to be a progressive process, which was more efficient when target velocity was increased than when it was decreased. These results suggest that movement correction is implemented through two phases: the first one is automatic, triggered by a direct visuomotor linkage independent of higher level demands of movement correction; and the second phase is a gradual process modulated by higher order levels of control. Effective movement reprogramming seems to be implemented only in this second phase, when voluntary feedback-based adjustments take place to change movement specifications.

THE EFFECTS OF AUDIENCE AND COMPETITION ON PERFORMANCE OF A NOVEL DART-AIMING TASK

Al-Nakeeb, Y., Lyons, M., Moreton, J., Duncan, M., Nevill, A., James, C.

Newman College of Higher Education, United Kingdom

Introduction: Several theories have attempted to explain why competition and presence of an audience affects performance (Strauss, 2002). The most popular, the drive theory of social facilitation proposed by Zajonc (1965) advocates that the presence of audience and competition increases arousal and therefore impairs the acquisition of new responses and facilitates the emission of well learned responses. However, later studies (Cottrell et al, 1968) have emphasised the role of evaluation apprehension and have shown that the mere presence of audience is not sufficient to influence performance.

Methods

The purpose of this study was to examine the effects of the presence of an evaluative audience and competition on performance of a novel task. Following practice (30 trials), twenty-four physically active young adults (12 males, 12 females; 21.70 ± 3.13 years) were assigned to one of two groups (skilled or unskilled) based on their practice scores. Each participant performed two blocks of six throws on the dart aiming task under three conditions (alone, competition and audience). Participants also completed the Jones et al.'s (2005) Sport Emotion Questionnaire following each condition to measure their state anxiety. In addition, participants' heart rate was monitored continuously during the three testing conditions to measure physiological arousal.

Results

A significant interaction ($p = 0.028$) between condition and skill level was revealed as a result of the repeated measures ANOVA. While performance of the skilled group improved under the audience and competition conditions, the unskilled group's performance deteriorated under those two conditions. Highly significant differences ($p < 0.001$) were found between the state anxiety levels under the three conditions, with the highest being under audience followed by competition then alone conditions. In addition, significant differences ($P = 0.008$) were found between heart rate during performance, with the audience condition inducing the highest heart rate followed by competition and alone conditions.

Discussion

The data suggest that performance of an aiming task in the presence of an evaluative audience or in competition by skilled performers was facilitated while the performance of the less skilled ones deteriorated. The results also indicated that performance in the presence of evaluative audience and in a competitive situation significantly increased the anxiety level and the heart rate of all performers irrespective of their skill level. The results provide further support for Cottrell et al.'s (1968) learned drive hypothesis in explaining the role of evaluation apprehension in influencing performance of motor skills.

References

Cottrell, N. B., et al (1968). Journal of Personality and Social Psychology, 35, 245-250.

Jones, M. V., et al (2005). Journal of Sport and Exercise Psychology, 27.

Strauss, B. (2002). Psychology of Sport and Exercise, 3, 237-256.

Zajonc, R. B. (1965). Science, 149, 269-274.

Oral presentation (OP)

OP1-15 Psychology 2/5 - "Turin FG"

PARAMETERS OF FOCUSED ATTENTION IN THE EEG: A COMPARISON BETWEEN SHOOTERS AND NOVICES

Finkenzeller, T., Doppelmayr, M., Amesberger, G.

University of Salzburg, Austria

The primary goal of this study was to examine shooter's aiming period to get a better understanding of the neural mechanisms associated with sustained, focused attention. Electroencephalographic activity during the preshot period was investigated in eight marksmen and eight novices for best and worst shots. According to the results of an exploratory wavelet analysis, changes in the bandpower of individually adjusted theta, lower alpha, beta 1 and beta 2 have been analyzed for the 2 seconds period prior to the shot. Additionally changes in the frontal midline theta and readiness potentials (RP's) were analyzed.

Although, well in accordance with the literature, higher theta power preceding the shot has been recorded in marksmen (Haufler et al., 2000), the repeatedly reported differences in alpha hemispheric activity (Hatfield et al. 1984; Landers et al. 1994) and differences in alpha activity between shooters and novices (Haufler et al., 2000) could not be replicated. Similarly no differences have been found between

experienced and unexperienced shooters or between good and bad shots for the RP's. However, marksmen exhibited more activation in frontal midline theta (Fm theta) as compared to novices. This result is consistent with the finding that Fm theta reflects sustained attention (Kubota et al., 2001). In the future, findings related to Fm theta might be used in neurofeedback training of marksmen.

REFERENCES

Hatfield, B. D., Landers, D. M. & Ray, W. J. (1984). Cognitive processes during self-paced motor performance: An electroencephalographic profile of skilled marksmen. Journal of Sport Psychology, 6, 42-59.

Haufler, A. J., Spalding, T. W., Santa Maria, D. L. & Hatfield, B. D. (2000). Neuro-cognitive activity during a self-paced visuospatial task: comparative EEG profiles in marksmen and novice shooters. Biological Psychology, 53, 131-160.

Kubota, Y., Wataru, S., Toichi, M., Murai, T., Okada, T., Hayashi, A. & Sengoku, A. (2001). Frontal midline theta rhythm is correlated with cardiac autonomic activities during the performance of an attention demanding meditation procedure. Cognitive Brain Research, 11, 281-287.

Landers, D. M., Han, M., Salazar, W., Petruzzello, S. J., Kubitz, K. A. & Gannon, T. L. (1994). Effects of Learning on Electroencephalographic and Electrocardiographic Patterns in Novice Archers. International Journal of Sport Psychology, 25, 313-330.

A TEST OF THE DUAL-MODE MODEL WITH YOUNG ADOLESCENTS

Sheppard, K., Parfitt, G.

University of Exeter, United Kingdom

Introduction: Ekkekakis' (2003) dual-mode model proposes that affective responses are generated through different mechanisms. These are linked directly to the metabolic demands of the exercise intensities. Affective responses below the ventilatory threshold (VT) are influenced by the interplay of cognitive processes and interoceptive physiological cues. Responses are variable due to the way individuals cognitively process exercise cues. Above VT interoceptive cues dominate, response are homogenously negative. This pattern of responses has been explored in adults but not in adolescents. There is neither research exploring acute psychological responses of adolescents to exercise, nor the relevant underlying cognitive processes. Methods: 22 adolescents (11 boys, 11 girls; 13.3 yrs (SD=.3); BMI 19.5 (SD=2.9); VO2max 43.3 (SD=8.2) took part. Affect was measured using the Feeling Scale (FS; Hardy & Rejeski, 1989). Participants completed a graded exercise test to establish maximal aerobic power (VO2 max) and VT; followed by 3 sub-maximal protocols, set at an intensity below the VT (<VT), above the VT (>VT) and a self-selected (S-S) intensity, which was set by asking participants "select an intensity that you would be happy to sustain for 15 minutes, that you would feel happy to do regularly" (Parfitt et al., 2000). In each trial pre-exercise heart rate (HR) and FS responses were taken 5 minutes before the start of the test and immediately pre-exercise. Participants cycled for 15 minutes, maintaining a cadence of approx. 70rpm. FS and HR responses were taken in the last 45 seconds of each 5-minute period (minutes 5, 10 & 15). FS was recorded on completion, and again at 5, 10, 15 and 30 minutes post exercise. Two-factor (time x condition) fully repeated measures analyses of variance (ANOVA) were conducted on HR and FS data. Results: Condition by time interactions were recorded for both HR [F(4.8, 67) = 19.9, p<.01] and FS [F (7.1, 141.4) = 14.6, p<.01]. HR increased over time but was significantly higher in the >VT condition during exercise. The S-S condition was significantly higher than the <VT condition in the latter stages of exercise. FS remained stable and positive throughout exercise in the <VT and S-S conditions, but declined during exercise in the <VT condition. Conclusions: The patterns of affective response during and following exercise support the proposals of the dual-mode model.

References:

Ekkekakis, P. (2003). Pleasure and displeasure from the body: Perspectives from exercise. Cognition & Emotion, 17, 213-239.

Hardy, C. J., & Rejeski, W. J. (1989). Not what, but how one feels: The measurement of affect during exercise. Journal of Sport & Exercise Psychology, 11, 304-317.

Parfitt, G., Rose, E.A., & Markland, D. (2000). The effect of prescribed and preferred intensity exercise on psychological affect and the influence of baseline measures of affect. Journal of Health Psychology, 5, 231-240.

INFLUENCE OF EXPECTED RUNNING DURATION OR DISTANCE ON PERCEIVED EXERTION AND ESTIMATED TIME LIMIT SCALES

Coquart, J., Raul, P., Garcin, M.

Laboratoire d'Etudes de la Motricité Humaine, EA 3608, France

INTRODUCTION

The influence of expected exercise duration on Ratings of Perceived Exertion (RPE) has been already shown (Rejeski & Ribisl, 1980). However, no study has investigated the influence of expected exercise duration or distance on Estimated of Time Limit scale (ETL). Consequently, the purpose of this study was to examine the influence of the expected running duration or distance on RPE and ETL values. SUBJECTS: 39 males (Mage = 24.4, SD = 3.8 yr; Mmass = 73.9, SD = 9.1 kg; Mheight = 180, SD = 6.2 cm) who ran regularly were recruited.

MATERIALS

Perceived effort was expressed with the RPE (Borg, 1970) and ETL scales (Garcin et al., 1999). Heart rate (HR) was recorded with a cardiotachometer (Accurex +, Polar).

METHODS

Each subject performed an exhaustive incremental test to measure Maximal Aerobic Velocity (MAV). Then, an exhaustive constant velocity test (90% MAV) was realised to determine their time limit (Tlim) and distance limit (Dlim). Next, three homogenous groups were formed. All groups performed two tests at 90% MAV during 80% Tlim and on 80% Dlim. The groups had different instructions: group 1 (G1) were expected to maintain the velocity during 60% Tlim (and Dlim), while group 2 (G2) and group 3 (G3) thought they maintained this velocity during 80 and 100% Tlim (and Dlim), respectively. During each test, RPE, ETL and HR values were collected. All tests were realised in the same conditions.

STATISTICAL ANALYSIS

RPE, ETL and HR values were compared by using a three-factor (Exercise Time Duration × Groups × Tests) analysis of variance (ANOVA). Moreover, when differences were obtained, Bonferroni post hoc tests were used.

RESULTS

The results have revealed: 1) an effect of exercise time duration on RPE, ETL and HR ($p < 0.01$); 2) significant differences between G1-G2 for RPE, and between G1-G2 and G1-G3 for ETL and HR ($p < 0.01$); 3) no effect for test (80% Tlim or Dlim) ($p > 0.05$).

DISCUSSION

Our study has shown that: 1) as expected, RPE and ETL values increased with exercise time duration; 2) moreover, a lower expected running duration or distance produced higher RPE and ETL values in comparison with a longer expected running duration or distance (i.e., these runners perceived the exercise as being harder and felt that they could endure less) and; 3) however, perceived values did not seem to be influenced by the type of test (duration or distance).

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the National School of Police of Roubaix.

REFERENCES

BORG G (1970). Perceived exertion as an indicator of somatic stress. Scandinavian Journal of Rehabilitation Medicine, 2, 92-98.

GARCIN M, VANDEWALLE H & MONOD H (1999). A new rating scale of perceived exertion based on subjective estimation of exhaustion time. International Journal of Sports Medicine, 20, 40-43.

REJESKI W & RIBISL P (1980). Expected task duration and perceived effort: an attributional analysis. Journal of Sport Psychology, 2, 227-236.

EFFECTS OF AEROBIC WATER EXERCISE ON SOMATOPHYSIOLOGICAL SYMTOMS OF DEPRESSION

Matinhomaee, H.

Azad University Of Tehran Centeral Branch, Iran

Aerobic water exercise enjoyable,pleasant,tranquilizer,with no pain and injuries (because of weigh loss),easy to do for all…and for these reasons seems to be better than other exercises to improvement depression symptoms .On the other hand effects of exercise on somato-physiological aspects of depression still are not clear .

Purpose:To determine whether aerobic water exercise(AWE)have any effect on somato-physiological symptoms of depression (SSD).

Methods:Untrained male college students (n=48,aged=23.2+_2.7years)with mild depression randomly assigned to experimental (n=24)and control(n=23)groups.All subjects were medication free and with no HPA related syndromes like chushing syndrome. Before and after 12 week (AWE) HPA changes was examined by dexamethason suppression test(DST). Tow milligram dexamethason tablets before 16 and 23 hours from blood sampling were feuded to subjects.Then plasma cortisol was measured by radio immune assay (RIA).Other (SSD)including sleep quality ,sense of healthful, sexual desire,appetite,sense of tiredness and having desire to do work and activity were assayed as described in Beck depression inventory and total weight ,lean body mass and rest heart rate were measured.

Results: plasma cortisol response to dexamethason and appetite had not significant change but other symptoms had significant ($P<0.05$)change toward improvement (SSD).

Conclusions:(AWE)and dexamethason have not effect on HPA function but have positive effects on other somato-physiological symptoms of mild depression .Thus (AWE)might be useful for diminishing and improvement of mild depression and prevention of intensification of (SSD) but we can not suggest (AWE)for improvement or treatment of HPA disorders in intensive or endogenous depression.

References:

1-Bidile.S.Exercise and treatment of depression . Brj.Hosp.Md.42(4):(207-217)England.1986.

2-Bishop,PA.Physiological response to treadmill and water running. Sports medicine.17(2).(87-90).USA.1989

3-Joanne ,M,Koury.Quatic therapy programming. Human Kinetics (18-57)USA.1996.

IDENTIFYING RELATIONSHIPS BETWEEN DECELERATION CONTROL AND INTERNAL MOVEMENT REPRESENTATIONS

Heinen, T.

German Sport University Cologne, Germany

Since the pioneering attempts of Lee (1976) to adress the problem of perception and control of (braking) action a large number of following studies focused on different aspects of deceleration control. In these studies the role of the (optical) variable tau in movement control was emphazised and attracted attention as time-to-contact-paradigm. New approaches in motor control suggest so-called perceptual-cognitive representations which are thought to form the reference system of human voluntary movements. Motor activity seems to be self organized to some degree in order to serve anticipated (sensory) effects and can be affected immediately by sensory information (Schack & Mechsner 2006). Merging both mentioned approaches it seems reasonable to assume relationships between (the use of) time-to-contact in controlling motion and the underlying perceptual-cognitive representations of movement. For this purposes and according to preliminary work (e.g. Bardy and Laurent, 1998) we focussed on analysing somersaulting in gymnastics. The major movement problem occuring in somersaulting is to land on ones feet in a defined body orientation and with a stable posture. Because the angular momentum remains constant during the flight phase, the gymnast has to use the ground contact in order to compensate the rotational movement. 120 somersaults of 20 gymnasts were analysed cinematographically (2D, 50 Hz). First, angular tau and other parameters (angular momentum, moment of inertia etc.) were calculated from the digitised datasets. Second, perceptual-cognitive representations were analysed by means of the structure-dimensional-analysis (SDA; Schack & Mechsner, 2006). Through SDA one gains information about structural aspects of the cognitive representations of each individual case. The results of the investigation show, that different strategies in controlling rotation with regard to different expertise of the gymnasts can be identified. Besides we discovered different structures of cognitive representations of each test person. Relationships between the use of time-to-contact information in controlling motion and the underlying perceptual-cognitive representation of the movement can be found. It seems reasonable that gymnasts control their somersault rotation prior to their cognitive representations with regard to their expertise level and with the use of invariant characteristics of time-to-contact information.

Bardy, B.G. & Laurent, M. (1998). How is body orientation controlled during somersaulting? Journal of experimental psychology. Human perception and performance, 24(3), 963-977.

Lee, D.N. (1976). A theory of visual control of braking based on information about time-to-collision. Perception, 5, 437-459.

Schack, T. & Mechsner, F. (2006). Representation of motor skills in human long-term memory. Neuroscience Letters, 391(3), 77-81.

17:00 - 18:30

Invited symposium (IS)

IS1-16 ACL ruptures in children (Ortho/Trauma) (SGSM symposium 2) - "Lausanne"

ACL RUPTURES IN CHILDREN WITH OPEN PHYSES - TREATMENT OPTION

Mayer, R.R. 1, Koenig, U. 2, Widmer, H. 1, Friederich, N.F. 1

1 Kantonsspital Bruderholz, CH-4101 Bruderholz, 2 Ortho-Klinik Rhein-Main, D-63067 Offenbach, Switzerland

Introduction:
ACL injuries in Children with open physes are rare but the number is lately increasing, especially due to the increase of risky trendsports. (Carving, Snowboarding, Inlineskating etc.) The strategy of treatment is still controversely discussed in the literature.
Material and Method:
Between 10/1997 and 5/2004 35 Children (mean age 12, range 10-14, 22 boys, 13 girls) with acl tear and open physes were operatively treated in our hospital.
The rupture occured during sport activity in all cases, the indication for reconstructive surgery was persisting ap instability.
Our operative technique needs a pit of 8mm in diameter on the femoral side just below the epiphyseal line. The bony block of the autologous quadriceps tendon graft with the same size is placed In this pit and fixed extraarticulary to a screw on the lateral side of the femur proximal to the physis. The tibial fixation is performed in a similar way, the free end of the quad tendon is armed with #3 nonresorbable sutures in <<baseball stitch>> technique and fixed through am 8mm transtibial tunnel to a second extraarticular screw medial and inferior to the tibial tuberosity.
In the followup Lysholm and IKDC scores were taken, as well as KT 1000 Masurements and plain x-rays. In some cases MRI were obtained.
Results: The average Lysholm Score was 95 (93-97), IKDC: 85% in group A and B. The average KT 1000 difference was 1,5mm (1-2mm) compared to the opposite side.
One patient showed a growth difference on the femoral side with an increase of femoral valgus. Tibial axis deviation did not occur. There were also no difference in leg length. 2 Patients showed enlargement of the tibial tunnel (bungee effect).
5 of 35 patients had a re-rupture in an adequate trauma in sport.
Conclusion:
We recommend children after acl rupture and persistant instability to undergo acl-reconstruction to avoid secondary intraarticular damage despite open physes.
Our technique with a quadriceps tendon autograft has an extraarticular fixation and shows no bungee effect on the femoral side. We found no growth disturbances, there was no tibial axis deformity despite of the (minimal) damage to the tibial physes. The rate of reruptures ist higher than in adults.

ACL RUPTURES IN CHILDREN: PROBLEMS AND FEARFUL COMPLICATIONS

Seil, R.

Centre Hospitalier Luxembourg - Clinique d'Eich, Luxembourg

The treatment of ligamentous tears of the anterior cruciate ligament (ACL) in children is still controversial. Considering the unfavourable natural history with a high number of secondary meniscus lesions and early signs of osteoarthritis, a long-term conservative treatment can no longer be recommended on a routine basis. With respect to the rarity of the cases, lacking medium and long-term data, the various types of proposed surgical procedures and the limited number of basic science studies, ACL reconstructions in young children (Tanner stages 1 and 2) cannot yet be proposed as a routine surgical procedure. Indications for surgery should be chosen with care and the complication potential should be considered. A precise knowledge of the anatomical specificities of the child's knee and a large experience in ACL reconstruction surgery should be mandatory when taking care of these injuries. The presentation will give a current overview of the risk of the conservative and the surgical treatment of these lesions in children.

CHILDREN ACL RECONSTRUCTION. SURGICAL TREATMENT : EXPERIENCES AND RESULT

Chotel, F., Brunet-Guedj, E., Chouteau, J., Chaker, M., Berard, J.

Debrousse Hospital / hospices civils de LYON, France

Bad results with children conservative treatment of midsubstance ACL tear, make a general consensus for surgical reconstruction. But controversies still exist about the moment and the technique to use, in order to avoid growth disturbance. Our experience with ACL reconstruction in skeletally immature patients concern 29 children. Between 2001 to 2003, 5 knee were reconstructed with a Facia Lata graft over the top at the femur and tibial trans-physeal. In 2004, we develop an new intra-articular technique ; the femoral tunnel conducted out/in, is transepiphyseal horizontal under the physis. The ACL replacement used a quadricipital autograft tendon with a patellar bone bloc. This bone is impacted with press-fit in the femoral tunnel ; and the graft get thought a transphyseal tibial tunnel. The rehabilitation program was very soft, and the knee was protected with temporary anti-recurvatum brace.
Methods
Twenty five children were injured during sport activity (10 ski, 7 football), and 4 children during traffic accident. The sex ratio was 25 males and 4 females.
The average period of time from injury to reconstruction was 19 months with facia lata, and 9 months for quadricipitale reconstruction. All patients presented instability before surgery. At time of surgery, 15 patients were in Tanner stage ≤ to 3, the average chronologic age was 12,4 ± 2 years (range, 7 to 15 years).
Twelve knee (41%) had a meniscus lesion at time of reconstruction (7 were lateral, and 7 medial); an abstention or stimulation was done 6 time, suture 6 time and partial meniscectomy only two time. For the quadricipitale technique, the femoral tunnel position was appreciated

according to Aglietti. Clinical outcomes were measured using Lysholm and IKDC scoring systems, follow-up radiographs and scanogram, and KT-1000 testing by independent examiner.

Results

All patients return to they're activity level and no instability was registered; there were no secondary meniscus lesion or meniscus surgery in both technique.

- The five patients with Facia Lata technique were seen with 1,2 to 5,6 years years follow-up ; the Lachman test gave elastic feeling but no striked stop. One patient developed a low asymmetric valgus tibial deformity without epiphysiodesis but tenodesis; it will be corrected with epiphysiodesis.

- The new technique results were evaluated in sixteen patients after one year follow-up. The computer assistance allow a good reproducibility; the mean femoral index is 63% according to Aglietti. After 1,5 years of mean follow-up, the mean Lysholm knee score was 98 (range 94 to 100) and the mean KT-1000 arthrometer side-to-side was 1,6mm (range 0 to 4). Using the IKDC evaluation form, there were 13 patients scored grade A, two grades B and one scored C. In this group, they were no significant growth disturbance.

Ccl.

The quadricipitale technique allows anatomic reconstruction, and is available in skeletal immature patients, it improved subjective and objective knee function.

Invited symposium (IS)

IS1-17 Safety and performance in football (sponsored by Adidas) - "Innsbruck"

IMPACT OF INTERVENTION PROGRAMS ON THE INCIDENCE RATE OF INJURIES IN BALL SPORTS: VOLLEYBALL AS AN EXAMPLE

van Mechelen, W., Verhagen, E.

VU University Medical Centre, Netherlands

While participating in sports one has the risk of sustaining sports injuries. Especially team ball sports pose a substantial risk for injury. Many reasons might attribute to this high risk, but generally it can be said that this risk is highly moderated by the presence of many players in close contact with each other. Throughout the literature one can find various studies on preventive measures against injuries. For ball sports one might find many biomechanical studies on the theoretical protective capabilities of certain sports gear, e.g. helmets, shin guards, and mouth guards. Other studies describe certain psychological aspects of player behaviour, while other describe the nature and onset of injuries and conclude with possible preventive strategies. Studies that actually study the effects of preventive measures on injury incidence in team ball sports are scarce. Based on and despite the limited information we have on this topic, there is a contemporary common idea that prevention programmes in team ball sports have great potential preventive effects.

In order to illustrate the potential benefits of such programmes one can look at preventive studies against ankle sprains. A number of studies have looked at the preventive effects of proprioceptive balance exercises against this type of injury. The majority of these studies showed positive results. Common denominator within these studies is that all were carried out within team ball sports. From a scientific point this is logical. For instance, in order to ascertain with a certain amount of confidence that such preventive exercises are beneficial for injury risk, one needs a large group of players that conduct the same exercises in a proper manner. Therefore, it is relatively easy to conduct such large scale studies within team ball sports in which all players train and compete on a regular basis. In addition in team ball sports all players complete a regular warming-up and cooling-down in which preventive exercises can be carried out without interfering too much with regular routines.

Specifically these traits of team ball sports gives prevention programmes within this setting great potential. In theory one can bundle together a number of preventive measures that can be carried out within a team setting, and for which preventive evidence exists (e.g. preventive exercises, risk perception, availability of preventive measures, screening tools). While all players are regularly exposed to this set of preventive measures the likelihood of preventive effects is high. An example of such a programme is a programme that was recently carried out in the Netherlands in volleyball and which can be transferred easily to soccer.

INJURIES IN FOOTBALL, RISK FACTORS AND PREVENTION

Arnason, A.

University of Iceland, Iceland

Football is one of the most widespread sports in the world. When studying injuries in football, three main questions are of interest: First, what is the magnitude of the problem? Second, what are the causes of injuries? Third, what can we do to prevent injuries? Many studies deal with the first question, but fewer studies have been carried out on the second and particularly the third question.

The incidence of injuries in football in elite leagues has been found to be 17-35 injuries/1000 hours for men and 34 injuries/1000 hours for women. During training the injury incidence is much lower or 2-7 injuries/1000 hours for men and 3 injuries/1000 hours for women. The most frequent injury locations are the thigh, knee, hip/groin and ankle, while muscle strains, ligament sprains and contusions are the most frequent injury types.

Various potential risk factors for injuries have been studied and some studies also test the interrelationship between different risk factors. Intrinsic factors as previous injuries, age, and gender have been documented as risk factors for new injuries. Extrinsic factors as low volume of training, a low training to match ratio, inadequate warm up and too high shoe-surface friction have also been considered to be risk factors. Injury mechanisms are of high importance and can interact with the risk factors. During recent years the use of systematic video-based methods in combination with medical information has improved our knowledge of injury mechanisms in football, particularly regarding ankle and head injuries.

Prevention of injuries is of great importance in football. However, relatively few studies have been performed on preventive measures. Some studies apply multifactorial prevention programs which decrease the possibility of identifying the most effective component of the program. Other studies focus on a specific type of injury and specific training, a single exercise or the use of specific equipment. Studies have shown that stability training or use of ankle orthosis can decrease the frequency of ankle sprains in previously injured ankles. Stud-

ies also indicate that stability training could reduce the risk of ACL injuries. In addition, eccentric strength training has also been shown to be of importance in lowering the incidence of hamstring strains.

More and larger studies are needed, that use multivariate models to compare many potential risk factors simultaneous between injured and non injured groups of players. Large studies applying multivariate models are required in order to detect weaker risk factors and relationships between risk factors. Further studies are also needed to investigate the effect of different preventive strategies.

THE INFLUENCE OF FOOTBALL CLEAT DESIGN ON JOINT LOADING

Stefanyshyn, D.

University of Calgary, Canada

Epidemiological studies have linked lower extremity injuries to high rotational resistance between shoe and surface. Torg et al. (1971, 1974) found that injuries in American football were more common under conditions with high rotational traction between the surface and shoe. A more recent prospective study (Lambson et al., 1996) on high school players reaffirmed the findings of Torg et al. They found a significantly higher Anterior Cruciate Ligament (ACL) injury rate with shoes that had higher torsional resistance. These studies suggest that shoe cleat designs with high rotational friction between shoe and surface are associated with knee injuries. However, the actual mechanism of how traction affects knee joint injury remains unknown. We hypothesized that traction of the shoe and surface influences the joint moments and loads at the knee. Therefore, the purpose of this study was to determine how soccer cleats of different designs and traction influence knee joint moments.

Twelve recreational soccer players were recruited for this experiment. All subjects performed a running v-cut with four different shoes. The v-cuts were performed by running straight ahead and then cutting at a 45° angle. All trials were performed on a sample of infilled artificial turf and were conducted at 4.0 m/s. The four different footwear conditions tested were a standard adidas running shoe and three different soccer cleats (Copa, World Cup, Trx). Eight trials per condition were collected with reflective markers placed on the right leg of the subjects. Eight high-speed cameras (240 Hz) were used to record kinematic data. Ground reaction forces were collected by a Kistler force plate (2400 Hz). Joint moments were calculated with inverse dynamics. A repeated measures ANOVA was used to compare the conditions with a level of significance set at 0.05.

There were no significant differences between shoes for the knee extension moments. However, the Copa and World Cup cleats had significantly higher knee abduction and external rotation moments than the Nova running shoes. The Copa cleats had significantly higher external rotation moments than the Trx Cleats. Knee joint loading in the transverse and frontal plane have been proposed to be associated with running injuries (Stefanyshyn et al., 1999) such as patellofemoral pain syndrome. Higher knee joint moments with the traditional soccer cleats (Copa and World Cup) may lead to higher local stress and overuse injuries in the knee joint. Also, the higher moments are likely closer to the ultimate limits of structures like the ACL. Thus, there is less room for error from unexpected perturbations during the movement, increasing the potential for acute injuries.

REFERENCES

Torg, J.S et al. (1971) Research Quarterly, 42, 203-211.

Torg, J.S. et al. (1974) Journal of Sports Medicine, 2, 261-269.

Lambson, R.B. et al. (1996) Am. J. Sports Med., 24, 155-159.

Stefanyshyn, D. et al. (1999) Proc. 4th Foot Biom. Symp., 86-87.

Invited symposium (IS)

IS1-18 Epithelial-sodium channel in sports - "St. Moritz"

EPITHELIAL SODIUM CHANNELS IN HEALTH AND DISEASES

Rossier, B., CH

Without abstract submission.

ALVEOLAR NA-TRANSPORT AND HIGH ALTITUDE PULMONARY EDEMA (HAPE)

Mairbäurl, H.

University of Heidelberg, Germany

Alveolar edema results from an imbalance between fluid filtration into the alveolar space and removal by reabsorption. Hypoxia increases filtration by raising pulmonary capillary pressure and increasing endothelial and epithelial permeability allowing fluid and blood cells to access the alveoli, whereas active Na-reabsorption drives the reabsorption of fluid from the alveolar space. Hypoxia inhibits reabsorption by inhibition of epithelial Na-channels (ENaC) and Na/K-ATPase by decreasing activity and gene expression of these transport proteins. A (genetically determined) low activity of alveolar reabsorption in normoxia and further inhibition by hypoxia might cause the susceptibility to high altitude pulmonary edema (HAPE), since at some point the depressed reabsorption may not keep pace with increased filtration, which will result in alveolar edema. Na-reabsorption might even prove totally inefficient in the presence of large leaks of the alveolar barrier, which has been found to occur at very high pulmonary capillary pressures.

Na-reabsorption across the alveolar epithelium has not been measured in HAPE. Therefore Na-transport across the nasal epithelium has been used as surrogate marker based on similarities in subunit expression of ENaC in nasal, airway, and alveolar epithelium. A decreased nasal epithelial potential difference in normoxia has been interpreted to indicate a defective Na-reabsorption as a possible mechanism that might contribute to HAPE-susceptibility, but the variability in nasal epithelial Na- and Cl-transport reduces the usefulness of nasal potentials to diagnose HAPE-susceptibility. Although there are indications for an inhibition of alveolar fluid reabsorption from human lung preparations, changes in lung fluid reabsorption in vivo are not known and measurements have been performed. However, extrapolations to transport activity at the human lung alveolar epithelium from nasal potential measurements appear unreliable since at high altitude cold, dryness, and nasal infections might affect nasal mucosa Cl-secretion, fluid balance and nasal potentials when they are not determined under standard laboratory conditions.

Invited symposium (IS)

IS1-19 Psychology of sport injuries - "Albertville"

PSYCHOLOGICAL PREDICTION ON SPORT INJURY: EMPIRICAL AND APPLIED ISSUES

Johnson, U.

Centre for Sport and Health Research, Sweden

Epidemiological studies report that the injury risk for elite football players is between 65% and 91% during one season. Thus, the chances of being injured while engaging in sport are statistically high. There has been only very modest evidence to support the assumption that acute injury is directly related to an athlete's physical characteristics. Researchers are increasingly recognizing the multifaceted pathogenesis of injuries.

While deductively derived models of post-injury responses are frequently documented in the literature, there are fewer models of pre-injury vulnerability. Thus, the purpose of this abstract is to examine a leading theoretical model that can predict the onset of a sport injury and contribute to the development of preventive interventions and strategies.

The most influential stress–injury model aimed at predicting the occurrence of sport injury was developed and modified by Williams and Andersen, 1998. It posits that individuals with personality characteristics that tend to exacerbate the stress response, with a history of many stressors, and with few coping resources will be more likely, when placed in a stressful situation, to appraise the situation as stressful. Thus, exhibit greater physiological activation and attentional disruption, leading to increased injury risk.

Several psychosocial factors seem to be related to the occurrence of sport injury. The most cited factors are high competitive trait anxiety, low self-esteem and positive or negative mood state, high life stress and life changes, and low coping skills and social support. However, research about the effect of social support on injury occurrence has not provided consistent findings.

To date, at least 6 studies about intervention strategies are primarily focused on reducing injury risk in sport settings (see Johnson, 2004). Stress management and relaxation are the most frequently used intervention techniques. All the studies claim to have reduced injuries or facilitated training without injury. Some of the studies also describe reduced stress levels and increased self-confidence as a result of the intervention. However, most studies lack a control group and do not report gender. Moreover, few intervention studies seem to be guided by theoretical models such as that of Williams & Andersen (1998).

References:

Johnson, U. (2004). Psychosocial antecedents to injury and illness. In G. S. Kolt & M. B. Andersen (Eds.), Psychology for the Physical and Manual Therapies (pp. 9–19). Elsevier Science: London.

Williams, J. M., & Andersen, M. B. (1998). Psychosocial antecedents of sport injury: Review and critique of the stress and injury model. Journal of Applied Sport Psychology, 10, 5–25.

MOOD STATES AND INJURY PREVENTION IN SPORT - EXPERIENCES FROM RESEARCH AND PRACTICE

Kleinert, J.

German Sport University Cologne, Germany

Measuring of psychological states give information about self-perception and herewith about subject-oriented action requirements. Furthermore, states are strongly connected with motivational aspects of behaviour, both as reasons and consequences of motivation. In this context psychological states are strongly connected with the occurrence of injuries in mainly two dimensions. First, mood states and perceived physical states can be related to the biomedical condition of a person. Although correlations between objective physical conditions and physical feelings of a person are mostly low, in single cases reported bad physical states could be evidence for a substantial lack of physical competence. Thus, perceived bad physical states could be interpreted as risk factors for injury. Secondly, psychological states say something about the motivation, namely the intention and willingness, for injury-related behaviour. This could be both, measures of prevention and risk behaviour.

With this theoretical background the basic question is, whether mood states and perceived physical states have relations to the injury process. This question demands a prospective methodological approach, in that psychological states are assessed more or less short term before potential injury situations. Three studies are reported, in which this demand is realised variably, depended on the organisational circumstances and empirical conditions. In all studies adjective lists have been used to assess physical feelings (questionnaire of perceived physical states - PEPS; Kleinert, 2004) so as mood and motivational states (items from different scales, especially the EZ-scale; Nitsch, 1976).

In study I 186 male and 107 female participants of the aptitude test at a Sport University were asked at the beginning of the test day on their physical states and mood states. 16 injuries (5,5% of participants) happened during the test day. Logistic regression analyses show that both physical feelings, so as high perceived physical activation, low perceived physical health state, and psychological states, so as low self confidence, high sleepiness, high sociableness, are significant predictors of injury occurrence.

In study II psychological states of 941 female soccer players were assessed at the beginning of a 3-day-tournament. The responsible physiotherapists categorised all injuries as low, moderate and high severe. In regression analyses with these injury categories as criterions, especially low perceived physical fitness, low perceived physical health, and high rated sociableness were significant predictors of injuries.

In study III weekly-assessed psychological states of 39 young male elite soccer players were compared with injury cases in the examined group. Case studies show, that mood state and physical state varied specifically some weeks before the injury occurs.

All results have to be discussed within a psycho-physiological and psycho-behavioral theoretical framework.

NARRATIVES OF A CATASTROPHIC ATHLETIC INJURY

Smith, B.

University of Exeter, United Kingdom

In recent years, qualitative researchers have in varied ways explored people's experiences of sport injury and the manner in which they have made a successful recovery from this and returned to their former sporting body-self. To date, however, few qualitative studies have

focused on those people who do not return from a sport injury and who are propelled across the border from the world of the able-bodied into the world of disability where they remain to this day. That is, a border crossing which is permanent and not transitory. Based on life history data, and against the backdrop of the narrative turn in psychology, this paper explores the stories of hope in the lives of a small group of men who have suffered a catastrophic athletic injury and become disabled through playing sport. The most common kind of hope used by the men in telling their stories as they live post-SCI is focused upon in detail. The multi-dimensionality of hope is highlighted. The ways in which three different narrative types operate to shape specific narratives of hope for these men are also illuminated to reveal the ways in which personal experiences of hope are shaped by and embedded within larger social constellations of meaning. Reactions given by sport and exercise scientists to each type of narrative and associated hope are discussed in relation to the issue of tellability and the medicalised practices tied to psychology. The implications of this dynamic process for the participants identity reconstruction as injured and disabled men are finally considered.

Invited symposium (IS)

IS1-20 Is training of reflexes possible? - "Berlin ABC"

AN OVERVIEW OF USEFUL REFLEXES WITH SPECIAL EMPHASIS ON SPORTS

Duysens, J.

University Medical Center, University of Nijmegen, Netherlands

In principle all reflexes can be useful at some point during sports but in this presentation the focus will be on the question that some reflexes may be particularly interesting in this context since they are highly modifiable and therefore can be subject to training. Although there have been claims that even the fastest reflexes can be adjusted to some extent (H-reflex in dancers) it is clear that reflexes with longer latencies are more adaptable. Of special interest are those reflexes with medium or long latency which occur in response to unexpected stimuli since they show habituation (hence plasticity), except if the subject can somehow control the stimuli. In studies on posture some of these responses have been termed automated balance correction responses and it will be argued that these are particularly important in sports situations which can induce ankle inversions. The most consistent responses occur at around 85 ms in leg muscles. It has been pointed out that similar responses are occasionally seen in man after a complete transection. However, this does not prove that these responses are entirely mediated by spinal reflexes. Rather it is argued that supraspinal pathways are important for these reflexes. There are many similarities with startle responses and it will be argued that a minor form of startle is a very functional adaptation since it provides for a brief period of freezing giving the perturbed subject sufficient time to assess the nature of the perturbation and provide an adequate response.

It is striking that these minor startle responses can be well integrated in the ongoing activities of the subject. During gait this assimilation is related to an efficient phase-dependent modulation of reflexes. The responses have been mostly studied in leg muscles. However, some recent work has used crutch walking to evaluate the responses in arm muscles after a brief unloading. These responses were found to habituate rapidly, again indicating a link with startle-induced behaviour.

The responses with the longest latencies occur at about 120 ms. These responses are still too fast to be voluntary reactions. It is argued that they represent triggered reactions and that they may be brainstem mediated reactions, which can be triggered by a cortical command (related to a visual stimulus for example). Of special interest are the recent findings that the latter type of responses may be speeded up by combining the stimuli with inputs, which can induce startle. Some authors have argued therefore that one can question the validity of the 100 ms limit used to establish the presence of false starts in various races. Furthermore, it has been suggested that these responses are basically mediated through subcortical pathways but triggered by a cortical command.

SENSORIMOTOR AND BALLISTIC STRENGTH TRAINING: SPINAL OR SUPRASPINAL NEURAL ADAPTATION?

Taube, W., Gruber, M., Beck, S., Gollhofer, A., Faist, M., Schubert, M.

University of Freiburg, Germany

Four weeks of SMT and BST were evaluated. It was ypothesized that SMT as a postural training predominantly affects propriospinal mechanisms while BST, in emphasizing voluntary movement will primarily induce supra-spinal adaptations. Therefore, a first series of experiments was designed to test this hypothesis. Changes at the cortical level were evaluated by means of transcranial magnetic stimulation (TMS), and spinal effects were assessed by means of peripheral nerve stimulation (H-reflex). Training was evaluated at rest and in the active state, i.e. in tasks corresponding to each of the two trainings: Subjects were tested during voluntary plantarflexion (PFL), corresponding to the movements required for BST and during stance perturbation on a treadmill (PER) which resembled to the motor task of SMT.

Both training interventions improved RFD and stance stability.

Corticospinal excitability was significantly reduced in tasks resembling the training condition, e.g. during perturbation following SMT and during PFL following BST. Conversely, corticospinal excitability was enhanced in the non-trained task, e.g. during PFL following SMT and during perturbation following BST. This observation of task-dependency of training effects underscores the need to consider the circumstance of any assessment. It is suggested that the actual training effect must be seen as the improved capability to modulate corticospinal facilitation between tasks.

A second series of experiments was designed to assess the relative adaptability of short (SLR) and long latency (LLR) reflexes following SMT. For this purpose fast posterior translations (PER_fast) were applied during stance on the treadmill to induce SLR and LLR in the soleus muscle. TMS and H-reflex testing again were used to assess spinal and supraspinal contribution to SLR and LLR. Training did not affect the SLR. This lack of SLR change indicates that the early component of a postural compensatory response is not affected by such a short period of training. Contrary to SLR, spinal as well as supraspinal excitability were reduced at LLR emphasizing strong neuroplasticity for later parts of the reflex response. As spinal adaptations were only observed for LLR it is assumed that supraspinal centres controlled motoneuronal transmission.

In summary our results support the claim that measurements should be taken during activity and not at rest in order to detect training related neural adaptations. We furthermore emphasize the need to measure in tasks closely related to the training condition. Moreover, challenging the system with an unfamiliar motor task may disclose a transfer of training effects to non-trained movements, thereby giving an idea of the true extent of training-induced plasticity. This implies that training affects the entire motor system and suggests supraspinal control to be relevant for spinal and transcortical reflex adaptation.

FROM OBSTACLE TO FALL? SENSORIMOTOR TRAINING HELPS FALL PREVENTION IN THE ELDERLY

Weerdesteyn, V., Duysens, J.

Sint Maartenskliniek, Netherlands

The problem of falls in the elderly has become a topic of growing scientific interest. Numerous studies on risk factors for falls and preventive strategies have been published in the past decades. The development of fall prevention interventions has usually been based on these known risk factors. Another approach would be to develop an intervention program that is based on the reported circumstances of falls. Such interventions would typically include elements like obstacle course walking, because a large number of falls in the elderly are a consequence of tripping over obstacles while walking. In order to enhance the probability of success of such intervention programs, it may help to get a better understanding of why elderly fall over obstacles. Previous studies have reported an age-related decline in the successfulness of obstacle avoidance under time pressure1. Differences between young and older adults, however, were rather limited, probably because only minor step adjustments were required. In order to further elucidate age-related limitations in obstacle avoidance skills and their relation to the risk for falling in the elderly, we have developed a new time-critical obstacle avoidance task that requires fairly large step length adjustments. In this task, participants are requested to avoid an obstacle that suddenly falls in front of the foot while walking on a treadmill. The results showed that advancing age had a detrimental effect on the successfulness on this task, which could be attributed to increased reaction times, non-optimal avoidance strategies, and smaller horizontal clearance margins. Furthermore, the successfulness on this task clearly discriminated recurrent fallers from non- or one-time fallers, which underscores the contribution of declined adaptive gait skills to the high fall incidence rates in the elderly. Therefore, a next research question was whether a new 5-week falls prevention exercise program for the elderly (with a strong emphasis on adaptive gait) could improve obstacle avoidance skills and whether this would coincide with a reduction in the number of falls. The program consisted of exercises on an obstacle course (with or without dual task and reduced vision conditions), walking exercises, and the practice of fall techniques. The effectiveness of this falls prevention program was evaluated in a randomized clinical trial. As a result of training, the obstacle avoidance success rates significantly improved, especially when there was very little time (<350 ms) to react. The improvement was mainly achieved by larger horizontal clearance margins. Most importantly, fall incidence rates of the exercise group were found to decrease by as much as 46% compared to the control group. In conclusion, an exercise program that is focused on adaptive gait skills does not only improve these skills, but also effectively reduces the risk for falling in the elderly.

1. Chen et al (1994). J Gerontol Med Sci 49:M227-M233.

Oral presentation (OP)

OP1-16 Physiology 4/10 - "Oslo"

ACTUAL MEASUREMENT OF ALVEOLAR OXYGEN STORE CHANGES ALLOWS REDUCING VARIABILITY OF BREATH-BY-BREATH OXYGEN UPTAKE IN HUMANS

Wüst, R.C. 1+2, Aliverti, A. 3, Kayser, B. 4

1 IFKB, Vrije Univ., Amsterdam, 2 Dipartimento di Bioingegneria, Polytechnic, Milan, 3 ISMMS, Faculty of Medicine, Univ. of Geneva, Geneva, 4 ISMMS, Faculty of Medicine, Univ. of Geneva, Carouge, Netherlands

Breath-by-breath (BbB) oxygen uptake at the mouth (VO2M) is used to study aerobic metabolism of the organism. However, VO2M is hampered by poor signal-to-noise ratio and this limits the study of oxygen uptake kinetics. Variability of VO2M is due to physiological and experimental factors. One physiological factor concerns BbB variation in lung oxygen stores due to BbB variation in end-expiratory lung volume (EEVL). Variability of actual alveolar BbB oxygen uptake (VO2A) should therefore be lower compared to VO2M. To date only imperfect estimations of BbB changes in lung oxygen stores were used to correct VO2M since direct measurement of lung oxygen stores was not possible. Opto-electronic plethysmography (OEP) now allows accurate monitoring of absolute lung volume changes and therefore pulmonary oxygen stores (Aliverti et al. J Appl Physiol, 96:1464-9, 2004). Methods. To test the hypothesis that BbB variability in VO2M is for a large part due to BbB variation of lung oxygen stores, we measured, by means of OEP, VO2M and VO2A in parallel, at rest and during transients and steady state cycling exercise at 60, 90 and 120 Watt in 7 healthy subjects [mean (std) age: 35.1 (9.0) years; FRC: 4.54 (0.85) l and TLC: 7.62 (0.96) l]. In addition, in order to test the robustness of direct measurement of VO2A with OEP we asked the subjects to voluntarily change their end-inspiratory lung volume (EIVL) and EEVL between breaths to exaggerate the effects of changes in gas stores in the lung. Results. Average VO2M and VO2A at steady state were the same. Direct measurement of VO2A reduced overall BbB variability by 24% ($P<0.0001$). The difference between VO2M and VO2A was larger during transients than at steady state ($P<0.0001$). This effect was greater during on-transients than off-transients ($P<0.01$). Variance of the difference between VO2M and VO2A could be explained for 46% by BbB changes in EEVL and 9% by BbB changes in end-expiratory gas oxygen fraction. During voluntary variation of EIVL and EEVL VO2M showed increased variability and occasional paradoxical net oxygen excretion while VO2A remained stable within a physiological range. Discussion.. The main findings were that 1) by taking into account actual changes in lung oxygen stores BbB variability of oxygen uptake is reduced, 2) the impact of changes in lung oxygen stores is greater during transients as compared to steady state conditions, 3) the effect from changes in lung oxygen stores is greater during on- than off-transients, 4) about half of the overall BbB variability at the mouth is due to BbB changes in end-expiratory lung volume and 5) the OEP measurement of VO2A allows to correct for large voluntary changes in lung oxygen stores. Conclusions. Actual measurement of alveolar oxygen uptake by OEP allows greatly reducing variability in BbB measurement of oxygen consumption by the organism. These findings open new avenues for research into oxygen uptake kinetics with greater precision as up to today.

THE RECOVERY OF REPEATED-SPRINT PERFORMANCE OCCURS BEFORE THE FULL RECOVERY OF MUSCLE LACTATE AND PHOSPHOCREATINE

McGawley, K., Edge, J., Bishop, D.

University of Brighton, United Kingdom

Single and repeated-sprint protocols result in significant rises in blood and muscle lactate (La-bl and La-m), and significant decreases in muscle pH (pHm) and phosphocreatine (PCr)(1,2). High correlations have been demonstrated between the percentage restoration of power during a second 30-s sprint and the percentage resynthesis of PCr, while neither pHm or La-m recovery were related to the recovery of 30-s sprint performance(1). To date, however, no study has investigated the relationship between the recovery of muscle metabolites and the recovery of repeated-sprint performance. Furthermore, no study has investigated metabolite concentrations at a point when subsequent performance is fully recovered. The aim of the present study was to identify the relationships between performance recovery and the recovery of muscle metabolites, La-bl and oxygen consumption (VO2) following 5 x 6-s repeated-sprint exercise. Nine female soccer players (mean ± SD: age 27 ± 7 y; mass 60.5 ± 5.3 kg; VO2max 50.0 ± 3.9 mL/kg/min) performed two consecutive 5 x 6-s maximal sprint-cycle bouts (B1 and B2) on eight separate occasions. The five sprints within each bout were separated by 24 s of active recovery and the two bouts were separated by passive recovery periods lasting 5 – 14 min. Trials 1 – 6 were used to identify the least time required to recover total work done (Wtot) over a 5 x 6-s bout (time = trec). During trial 7, expired air was collected between B1 and B2 (separated by trec). During trial 8, blood samples and v. lateralis muscle biopsies were taken at rest, immediately post B1 and at the individual trec. Following trec (mean ± SD: 10.7 ± 1.2 min), Wtot recovered to 100 ± 1.05 % (B1: 18575 ± 1792 J, B2: 18579 ± 1861 J; P=0.947). La-bl was higher than at rest both immediately post B1 and after trec (11.6 ± 3.2 and 10.9 ± 4.6 vs 1.0 ± 0.5 mmol/L; P<0.001). pHm dropped during B1 (7.1 ± 0.1 to 6.9 ± 0.1; P<0.01) and recovered to 7.1 ± 0.1 at trec (not different from rest, P>0.1). La-m content was elevated above the resting value post B1 (95.0 ± 54.7 vs 14.4 ± 1.6 mmol/L; P<0.05) and dropped significantly during recovery, remaining higher than the resting value (38.0 ± 16.4 mmol/L; P<0.05). PCr was reduced to 43 ± 22 % of resting content following B1 and despite recovering to 82 ± 13 %, remained lower than baseline PCr content after trec. During recovery from B1, VO2 was unchanged (i.e., had stabilised) after 3.0 min (P>0.05). Results suggest that the full recovery of La-bl, La-m and PCr is not necessary for the recovery of 5 x 6-s sprint performance in trained, female, team-sport athletes. Instead it may be more important for pHm to have returned to baseline levels and for sufficient PCr resynthesis to have occurred to recover work in a second bout. 1. Bogdanis G., et al. (1995). J Physiol 482(2): 467-480; 2. Bishop D., et al. (2004). Eur J Appl Physiol 92: 540-547. The first author's position is supported by the EU-funded Interreg IIIa programme.

METABOLIC AND MECHANICAL CONTRIBUTIONS TO THE EXERCISE-INDUCED CIRCULATORY RESPONSE

Dufour, S., Doutreleau, S., Lonsdorfer-Wolf, E., Lampert, E., Piquard, F., Lonsdorfer, J., Geny, B., Mettauer, B., Richard, R.

Service de Physiologie et d'Explorations Fonctionnelles, Hôpital Civil, France

Background. Because of its pivotal role in setting systemic oxygen (O2) delivery, cardiac output (Q) is considered as a determining factor of aerobic exercise capacity in both health (1) and many disease states (3). Both heart rate (HR) and stroke volume (SV) are direct determinants of Q adjustments during exercise and their observed responses are expected to be driven by metabolic (i.e. whole body energy demand) and/or mechanical (i.e. muscle tension) components of the exercise workload (2). Metabolic demand and muscle mechanical tension are closely coupled during whole-body exercise, making their respective drives to the circulatory response difficult to establish. As this coupling is altered in eccentric cycling, we implemented an experimental design featuring eccentric vs. concentric constant-load cycling bouts to gain new insights in human circulatory control during exercise.

Methods. HR, SV, Q, whole body oxygen uptake (VO2) and electromyographic (EMG) activity of the quadriceps muscles were determined in 11 subjects at baseline and during heavy concentric (HC), low concentric (LC) and high eccentric (HE) cycle exercises. HE and LC were designed to elicit similar VO2 (~1.15 L/min) whereas HC and HE were set at equivalent power output (270 ± 13W). Using a reductionist approach, the difference of circulatory response observed between HC vs. LC was subsequently ascribed to either the metabolic (as estimated from HE vs. HC) or to the mechanical (as estimated from HE vs. LC) component of the exercise workload.

Results. SV responses to exercise were almost exclusively determined by the whole body metabolic demand (85%), which also accounted for 75% and 66% of the Q and HR responses respectively. Muscle mechanical tension appeared to exert a significant influence on the circulatory adjustments, accounting for 25% and 33% of the Q and HR response respectively. Q and HR responses were strongly associated with EMG changes, whatever the combination of whole body metabolic demand or muscle mechanical tension.

Conclusion. Even if whole body metabolic demand is the main driving factor to the exercise-induced circulatory response, these results suggest that the circulatory adjustments to exercise are also under significant muscle mechanical tension control. Moreover, these findings support the idea that the circulatory response is adjusted to muscle activity during high-intensity cycle exercise in humans.

References:

1. Gonzalez-Alonso J and Calbet JA. Reductions in systemic and skeletal muscle blood flow and oxygen delivery limit maximal aerobic capacity in humans. Circulation 107: 824-830, 2003.

2. Hamann JJ, Kluess HA, Buckwalter JB, and Clifford PS. Blood flow response to muscle contractions is more closely related to metabolic rate than contractile work. J Appl Physiol 98: 2096-2100, 2005.

3. Wasserman K and Whipp BJ. Excercise physiology in health and disease. Am Rev Respir Dis 112: 219-249, 1975.

PHYSIOLOGICAL ADAPTATIONS TO ENDURANCE TRAINING IN ELITE CYCLISTS

García-Zapico, A., Calderón-Montero, F.J., Benito-Peinado, P.J., González-Barbera, C.

Universidad Complutense de Madrid, Spain

The purpose of this study was to describe and evaluate the evolution of physiological parameters as a control tool for training monitoring in a group of young cyclists (age 20±1.9 years; mean VO2max ~77 ml•kg-1•min-1), during one season of training, divided in two periods (winter or "volume" mesocycle and spring or "intensity" mesocycle) between the tests that they carried out in the laboratory, consisting on a ramp test until exhaustion (work load increases 25 W•min-1) and a maximal lactate steady state (MLSS) test in a cycle ergometer. The following variables were recorded at VO2max, first ventilatory threshold (VT1), second ventilatory threshold (VT2) and MLSS: load (W), oxygen consumption per kilogram body mass (VO2max in ml•kg-1•min-1; except in MLSS), hart rate (HR beats•min-1) and Lactate concentration ([La] in mmol•l-1). Macronutrients and haematological variables were also recorded during the test periods, and volume and intensity of training everyday from the beginning until the end of the study.

The physiological obtained data (463±13.4 Wats; 80.5±1.8 ml•kg-1•min-1; 62±1.7% VO2max for VT1 and 90.1±1.4% VO2max VT2) were similar to those previously reported for professional cyclists (Lucia, Hoyos & Chicharro, 2001, Mujika & Padilla, 2001). Also the values for the MLSS (255±10.6 Wats) agree with the ones reported by (Beneke, 2003). The adaptation response is represented by higher loads and VO2max (increases of ~9% of VO2max and ~8% in maximal reached Load) . Subjects improved VT1 and VT2 ($p<0.05$) after the first period (8% and 5% respectively) of training even thought the low intensity of it, focused on the performance of VT1. The MLSS performed after the first period ($p<0.05$) and remained high in the second. High levels of CK (~230 U•L-1) and Urea (37 mg•l-1) plus an insufficient Carbohydrates intake (~52%) could be responsible of the decrease of some red blood cell parameters ($p<0.05$) like the Haemoglobin values, advising of possible future overreaching processes described in similar training groups.

In conclusion, the high levels reached by the subjects after the first period of training could only be maintained in central indicators and probably improved in peripheral variables not measured in the study as previously reported for professional cyclists.

References

Beneke, R (2003).Maximal lactate steady state concentration (MLSS): experimental and modelling approaches. Eur J Appl Physiol, 88 (4-5), 361-9.

Lucia, A; Hoyos, J & Chicharro, JL (2001).Physiology of professional road cycling. Sports Med, 31 (5), 325-37.

Mujika, I & Padilla, S (2001).Physiological and performance characteristics of male professional road cyclists. Sports Med, 31 (7), 479-87.

PATTERN, MAGNITUDE AND RELIABILITY OF STRAIN OF ULTRA-ENDURANCE (>24 H) COMPETITION

Lucas, S.J., Cotter, J.D., Palmer, C.D., MacKay, T., Anson, J.G.

University of Otago , New Zealand

There has been little research on the physiology of competitive ultra-endurance exercise lasting longer than one day. Ultra-endurance events such as adventure races involve substantial environmental, exertional and cognitive stresses with severe sleep deprivation. We have now studied the pattern and magnitude of cardiovascular strain and haemodynamic responses across two semi-continuous races lasting 86-120 h (2003 and 2004 Southern Traverse Adventure Race). Heart rate averaged 64% of athletes' heart rate range (HRR) for the first 12 h of both races, and 40-45% HRR thereafter (41% in 2003, n=11; 44% in 2004; n=4). Standardised exercise tests conducted before and after the 2003 race showed that the heart rate to work rate relationship was consistent but perceived exertion was elevated (reported previously). The hypervolaemic response was also large and reliable; plasma volume expanded by 24 ± 10% in both the 2003 race ($p<0.01$, n=37) and the 2004 race ($p=0.02$, n=4). Differential leukocyte count responses were less reliable. The large increases in plasma concentrations of neutrophils and monocytes early (15-35 h) in racing were apparent both in 2003 (n=11; up by 166 and 130%, respectively) and 2004 (n=4; 235 and 170%), but the 44% increase ($p<0.05$) in lymphocyte counts in 2003 was not evident in 2004 (up by 6%; $p=0.59$). The elevations in neutrophils and monocytes were still evident at completion of both races (up by 80 and 60%, respectively in 2003; 138 and 81% in 2004), whereas lymphocytes were only slightly elevated in 2003 (up by 13%, $p=0.36$) and lower in 2004 (down by 36%, $p=0.02$). Thus, neutrophilia and monocytosis responses were reliable across races and concur with findings from shorter endurance exercise and sustained military training, however the lymphocyte numbers did not consistently show the decreases reported by others following endurance exercise and sustained military training.

Heart rate data (n=3) collected in subsequent 24-h competitive and semi-controlled studies of sustained exercise indicate a similar trend. Data obtained from one athlete competing in a 24-h event and who had competed in both the 2003 and 2004 Southern Traverses, averaged 61% HHR for the first 12 h and then 35% for the remainder of the 24-h event. Heart rate data collected from a pilot study (n=2) of a 24-hour adventure race simulation averaged 60% HHR for the first 12 h and then 42% for the remainder of the simulation. Thus, the magnitude and pattern of exercise intensity appear to indicate a reliable intensity reduction, plateauing to 40-45% HRR within 24 h.

We have observed a consistent pattern of cardiovascular strain during sustained, ultra-endurance events lasting 24 hours or more. After the first 12 hours of higher intensity, athletes select a sustainable pace that they maintain for the remainder of the race, at 40-45% of heart rate range. We are currently using the 24-hour simulation to investigate the mechanisms behind this change in pace selection.

Oral presentation (OP)

OP1-17 Doping 1/1 - "Turin ABC"

ON EDUCATION FOR NOBLE SPORTS RIVALRY

Kosiewicz, J.

Academy of Physical Education , Poland

It is possible to exert a significant and lasting influence on sportspersons' ethical attitudes; to contribute to their personal and moral transformations, as well as to their maturation taking into account the fair play principle as a momentous idea included in a superior – and the highest – moral value which is the Good in its Socratic and Platonic interpretation.

The principle of fair play constitutes some specific part of a broader moral idea of fair conduct. It concentrates on the ethos of honest play, but only in a highly reductionist meaning; namely, on moral convictions of persons connected with sport. In this sense, persons studying manifestations of the principle of fair play do not focus their attention on other forms of game – e.g. those connected with war games, gambling or other , etc. – the theory of games refers to. Neither it deals with various forms of games being present in art.

The ethical discourse concerning sports rivalry, if referred solely to the principle of fair play, does not also take into account a broader theoretical and postulative context of these forms of fair conduct which are not connected with any form of a game. Neither it takes into account other ethical theories, codices, moral ideals – both in their diachronic and synchronic, religious and non-religious interpretation – concerning Western and non-Western (e.g. Oriental) moral systems.

The discourse on the issue of noble sports rivalry should not concern solely moral reflection of the principle of fair play isolated from a broader context. It should be closely connected with moral education as such, and especially with ethics as a discipline providing a proper context for theoretical and postulative considerations on the idea of fair play, on the ethos of honest play where sport is treated as a special field of objectification of active goodness.

If there are no classes in ethics as an autonomous subject – and, additionally, classes in ethics referring to sports activity, which would take into account ethical aspects of sport, including the idea of fair play, in their curricula - in primary and secondary schools, this is the

situation when the whole burden of initial and developing education for the noble sport rivalry should, according to my opinion, rest on persons connected with sport for all (that is, school teachers of physical education, coaches, instructors), as well as with school sport, movement recreation and recreational forms of tourism constituting the basis of activities of various extra-school associations.

REMOVING DRUGS FROM SPORT: IS IT TOO LATE?

Freeman, W.H.

Campbell University, United States

The problem of removing illegal performance-enhancing drugs from sport becomes greater each year. Drug use removes the assumption of a fair platform for competition, skirts the ethic of success through diligence and devalues records that become unattainable by honest means. Even as more thorough methods of testing are developed, they arrive in the face of ever more subtle advances in the development of less-detectable substances. One recent drug regimen that produced several world champions was detected only because a competing coach turned in a sample of the drug, enabling researchers to develop a detection mechanism. Detection difficulties create suspicion of all elite performances and of great athletes. Is it possible that the detection process will never fully catch up with the cheaters? Should we give up and remove drug restrictions, especially as there are no other types of restrictions on training? If we did remove drug restrictions, on the positive side the records would no longer be questioned and the competitions would become more fair, as all athletes could use any means for improvements in performance. On the negative side, athletes never evaluate risk objectively, as the desire to win is too great. Also, advice to athletes may be questionable, as there are always coaches and medical people willing to assist in ways that put the athlete at risk. There may never be clean sport at any level. The long term impacts of drugs on sport include the drift toward androids: Athletes may become less human as they drug and genetically engineer themselves farther from normal humans. Serious risks will always be present. Medical ethics usually prevent research into the effectiveness of dangerous drugs and of extreme levels of dosages, which by definition is what athletes will choose to use, thus leaving large areas of unknown risk. The risk will shift from the danger of using drugs to the degree of using more dangerous levels or types of drugs to get ahead of a field where everyone uses drugs. Ultimately the removal of drug restrictions will result in an increased rate of athlete fatalities due to drug usage.

HOW EFFECTIVE ARE THE ANTI-DOPING CAMPAIGN?

Hanstad, D.V.

Norwegian School of Sport Sciences, Norway

Introduction

The anti-doping work is characterized by a strong development after the establishment of World Anti-Doping Agency in 1999. In the Olympic movement, where most of the tests are taken, all OF the 202 National Olympic Committees (NOCs) and all OF the 35 international federations have accepted the World Anti-Doping Code (WADC) and are undertaking anti-doping work.

But how effective is the anti-doping work? How many of these organisations are carrying out well functioning doping controls? This is the topic for my presentation.

Methods

The study is based mainly on interviews with key figures in eight different anti-doping organisations (ADOs) and in the WADA. The anti-doping organizations were the national organisations (NADOs) in South-Africa, France, China, USA and Norway, and the sport federations of athletics and rowing (Hanstad & Loland 2005). In addition, a number of sources have also been systematically examined, mainly documents regarding the World Anti-Doping Programme (WADP), statistics from individual ADOs as well as other relevant literature on anti-doping work.

Results

Among the National Olympic Committees, less than half, approximately 90 out of 202, test their athletes for drugs. Less than half of them have programmes that do not meet the requirements of the World Anti-Doping Code. The remaining 40 have their own NADOs. However, when addressing the Code requirements of registered testing pool, whereabouts information and out-of-competition testing, more committees are left out.

If the characteristics for a good NADO means ISO-certification or taking out-of-competition tests for the WADA, or have proven that they follow WADP and conduct a reasonable number of efficient controls, only about twenty NADOs can be characterized as such.

Similary, according to the WADA Code the 35 international Olympic sports federations have to meet the adopt and implement anti-doping policies and rules which conform with the Code as well. The study shows that the number of good ADOS is just as low here as with the NADOs.

Discussion/Conclusion

The real, critical question in current anti-doping work is the lack of well functioning NADOs and ADOs in the international federations. This situation has many causes, among them a lack of resources and a lack of will to give priority to anti-doping activities. The anti-doping movement need to develop strategies in this respect. The most important requirements to increase the effectiveness of ADOS are:

(i) The coordination and cooperation between ADOs, primarily between NADOs and IFs, have to be improved and made more close. (ii) Anti-doping organizations and governments need to be independent from sport. (iii) There are needs of better procedures for recruiting doping control officers and stronger educational programs.

Litterature

Hanstad, D. V. & Loland, S. (2005). What is efficient doping control? Oslo: Norwegian School of Sport Sciences.

THE TURKISH ATHLETES ATTITUDES TOWARDS DOPING. WHY DO THEY USE?

Karli, U., Polat, E., Kocak, S.

Middle East Technical University, Turkey

THE TURKISH ATHLETES ATTITUDES TOWARDS DOPING. WHY DO THEY USE?

Ünal KARLI, Ercan POLAT, Settar KOÇAK

The problem of doping has existed as long as sport has been known as a social phenomenon. Up to date, national and international sports governing bodies have put forth legislations and regulations in the anti-doping fight. In the past and now laws and penalties are constructed to dissuade the athletes from their unfair and unhealthy behaviors, but it is seen that all were useless in preventing athletes

from doping. Although athletes' beliefs and motives are known to influence their doping usage behavior, there is no deep information about subject. Therefore, the purpose of this paper was to investigate the attitudes of Turkish athletes towards doping.

In-depth interviews with the athletes were the primary source of data collection procedure. Power athletes who had experience in using illegal ergogenic aids and who are still using them in their sports life composed the subject group. The authors get in contact with 25 subjects and 11 of them accepted to be subject to the research. Semi-structured interviews were conducted to the 11 athletes who accepted participating voluntarily, and 10 of them were taken into considerations. The interview was composed of questions such as; ice breaking questions "Let's tell us about your athletic background" and "What does sports mean for you?" and main questions "What do you think about the role of doping in performances of athletes in our country and all over the world?", "What is your opinion about doping usage of the athletes?", "How many times have you experienced legal and illegal performance enhancers in your athletic life? What would you tell us about your experiences?" and so on.

After transcribing the data gathered from the interviews, three of the authors coded the data and after then, each of the coded out puts was compared. Then after all the authors consensus the data ordered under five themes which were the athletic background of the subjects and their approach to sports, the usage rate of doping and its role on athletic success, subjects experience with legal and illegal performance enhancers, doping and social life and the fight against doping.

Findings indicated that the athletes purpose on involving in sports shifted by time, while it was such a leisure activity at first now it is a profession for them. They reported that using doping is inevitable for athletic success and they believed that the usage rate of doping in Turkey and all over the world is very high. Additionally, the subjects stated that curiosity, performance enhancement, friend and coach offers were their initiating reasons for their initial experiences with doping. Also they think that the policy about the fight against doping is not fair both in national and international level. They see doping as a must to reach sportive success, but even they think so, they mentioned that their preference is that competing in a drug purified competition.

Oral presentation (OP)

OP1-18 Health and Fitness 2/4 - "Berlin DE"

EFFECTS OF WALKING ON DESIRE TO SMOKE AND WITHDRAWAL SYMPTOMS DURING A SMOKING CUE, AND AD LIBITUM SMOKING

Katomeri, M., Taylor, A.H.

University of Exeter, United Kingdom

Failure to cope with cigarette cravings have been linked to high relapse rates among smokers attempting to quit. Recent research has shown a positive effect of walking on cravings, responses to a smoking cue (following stress), and on ad libitum smoking (Katomeri & Taylor, 2005). This study aimed to examine the effects of a 15 min walk on withdrawal symptoms and cravings, response to a smoking cue (with no prior stressor), and time to ad libitum smoking. 17 males and 13 females, aged 21.9 (SD = 2.1) years, smoking 13.7 (SD = 4.3) cigarettes daily were recruited. Following 2 hours of abstinence, smokers attended sessions involving either a brisk self-paced treadmill walk or being seated for 15 min, in a counterbalanced within-subject design. After treatment, subjects remained seated for 10 mins and then were only allowed to handle a lit cigarette. A single-item measure of desire to smoke (Tiffany and Drobes, 1991), and the seven item Mood and Physical Symptoms Scale (West and Russell, 1985), to assess withdrawal symptoms, were administered pre-, mid-, and post-treatment, and also pre and post handling the lit cigarette. A series of two-way fully repeated ANOVAs revealed a significant overall interaction effect for time x condition for all 7 MPSS items, Depression $F(2.7, 79.7)=9.5$, $P<0.001$; Irritability $F(4, 116)= 10.5$, $P<0.001$; Restless $F(3.2, 91.7)=7.7$, $P<0.001$; Tension $F(3.1, 91.3)=10.9$, $P<0.001$; Concentration $F(2.2, 64.9)=18.7$, $P<0.001$; Stress $F(2.9, 84.3)=15.9$, $P<0.001$; Anxiety $F(4, 116)=8.6$, $P<0.001$; and the desire to smoke item $F(3.0, 87.3)=39.2$, $P<0.001$, all with a Greenhouse-Glasser correction (except where df=4, 116). In all cases, post hoc t tests revealed significantly lower measures following exercise than the control condition, relative to baseline. Unlike a previous study (Katomeri & Taylor, 2005), calculated changes in desire to smoke from pre to post smoking cue were greater following exercise compared with the control condition. This may have been due to a ceiling effect for the control condition or a response to a higher exercise intensity (HRR=37.3; mean Rating of Perceived Exertion (RPE) =12.2) than reported by Katomeri & Taylor (2005)(HRR=24.1; RPE=10.9). Also, a first cigarette was smoked significantly later, $F(1,19)=8.5$, $P<.01$, following exercise (ie, 66 mins (SD=48) compared with 31 mins (SD=33) after the control condition.

References

Katomeri M, Taylor AH (2005). Effects of walking on cigarette cravings during smoking cue simulation and on lag time to the next cigarette. Paper presented at ECSS conference,Serbia-Montenegro.

Tiffany TS, Drobes DJ (1991). The development and initial validation of a questionnaire on smoking urges. British J of Addiction, 86:467-1476

West R, Russell M (1985). Pre-abstinence smoke intake and smoking motivation as predictors of severity of cigarette withdrawal symptoms. Psychopharmacology 87:407-415.

COMPARISON OF THE PHYSICAL CAPACITY OF NORMAL WEIGHT AND OBESE ADULTS

Kümmerle, A., Schaar, B.

German Sport University Cologne, Germany

Obesity is a chronic disease affecting people of all ages and socio-economic backgrounds. The resulting costs for health insurances range from 3.9 to 10.33 billion per year. By 2000, the number of obese adults in Germany had risen to more than 13 million and to over 300 million worldwide. These people suffer from lack of exercise. To prevent both over- and underestimation of individual training intensity a diagnosis of the actual fitness level is required. But there seem to be deficits in knowledge about exercise testing in obese adults and in transforming standard tests for studying obesity. The purpose of this project is to compare physical capacity in obese subjects during treadmill and bicycle exercise to examine the limiting factors.

3 groups performed the same standardized test on treadmill (TM)(modified WHO) and bicycle (B) (WHO): 1. Obese (n=24, 40±8.6 years, 174.7±9.2cm, 34.3±3.1kg/m²); 2. Normal weight (n=24, 39.7±8.3 years, 177.1±9.7cm, 22.8±1.8kg/m²), 3. Students of sports science (n=20, 24.1±2.1 years, 177.7±9.2cm, 21.6±2.0kg/m²). The limiting factors and the applicability of the tests were examined to give an outlook onto

their potential modification and optimization for obese people. Body composition, BMR and maximal values for HR, lactate, VO2, RER, load and time were registered. The study was done as a quasi-experimental examination with 3 groups and 2 tests in one session.

Body composition shows a significant difference in FM only (p=0.000). No difference in BMR (p=0.362) and VO2rest (p=0.402) can be proved between the 3 groups. While EG1 differs from EG2 and EG3 in HRmax (p=0.000), Pmax (p=0.000), tmax (p=0.000), HR2mmol (p=0.000), HR4mmol (p=0.000), v2mmol (p=0.000) and v4mmol (p=0.000) on treadmill, EG1 and EG2 show no difference in bicycle results for these parameters. EG1 shows the least endurance capacity and no maximal load on TM but a significantly better performance on B. The correlation of Pmax, tmax, HRmax, v and HR at 2 and 4 mmol/l lactate indicates a clear link to both BMI and FM on treadmill in contrast to on bicycle.

Cardiac, pulmonary, vascular and muscular performance does not differ between obese and normal weight subjects when testing is executed under body weight relief. The data suggests that FM limits maximal performance and is more important than metabolic, respiratory and cardiovascular factors when stress testing is executed under full body weight. In conclusion, compared to B results the TM test is not suitable for the obese to reach maximal load so a data-based training control is hardly possible because of low performance and FM as a performance limiting factor. Further studies should focus on the modification and standardization of treadmill tests for the obese.

Blake A et al. (2000), J Sports Med Phys Fitness Vol.40, No.2:170-177

Donnelly JE et al. (1990), Diabetes Res Clin Prac No.10, Suppl.1 :283-286

Salvadori A et al. (1992), Chest Vol.101, No.3:674-679.

THE EFFECT OF EXERCISE TRAINING ON FAT OXIDATION AND INSULIN SENSITIVITY IN OBESE MEN

Venables, M.C., Heywood, B., Jeukendrup, A.E.

Human Performance Laboratory, the University of Birmingham, United Kingdom

PURPOSE: Insulin resistance is a state commonly associated with inactivity, and is a hallmark feature of disease states such as obesity and non-insulin dependent diabetes mellitus. As well as being associated with insulin resistance obese and inactive individuals have an impaired ability to oxidize lipids. The purpose of the study was to investigate whether an endurance exercise training protocol, designed to utilize high rates of fat, produced more favourable effects on both fat oxidation and insulin sensitivity than a program designed to utilise less fat.

METHODS: In a counterbalanced cross over design, eight sedentary, obese but otherwise healthy male subjects (Age 40 ± 5 y; BMI 32.9 ± 2.9 kg∙m-2) performed two blocks of endurance training at different intensities: either at a predetermined intensity eliciting maximal fat oxidation (TPCON), or at 5-min intervals of ± 20% FATmax (TPINT). Each training block lasted 4-weeks and were separated by six-weeks of no exercise. Training sessions (5 times per week) were 30-mins in week 1, increasing by 10-mins per week until each session was 60-mins by week 4. An OGTT, VO2max test, 30-min steady state exercise at 50% of pre-training VO2max and measurements of body composition were undertaken pre- and post-training. Throughout the day preceding these tests, subjects were fed a diet consisting of 50% carbohydrate, 35% fat and 15% protein, totalling ~2900 Kcal per day. Variables were compared using training type (TPCON, TPINT) x exercise (pre-, post-training) repeated measures analyses of variance.

RESULTS: No change in body weight, body mass index (BMI), waist to hip ratio (WHR) or percent body fat (%BF) was observed post TPCON or post TPINT. Average energy expenditure during the training sessions increased from ~250 kcal in week 1 to ~500 kcal in week 4 and was no different between the protocols. However average training intensities for TPCON was 44 ± 6 %VO2max and for TPINT were 25 ± 6 and 65 ± 6 %VO2max, respectively.

It was shown that fat oxidation rates were increased by 44% post TPCON (0.24 ± 0.01 vs 0.35 ± 0.03 g∙min-1), $p<0.005$ but not post TPINT and that whole body insulin sensitivity index was increased by 27% post TPCON (2.47 ± 0.26 vs 3.13 ± 0.31, $p<0.01$) but only 2% post TPINT.

CONCLUSION: It can be concluded that a short term exercise training protocol designed to induce high rates of fat oxidation, increases the contribution of fat to substrate oxidation during exercise and can significantly increase insulin sensitivity within 4 weeks.

OSTEOGENIC INDEX OF STEP EXERCISE

Veloso, A., Oliveira, C., Santos-Rocha, R.

Sport School RioMaior-Polytechnic Inst. Santarém / Fac. Human Movement-Technical Univ. Lisbon, Portugal

Step Exercise has been promoted as a low impact physical activity recommended for the improvement of cardio respiratory and muscular fitness. It allows obtaining metabolic and biomechanical stimuli, higher that those obtained during walking, similar to those obtained during jogging, but with lower risk of injury. Hundred Step sessions were observed and characterised in terms of session duration, stepping rate every 5 minutes, total number and type of movements, and number of loading cycles. Peak vertical ground reaction forces (GRF) in normalised units of body weight (BW) were obtained in previous studies (Santos-Rocha & Veloso, 2005). Using the equation proposed by Turner and Robling (2003) the osteogenic index (OI) of Step Exercise was calculated: OI (one session) = Peak ground reaction force(BW)*Ln(number of loading cycles+1). Main results were (mean±sd): OI was 11.95±0.82; peak ground reaction force (GRF) was 1.44±0.09 times bodyweight (BW); session duration was 38.6±8.3 min; rate of stepping (BPM) was 134.6±4.7 beats per minute (bpm); march was the exercise performed more often; the other movements performed more often were knee-hop, side-leg, L-step and over-the-top; number of loading cycles was 4194.1±1055.2; two regression models were determined: OI=2.182+0.073*BPM (R=0.415; R2=0.172; Sig=0.000); GRF=0.271+0.009*BPM (R=0.450; R2=0.203; Sig=0.000). OI and GRF increases significantly when stepping rate is higher than 135 bpm. A frequency of 2 to 3 sessions per week of Step Exercise might be recommended. Despite of the benefits that have been stated when Step classes are provided correctly and adapted to participants; more research is needed concerning biomechanical load, exercise prescription and injury prevention.

References

Santos-Rocha, R & Veloso, A (2005). Plantar Pressure and Peak Ground Reaction Forces in Step Exercise. Comparison of Field and Laboratory Assessment. In Rodrigues, H; Cerrolaza, M; Doblaré, M; Ambrósio, J & Viceconti, M (Eds), Proceedings of the ICCB 2005 – II International Conference on Computational Bioengineering (volumes 1 & 2), Lisbon, Portugal, (pp 885-894).

Turner, CH & Robling, AG (2003). Designing Exercise Regimens to Increase Bone Strength. Exercise and Sport Science Review, 31(1), (pp 45-50).

POPULATION-BASED STEP COUNTS IN BELGIUM: COMPARISON BETWEEN DEMOGRAPHIC VARIABLES

De Cocker, K., Cardon, G., De Bourdeaudhuij, I.

University Ghent, Belgium

Introduction: Information on pedometer-determined physical activity population levels is still sparse and only collected in a limited number of countries. No recent pedometer-based data are available of European countries. Therefore, the main purpose was to provide pedometer-determined physical activity levels in Belgian adults. Mean steps/day were compared between gender, age groups, state of professional activity and among days of monitoring.

Methods: Participants were randomly recruited out of a sample of 5000 names of 25-75 years old inhabitants of East-Flanders, Belgium. Of this sample 4067 persons were invited by telephone or mail to complete the long International Physical Activity Questionnaire and to self-monitor pedometer-determined physical activity for 7 consecutive days. Steps data were returned by 1239 participants (604 males and 635 females, mean age was 48.6 ± 13.6 years). Steps for biking and swimming were imputed.

Results: The average adult in Belgium reported taking 9655 ± 4526 steps/day. According to the pedometer indices of Tudor-Locke and Bassett 12.9 % was sedentary, 19.3 % was low active, 26.2 % was somewhat active, 21.1 % could be classified as active and 21.2 % was highly active. Steps/day differed significantly between sexes (men: 9919 steps/day vs women: 8962 steps/day, $F = 5$, $p = 0.026$), across age groups (25-35 year old: 9201 steps/day vs 36-45 year old: 10926 steps/day vs 46-55 year old: 9686 steps/day vs 56-65 year old: 9184 steps/day vs 66-75 year old: 8205 steps/day, $F = 3.3$, $p = 0.01$), between state of professional activity (employed: 9973 steps/day vs unemployed: 8908 steps/day, $F = 6.2$, $p = 0.013$) and among days of monitoring (weekdays: 9755 steps/day vs weekend days: 9433 steps/day, $F = 7.4$, $p = 0.007$).

Conclusion: This study was the single largest survey of adult pedometer-assessed physical activity in Europe in the twenty-first century. The Belgian population accumulated relatively high step levels. However, the large standard deviation was a sign of a wide distribution of ambulatory behaviour. Consistent with other studies, men accumulated more steps/day than women and steps/day were related to age.

Reference: Tudor-Locke C, Bassett D, How many steps/day are enough? Preliminary pedometer indices for public health. Sports Medicine 2004; 34 (1): 1-8.

Oral presentation (OP)

OP1-19 Ageing 1/1 - "Turin DE"

PHYSICAL PERFORMANCE, ARTERIAL STRUCTURE AND FUNCTION IN ADVANCED AGE

Welsch, M.A. 1, Arce, A.A. 1, Dobrosielski, D.A. 1, Wood, R.H. 1, Jazwinski, M. 2

1 Louisiana State University, Baton Rouge, LA. Louisiana State University Health Sciences Center, 2 The Louisiana Healthy Aging Study, United States

Individuals with reduced physical function have an increased likelihood for morbidity, mortality, hospitalization, and poor quality of life. The six-minute walk test is a measure of physical performance that accurately predicts the onset of disability in the elderly. It was hypothesized that even in advanced age; those with the highest physical performance scores would have lower arterial thickness and greater arterial reactivity, suggestive of a healthier vasculature. PURPOSE: To examine the influence of vascular dimensions and function on the six-minute walk distance in advanced age. METHODS: Forty individuals (Age: 83±11yrs) from the Louisiana Healthy Aging Study were used for these analyses. Exercise tolerance was defined as the maximal walking distance (MWD) achieved on a six-minute walk test conducted in an internal hallway. Carotid and brachial artery dimensions (diameters, and carotid intima-media thickness (CIMT)) were measured using high-resolution ultrasonography. Average and maximum CIMT were obtained from the anterior and posterior walls of the common carotid across a marked length of 10 mm. Brachial artery peak flow velocities (BAPFV) and flow mediated dilation (BAFMD) were measured after 5 minutes of forearm occlusion. RESULTS: The average MWD was 364±122m. The average carotid vessel diameter was 8.35±0.85mm and the average and maximum CIMT was 0.94±0.06mm and 0.95±0.06mm, respectively. Brachial artery vessel diameter averaged 4.21±0.74mm. BAPFV and BAFMD were 83.63±74.13U and 2.70±2.69%, respectively. Importantly, BAPFV and BAFMD were significantly associated ($y=0.019(x)+1.728$; $r=0.48$, $p=0.001$). Multivariate analyses revealed smaller carotid vessel diameters (mean difference: 0.59mm; $p=0.026$), average (mean difference: 0.049mm; $p=0.017$) and maximum CIMT (mean difference: 0.049mm; $p=0.017$) in individuals with a MWD over 400m compared to those below 400m. Moreover, those with a MWD over 400m had greater BAFMD (mean difference: 1.74%; $p=0.005$), despite similar pre-occlusion brachial artery diameters and BAPFV. CONCLUSIONS: The lower average and maximum CIMT and greater BAFMD, in those individuals scoring above the 400m threshold on the six-minute walk test, suggests that the positive effects of physical fitness on arterial structure and function extend even in advanced age.

This research was supported by a grant from the Louisiana Board of Regents through the Millennium Trust Health Excellence Fund [HEF(2001-06)-02], and by a grant from the National Institute on Aging (1 P01 AG022064).

RELATIONSHIPS BETWEEN CAROTID-FEMORAL PULSE WAVE VELOCITY AND SPECTRAL COMPONENTS OF HEART RATE VARIABILITY IN HEALTHY OLDER MEN

Perkins, G., Owen, A., Swaine, I.L.

Canterbury Christ Church University, United Kingdom

BACKGROUND: Pulse wave velocity (PWV) is a measure of arterial stiffness which is influenced by a combination of structural and functional factors. Heart rate variability (HRV) is a measure of autonomic regulation of the heart rate. Nakao et al. (2004) have shown that brachial-ankle PWV is associated with power spectral components of HRV in 24–39 year-old men, independent of age and blood pressure. The purpose of the present study was to examine the relationships between carotid-femoral PWV (cfPWV) and spectral power parameters of HRV in 40–65 year-old men.

METHODS: Participants were healthy men (N=97). Mean age (±SD) was 50.9 (7.0) years. Body mass and height were 86.7 (12.6) kg and 1.78 (0.1) m, respectively. cfPWV and HRV were measured during supine rest. cfPWV was obtained using an automatic device (Complior) which measures transit time of pulse waves between the carotid and femoral sites. Spectral power components of HRV were derived

from a 5-min ECG recording during paced breathing. Spectral power was determined as total power (TP) and two frequency bands: high-frequency (HF: 0.15–0.45 Hz) and low-frequency (LF: 0.04–0.15 Hz) power. Resting blood pressure was measured in the seated position using a semi-automated blood pressure monitor. Resting heart rate (RHR) was derived during PWV signal acquisition. HRV data was natural log-transformed prior to analysis. Pearson's correlation was used to explore the relationships between cfPWV and spectral components of HRV. Partial correlational analysis was used to control for the effects of age, systolic blood pressure (SBP) and RHR, which are known confounders of PWV. Significance level was set at $p<0.05$.

RESULTS: Mean cfPWV (±SD) was 8.6 (1.5) m•s-1. TP, HF and LF were 1694.9 (1605.8), 435 (583.6) and 443.1 (507.0) ms2, respectively. SBP was 129.8 (11.3) mmHg and RHR was 56.9 (8.8) b•min-1. cfPWV was inversely correlated with all log-transformed spectral components of HRV (TP: r=-0.28, p<0.01; HF: r=-0.34, p<0.01; LF: r=-0.38, p<0.01). These relationships were stronger than in the partial correlations when age, SBP and RHR were controlled for (r=-0.10–0.34, p<0.01–0.31).

DISCUSSION: These findings in older men support those of Nakao et al. (2004) in younger men in that there is an association between PWV and spectral components of HRV. Furthermore, the relationship does not appear to be affected when cfPWV measurement is used compared to brachial-ankle PWV. The relationship between PWV and HRV seems to be maintained through a wide age-range in adult men. Whether there is a common link between the two variables which underlies this association has yet to be elucidated.

Nakao, M., Nomura, K., Karita, K., Nishikitani, M. & Yano, E. (2004). Relationship between brachial-ankle pulse wave velocity and heart rate variability in young Japanese men. Hypertension Research. 27: 925–931.

INSULIN RESISTANCE OF AGING: EFFECTS OF EXERCISE AND WEIGHT LOSS

Amati, F. 1+2, Dubé, J. 1, Stefanovic-Racic, M. 1, Toledo, F. 1, Goodpaster, B. 1

1 University of Pittsburgh, Pittsburgh, Pennsylvania, USA, 2 Hôpital Universitaire de Genève, Geneva, Switzerland, United States

Aging is associated with insulin resistance, which is a key factor in the development of type 2 diabetes. However, it is not clear to what degree obesity or physical inactivity underlies this 'aging effect'. Moreover, randomized trials to examine the separate effects of weight loss and exercise in older adults with insulin resistance are lacking. This study determined the separate effects of 4-months of diet-induced weight loss (WL; n=5), exercise (EX; n=8), and combined diet and exercise (WL+EX, n=9) on body composition, physical fitness and insulin sensitivity in older (68 ± 4 yr) overweight to obese (31.2 ± 3.2 kg•m-2) sedentary men and women. The EX group lost less ($P<0.05$) weight (-1.8 ± 1.2 kg) than the WL (-9.4 ± 1.6 kg) or WL+EX groups (-5.7 ± 1.2 kg). EX also lost less fat mass (-1.8 ± 1.0 kg) than WL (-7.2 ± 1.3 kg) or WL+EX groups (-4.8 ± 1.0 kg). Body composition was determined by dual-energy X-ray absorptiometry (DEXA). Physical fitness determined by maximal aerobic capacity (VO2max) using a graded exercise test, improved ($P<0.05$) in EX but not WL. Insulin sensitivity determined by a hyperinsulinemic (40mU•m-2•min-1) euglycemic clamp improved ($P<0.05$) in all three groups; however, there was no difference in the degree of improvement among EX (34 ± 11%), WL (23 ± 14%) and WL+EX (35 ± 12%). In conclusion, exercise and weight loss independently improve insulin resistance in older adults. Further studies are needed to determine the distinct mechanisms by which exercise and weight loss improve skeletal muscle insulin resistance in aging.

PERSISTENCE IN EXERCISE DECREASES WEIGHT GAIN IN ADULTS. A 30-YEAR LONGITUDINAL STUDY IN TWIN PAIRS DISCORDANT FOR LEISURE TIME PHYSICAL ACTIVITY

Backman, K. 1, Kaprio, J. 2, Kujala, U.M. 1

1 University of Jyväskylä, 2 University of Helsinki, Finland

Obesity is considered as one of the major health problems in the Western world. Lack of physical activity is one cause of weight gain. The main aim of this study was to find out whether persistent time leisure physical activity, adjusted for genetic liability and childhood experiences, protect against weight gain and other indicators of metabolic syndrome. The genetic liability to weight gain was partially controlled by investigating the effect of physical activity on anthropometric measurements in twin pairs discordant for physical activity for 30 years.

The study included 111 pairs of twins discordant for physical activity who were systematically selected from the large Finnish Twin Cohort. Physical activity discordance was initially assessed by similar questionnaires in 1975 and 1981; in both years the more active co-twin participated in higher levels of both vigorous activity and volume of activity than the less active co-twin. The outcome measurement of weight, height, self-measured waist circumference and present and past physical activity levels were assessed by a structured telephone interview in 2005. 89 pairs (40 male, 49 female, 72 dizygotic and 17 monozygotic pairs) of twins completed all parts of the interview. Paired samples t-test was used to analyse the differences in anthropometric measurements between inactive and active co-twins.

Mean age of the subjects was 58 years (range from 47 to 79 years) in 2005. There was a significant difference in the physical activity participation between initially inactive and active co-twins during 30 year follow up. Active co-twins participated in physical activity on average 4.3 MET-hours/day more when compared with inactive co-twins ($p<0.001$). 42 pairs of twins were found who remained consistently discordant for physical activity for 30 years according to the retrospective questions recorded within 5-year intervals. Within these pairs who remained persistently discordant for physical activity for 30 years the weight gain was 5.4 kg (95% CI 2.0-8.9) higher in the inactive member of the twin pair compared with the more active co-twin ($p=0.003$) during 30-year follow-up. The waist circumference was on average 8.4 cm (95% CI 4.0-12.7) greater in the inactive co-twin when compared with the active co-twin ($p<0.001$) at the end of the follow-up. The results were similar for both dizygotic and monozygotic and male and female twin pairs. This difference in change in weight and waist circumference was not seen in the twin pairs (n=47) who were not persistently discordant for physical activity for 30 years.

Even after partially controlling for genes and childhood experiences, persistent participation in leisure time physical activity in adulthood decreases the rate of weight gain and results in a smaller waist circumference. Participation in physical activity needs to continue throughout life to maintain these benefits.

INFLUENCE OF MAXIMAL POWER DETERMINANTS ON ELDERLY WOMEN PHYSICAL PERFORMANCE

Clémençon, M., Hautier, C., Rahmani, A., Cornu, C., Bonnefoy, M.

UFR STAPS Lyon, France

Background: The loss of autonomy, because of some motor disability, is revealed by dramatic functional decline particularly among elderly persons in the community. Determinants of functional limitations have been well established from several studies. Muscle power is well related to functional status and many basic activities in daily life such as walking, rising from chairs, or climbing stairs. Leg exten-

sor muscles capacities appear very important when accomplishing movements similar to those made in every day life. Power-velocity relationships obtained from force-velocity tests measured during explosive leg extension permit to measure maximal power (Pmax), optimal torque (Mopt) and optimal velocity (Vopt). Optimal velocity has been shown to be related to muscle fiber type and thus may serve as a surrogate measure for muscle fiber-type distribution (Martin et al., 2000). Thus, we consider that optimal torque and optimal velocity can give important information on quantitative (effective muscle mass) and qualitative (typology) muscular factors. The purpose of the present study was to evaluate physical performance and its relation to the production of maximal power and its corresponding determinants.

Methods

Three tests were performed to assess physical performance in 39 elderly women volunteers (83 ± 5.8 yr): walking speed, five-time chair rise time and six stair climb time. Maximal leg extension power and its corresponding determinants, i.e. Mopt and Vopt, were measured as described by Rahmani et al. (2003). To assess the relationships between impairments in leg power and its determinants and physical performance, multiple regression analyses were conducted.

Results

Participants presented a maximal walking speed of 0.85 ± 0.39 m.s-1, a five time chair rise time of 16.3 ± 7.7 s and a six stair climb time of 7.0 ± 4.0 s. Subjects produced 1.37 ± 0.78 W.kg-1 maximal leg power relative to body mass, 1.79 ± 1.21 rad.s-1 optimal velocity, and 50.75 ± 16.94 N.m optimal torque. In multiple regression analyses, maximal power and optimal velocity were better predictors of physical performance tests than optimal torque:

Conclusion

These findings, obtained in a group of very old women, showed optimal velocity to be an important determinant of physical performance. Leg power was also recognized as a predictor of physical performance. Together these two parameters explain 15% to 30% of physical performance. Force-velocity test may serve to predict disability and to design and to evaluate training rehabilitation programs. Moreover, present results give indication on the qualitative state of muscle, notably about the estimated fiber type distribution in leg extensor muscles.

References

Martin et al. (2000) J. Gerontol. Vol 55 : 311-316.

Rahmani et al. (2003) Br. J. Nutr. Vol 89 : 731-739.

Oral presentation (OP)

OP1-20 Psychology 3/5 - "Turin FG"

EFFECT OF IMAGINED MOVEMENT SPEED ON SUBSEQUENT MOTOR PERFORMANCE

Louis, M., Guillot, A., Collet, C.

C.R.I.S., Centre de Recherche et d'Innovation sur le Sport, Université Claude Bernard Lyon I - A.I.S.T.S. International Academy of Sports Science and Technology, Lausanne, France

Motor imagery (MI) is a valuable technique for improving performance in sport. MI should reflect in every respect, including speed, the motor action that athletes actually perform. Although actual and MI durations may be identical (Decety et al., 1989), times are often found to be under- or overestimated, due to individual and task-related factors (Guillot & Collet, 2005). However, performing MI of a sequential motor action at slow/ fast speed voluntarily (compared to a baseline test) was found to elicit a decrease/ increase in the actual movement speed during the post test (Boschker et al., 2000). Based on these findings, this study was designed to check whether there was any risks to have the athletes voluntarily change the speed of their MI and what effect would that have on the real task. The study consisted of 2 MI experiments. For the 1st one, 24 sport students imagined 2 series of body movements (upper & lower) by using together internal visual and kinaesthetic imagery. They were divided into 3 groups of 8 participants each. During the pre-test, each participant performed the sequences at an initial chosen speed. They were then asked to imagine the sequences during a retention interval (450 trials). One group mentally rehearsed them at a faster speed, while the second group imagined them at a slower speed. The control group performed a neutral task. The post-test was identical to the pre-test. The 2nd experiment was similar but included 21 black belt judokas doing 1 kata on both sides for 12 MI sessions (120 trials). For the 1st experiment, movement times for the control group did not change for both upper and lower body sequences ($p>.05$), while the fast group increased their actual times ($p<.01$). No difference was found for the slow group. In the 2nd experiment, the post test times analysis showed a strong effect of MI ($p<.001$). The actual times increased for the fast imagery group ($p<.001$) and reduced for the slow imagery group ($p<.001$). This study emphasized the strong effect of MI on the actual task speed. The increase or decrease of MI speed during the retention interval is seen by a change in actual times. This effect may also occur on a motor task that does not include locomotion (upper body sequence). The results also suggest a similar outcome for a highly automatic task, even in a sport skill where the duration is already very much fixed and controlled (judo). Therefore, these results prove that the control of MI speed is a very important aspect of mental training: since it is recommended to keep MI at the same speed as the real performance, to increase or decrease it consistently could have a negative and unexpected effect on the actual performance speed. By contrast, it could also have a positive effect if MI is combined with actual skill learning, to change movement duration.

Boschker MSJ, et. al (2000) J Sports Sci 18, 593-603

Decety J, et. al (1989) Behav Brain Res, 42, 1-5

Guillot A & Collet C (2005) J Mot Behav, 37, 1, 10-20.

PERCEIVED SUPPORT, COGNITIVE APPRAISAL, AND PERFORMANCE

Freeman, P., Rees, T.

University of Exeter, United Kingdom

Although Sarason, Sarason, and Pierce (1990) proposed that social support might affect sports performance, there have been no explicit attempts to test this proposal upon objective performance outcome. The beneficial effects of social support are well established in general social psychology, but the specific mechanisms through which it operates are poorly understood (Saltzman & Holahan, 2002). This

study addressed these issues, and examined if cognitive appraisal is one mechanism through which perceived support exerts beneficial effects upon performance. Two path models were tested that examined if perceived support influenced challenge and threat appraisals directly, or indirectly through altering perceived situational control. In both models, it was hypothesized that challenge appraisals would be associated with better performance, and threat appraisals with poorer performance. A high-performance sample of 118 male golfers, mean age 25.4 years (SD 6.5), completed measures of perceived support, challenge, threat, and situational control before competitions. After the competitions, performance outcome was recorded. Observed variable path analysis found an excellent fit to two models. In model 1, participants with high levels of perceived support appraised the upcoming competition as more of a challenge (gamma = .64, t = 9.00) and less of a threat (gamma = -.55, t = -7.08). Challenge appraisals were associated with better performance (beta = -.20, t = -2.08) and threat appraisals with poorer performance (beta = .19, t = 2.06). Model 1 accounted for 10.2% of the variance in performance. In model 2, participants with high levels of perceived support appraised the upcoming competition as more of a challenge (gamma = .37, t = 5.03), less of a threat (gamma = -.45, t = -4.91), and had higher situational control (gamma = .56, t = 7.25). Higher situational control was associated with higher levels of challenge appraisals (beta = .50, t = 6.82), but not with threat appraisals (beta = -.17, t = -1.86). Challenge appraisals were associated with better performance (beta = -.20, t = -2.08) and threat appraisals with poorer performance (beta = .19, t = 2.06). Model 2 accounted for 10.6% of the variance in performance. The results suggest that cognitive appraisal may be one mechanism through which perceived support influences performance. Perceived support was associated directly with both challenge and threat appraisals but also indirectly with challenge appraisals through influencing situational control. Increasing perceived support may therefore influence how an athlete appraises competitive situations and lead to improve performance.

Sarason, I. G., Sarason, B. R., & Pierce, G. R. (1990). Social support, personality and performance. Journal of Applied Sport Psychology, 2, 117-127.

Saltzman, K. M., & Holahan, C. J. (2002). Social support, self-efficacy, and depressive symptoms: An integrative model. Journal of Consulting and Clinical Psychology, 21, 309-322.

MOOD CHANGES AS A RELIABLE INDICATOR OF PHYSICAL STRESS AND OVERTRAINING

Birrer, D., Seiler, R., Baume, N.

Swiss Federal Institute of Sports Magglingen, Switzerland

Introduction: Disturbed mood states have been consistently described as sensitive markers of overtraining. Nevertheless, sport scientists have not clearly established a model to identify the early stages of overtraining. The majority of studies have used a global mood score. However, various mood factors differ substantially in their function and in their reactivity to the training load. This presentation will highlight the reaction of different mood factors to training load and different stages in the development of overtraining syndrome (OTS). Data will be presented from 3 different studies. Method and results of study 1: 6 elite male road cyclists using SRM power cranks 2 weeks prior and during a six day stage race were daily monitored with a mood measurement (BFS; Abele-Brehm & Brehm, 1986). Data was analysed on a single case basis using the cross correlation function. All 6 athletes showed a significant cross correlation between the training load and the mood states fatigue and positive activation at a lag of 1 day. No strong correlations were found for the other mood factors. Method and results of study 2: 30 male volunteers participated in a double blind study with the controlled administration of oral doses of placebo (n=10), 19-norandrostenedione (n=10) and testosterone undecanoate (n=10). During one month the volunteers underwent a rigorous endurance training program. The POMS was administered 3 times during this period. Repeated ANOVA measurements and discriminant analysis were calculated to identify mood development over time and predict group membership from mood states. Significant differences between the 3 groups were found in the mood factors vigour and fatigue. A direct discriminant function analysis matched 88% of the participants to the respective group (64% in the cross validation condition). Method and results of study 3: 35 athletes suspected of overtraining were administered the BFS. From performance analyses 13 of the athletes were diagnosed as overtrained and 22 as overreached. 26 athletes in a normal training condition administered the BFS as a control group. Data was analysed using discriminant function analysis in order to establish an instrument for future diagnosis of overtraining and to explore the role of the different mood factors in the development of OTS. The direct discriminant function ensured that all cases were correctly assigned to one of the 3 groups (1 mismatch in the cross validation condition). The mood factor depressed mood had the highest weight in the standardized canonical discriminant function followed by positive activation, fatigue and agitation. Discussion: Changes in the mood factors positive activation (vigour in POMS) and fatigue appear to be inextricably linked to the training load. Changes in these factors show an inability to cope with physical stress. In certain situations more psychologically related mood states (e.g., depressed mood, agitation, calmness) may be related to overtraining.

VISUAL SEARCH STRATEGY AND DECISION-MAKING SKILL IN YOUTH SOCCER: A CONSTRAINTS-BASED APPROACH

Vaeyens, R. 1, Lenoir, M. 1, Williams, A.M. 2, Philippaerts, R.M. 1

1 Ghent University, 2 Liverpool John Moores University, Belgium

It is widely accepted that perceptual-cognitive skills play a crucial role in sports performance (Ward & Williams, 2003). Skilled athletes develop sophisticated knowledge structures enabling them to pick up and interpret perceptual information more effectively than their less skilled counterparts, resulting in superior anticipation skill. Although these knowledge structures help guide the search for relevant visual information, researchers have recently highlighted how task, environmental and organismic constraints also shape the emergent behaviour (Williams et al., 2004). The aim in this paper is to examine differences in visual search strategy and decision-making skill as a function of task constraints in soccer.

Participants included 87 youth soccer players (13.0-15.8 yrs) varying in skill and experience (elite, sub-elite, regional level and non-soccer group). We used 33 realistic film simulations involving 2 vs. 1, 3 vs. 1, 3 vs. 2, 4 vs. 3, and 5 vs. 3 offensive situations. Performance was assessed using movement-based response measures (decision time and response accuracy) and an eye movement registration technique. As predicted, an increase in the number of players presented on screen and a higher relative proportion of defensive to offensive players increased the demands of the task, resulting in slower decision times and lower response accuracy scores ($p < .001$). Significant differences in visual search behaviour were observed between the 2 vs. 1 and 3 vs. 1 viewing conditions on the one hand and the 3 vs. 2, 4 vs. 3 and 5 vs. 3 conditions on the other. The first group of conditions is characterised by a low(er) number of fixations combined with a long(er) mean fixation duration, while more fixations of shorter duration are apparent in the latter group of simulations. Moreover, the mean fixation duration in the 3 vs. 2 condition was significantly higher than in the 4 vs. 3 and 5 vs. 3 conditions, respectively. Significant differences in performance were observed between players and non-players and across groups of soccer players matched on playing experience but differing in playing level.

Playing experience, skill level and the unique task constraints, expressed by the number of players and the relative proportion of offensive and defensive players, determined the observed search behaviour and processing requirements imposed on players in dynamic offensive team simulations. Such measures may have practical utility for the testing and training in soccer. The results provide empirical evidence supporting a constraints-based explanation of visual search behaviour.

Ward, P., & Williams, A. M. (2003). Perceptual and cognitive skill development in soccer: The multidimensional nature of expert performance. Journal of Sport & Exercise Psychology, 25(1), 93-111.

Williams, A. M., Janelle, C. M., & Davids, K. (2004). Constraints on the Search for visual information in sport. International Journal of Sport and Exercise Psychology, 2(3), 301-318.

PATTERNS IN THE DEVELOPMENT OF ELITE PERFORMANCE IN ACROBATIC SPORT

Hauw, D., Ramdani, S., Durand, M.

JE 2416 GP3S, University of Montpellier 1, France

Introduction

The aim of this study was to analyse the activity of elite athletes engaged in intensive training and in international competitions in trampolining, using a situated analysis (Clancey, 1998, Hauw & Durand, 2004). We expected to identify different types of activity underlying patterns of performance development trajectories. These patterns corresponded to macroscopic processes that athletes deployed to find the best organisation for their performance. In such acrobatic sports, athletes' activity is particularly dedicated to designing the best adjustment between the level of performance (i.e., the difficulty like the choice of number of twists or somersaults) and the way to perform it (i.e., the execution). Thus, each performance could be characterised by a particular coupling between an action that athletes perform and the situation defined by it. In order to qualify these coupling, we used a series of indicators that abstracted acrobatic performance.

Method

88 exercises performed by six elite athletes of the French national team during international competitions between 1999 and 2004 were recorded. Using the dart trainer software, we collected for each exercise (a) the number of somersaults with the adopted position, (b) the number of twists, (c) the flight time per move (sec) and its index of variation between each move for each exercise, (d) the sum of the amplitude of the horizontal distance travelled for each move on the trampoline bed. The means of these indicators for each athlete during a season were used to describe their developmental trajectories of performance and to qualify the evolution of their action-situation coupling.

Results

Three developmental patterns of activity were identified. « Building new action-situation coupling to attain the world's top-level performances » corresponded to an increasing score of each performance indicator season after season. « Optimising action-situation coupling » was characterised by contradictory evolutions of performance indicators, suggesting an activity of research into the correct steady state between action and situation. « Advancement – wander about » was characterised by wide and erratic variations of the performance indicators, suggesting a particular activity of research that does not lead to a satisfactory state.

Discussion

These results revealed different types of elite athletes' activity when engaged in the same intensive training. These activities can be described as the construction of new action and situation possibilities or as the deployment of better modalities of interaction with the situations that favour performance (Reed, 1993). Athletes' developmental trajectories also show differences in terms of paths, suggesting that their activities are based on a high level of undetermined results. Further research should be deployed in order to know how these developmental trajectories could be controlled and oriented toward performance enhancement.

Friday, 7th July 2006

08:15 - 09:30

Plenary session (PLS)

PLS2 High-Tech in Sport - "Athene"

SPORT: A UNIQUE IMPLEMENTATION DYNAMIC FOR TECHNOLOGIES

Manson, J.-A., Bourban, P.-E.

Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland

Sport: a unique implementation dynamic for technologies
Jan-Anders E. Månson, Pierre-Etienne Bourban
Ecole Polytechnique Fédérale de Lausanne (EPFL)
Vice présidence pour l'innovation et la valorisation (VPIV)
CH-1015 Lausanne, Switzerland

Athlete seeks the ultimate performance out of his own body, his equipment and his outfit while taking a maximum benefit from his skills and physical ability.

For this an equipment and outfit does not just need to be made of materials with the most extreme physical properties but it must also allow to transmit the "right" feeling and touch between himself and his equipment. Thus, in most cases the material has to possess a unique combination of structural and functional capabilities. Today these unique structural performances and functions are widely integrated in many sport equipments. For examples the latest tennis rackets and skies integrates these novel materials to reach the otherwise impossible combination of high stiffness, low weight and tuned damping performance.

Furthermore, the improvement of performance, perception, skill acquisition, comfort, safety and injury prediction, requires synergy between life sciences and engineering sciences. For example, by a more efficient measurement and control of sensations, body motion and by studying the influence of equipment and environment on performance or potential injury it will possible to propose technology for an improved and optimal adequacy between body, environment and performance. This is the objective of the current research programmes such as the Sport and Rehabilitation Engineering programme at EPFL (http://sre.epfl.ch) grouping key competences in cognitive assessment, psychophysics, tissue engineering, smart materials/structures, bio-sensors, multi-task control, simulation and imaging.

Technologies developed for professional sport will also impact our life quality, indeed they are in many cases established on the same generic platform as research on support system for any valid or disabled persons.

There are no doubts that the sports industry plays an important role during the implementation of a new technology to the market. In comparison to other industrial branches such as aerospace and automotive the speed of the market changes in sport equipments and outfits are very high. This puts enormous time constrains on technology adaptation and market implementation. It is well known you cannot win America's Cup or Formula 1 without the very latest advanced technology. Thus, it is not surprising that sport during last decade has increasingly positioned itself as one of the driver in research. However, it is vital to seek synergies in research and implementation strategies in order to gain maximum experience from each other's unique experience about design, material performance, durability and manufacturing concepts.

Finally, it is clearly demonstrated in recent years that sport does not just take increased use of advanced technologies it also shows an increased importance for the public economy.

TECHNOLOGY IN SPORT - ETHICAL CHALLENGES AND POSSIBLE SOLUTIONS

Loland, S.

The Norwegian School of Sport Sciences, Norway

In the paper I propose a categorization of technology in sport and present what I find to be the most significant challenges to the values of sport posed by technology.

Technology is understood as human made means to reach human interests and goals. Technology in sport, then, is seen to be human made means to reach human interests and goals in sport or related to sport.

Such technologies may have constitutive functions (skis and rackets are necessary means for skiing and tennis); they may serve goals of health and non-harm (shock-absorbing soles in shoes, and helmets and protection gear in ice hockey); and/or they may be developed with performance-enhancing intentions (aerodynamic suits in speed skating, hypoxic chambers in endurance sports). I argue that technologies intended to enhance performance are those that pose the most significant challenges to sport values.

Performance-enhancing technologies can be distinguished in at least four categories. I distinguish between body techniques (such as the Fosbury flop); sport equipment used by athletes in the performance of their sport (skis, rackets); training technologies used by athletes to prepare for performance (thread mills and strength training machines); and technologies administered to athletes outside of competition and that do not require athletic effort (advanced diet regimes, hypoxic chambers, drugs). Innovation in body techniques are generally to be admired and are ethically unproblematic. Innovation in sport equipment and training technologies usually raises questions of fairness and equality. Expert-administered technologies are the most problematic category as they often raise radical challenges to established ideas of sport performance and sport ethics.

In the final section, I propose a casuistic methodology of how deal with the ethical challenges of expert-administered technologies by examining a continuum ranging from rather unproblematic diet regimes in the one end, via hypoxic chambers, to performance-enhancing drugs and genetic technologies in the other end.

09:40 - 11:10

Invited symposium (IS)

IS2-01 Alinghi: sport as driving force for people and technology (sponsored by UBS) - "Athene"

ALINGHI AS A TEAM

Karcher, C.

Alinghi, Spain

Alinghi raced to a staggering 5-0 victory against Team New Zealand on March 2, 2003, winning the most prestigious yachting trophy of all time: the America's Cup. They guaranteed themselves a place in the history books by being the first team since the inaugural race in 1851 to return the Auld Mug to Europe and on top of that for being the first team to win the Cup on a first attempt.

Alinghi's vision is "to win the America's Cup, while earning respect and recognition as a world class sports team as well as sharing our passion". And the team is well-positioned to mount a fearless defense of its title in 2007.

A summary of the steps leading up to the next America's Cup will be presented, illustrating the human and technical challenges of the competition. The Swiss-based team is made up of 21 different nationalities, all these individuals focusing on the same challenging goal. This efficient Team will depend upon the collective experience of all its members as it prepares for and faces the competition.

Technology behind the Alinghi America's cup Team

It is well recognized that the America's Cup will not be won with old technology. Thus it is not surprising that this competition has increasingly positioned itself as a driving force for research over the last decade. From the initial design of the boat up through performance analysis in race conditions, the technology used must be cutting-edge for the team to have a shot at the trophy.

To design and build a sailing boat that respects the constraining class regulation and still optimizes performance is a continual challenge. An overview of the most important constraints as well as how these rules affect design and construction of the most critical parts of the boat will be presented, illustrating the importance of continuously integrating the latest technological breakthroughs. Alinghi relies on the experience and scientific knowledge of its Design Team, as they gather and combine scientific data from research and feedback from the sailors in a unique and high-performance boat.

It is vital to seek synergy in research and implementation strategies in order to benefit fully from the unique experience of design, materials performance, durability and manufacturing that individual disciplines can contribute. Many partners are involved in the numerous steps from the concept of a new boat to its launch in competition.

TECHNOLOGY BEHIND THE ALINGHI AMERICA'S CUP TEAM

Simmer, G.

Team Alinghi, Spain

It is well recognized that the America's Cup will not be won with old technology. Thus it is not surprising that this competition has increasingly positioned itself as a driving force for research over the last decade. From the initial design of the boat up through performance analysis in race conditions, the technology used must be cutting-edge for the team to have a shot at the trophy.

To design and build a sailing boat that respects the constraining class regulation and still optimizes performance is a continual challenge. An overview of the most important constraints as well as how these rules affect design and construction of the most critical parts of the boat will be presented, illustrating the importance of continuously integrating the latest technological breakthroughs. Alinghi relies on the experience and scientific knowledge of its Design Team, as they gather and combine scientific data from research and feedback from the sailors in a unique and high-performance boat.

It is vital to seek synergy in research and implementation strategies in order to benefit fully from the unique experience of design, materials performance, durability and manufacturing that individual disciplines can contribute. Many partners are involved in the numerous steps from the concept of a new boat to its launch in competition.

THE ROLE OF EPFL AS SCIENTIFIC ADVISOR FOR ALINGHI

Vuilliomenet, P., Manson, J.-A.

Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland

The Ecole Polytechnique Fédérale de Lausanne (EPFL) collaborated with Alinghi prior to its 2003 America's Cup victory, and this collaboration generated a strong relationship between the Alinghi Design Team and EPFL researchers. Based on this experience, the number of research topics has been increased for the 2007 campaign, leading to a massive effort in terms of scientific research and implementation strategy of new technologies.

The Scientific Advisor acts as an extension of Alinghi Design Team. Research is carried out in close collaboration with the designers of Alinghi, thus ensuring that the technological and scientific advances developed in the university can be adapted to and implemented in the very specific domain of an America's Cup boat.

The hull of Alinghi is made of a rigid, strong and incredibly light composite material referred to as a "sandwich". The production process for this composite sandwich involves several steps and variable factors that must be optimized for reliability and performance. When combined with optical fiber sensors, these composites become "intelligent."

Computational Fluid and Structural Dynamics is a mathematical approach that aims at simulating a wide range of flow conditions. Both the aerodynamic flow (i.e. the wind) around the sails and the hydrodynamic (i.e. the water) flow around the hull and appendages are considered in these simulations.

One way to improve the design of sails is to use video imaging techniques to analyze how they behave under actual sailing conditions and to extract data on how the sail, and ultimately the boat, is responding to physical conditions.

Another project aims to help the navigator by making sailing as much a science as possible. Researchers are developing a mathematical model that will be able to provide the navigator with a rational method for planning out the fastest possible course, even in the face of variable weather conditions.

It is always a challenge for a University to undertake projects of this nature and scope, because they combine long-term goals with very short term needs and decisions. A split-vision approach is needed, and this is both demanding and challenging for the partners when designing at the extreme limit. Finally, it has clearly been demonstrated in recent years that sport not only makes increasing use of advanced technologies but is also a fabulous driving force that motivates students and researchers alike.

Invited symposium (IS)

IS2-02 Public health approaches to physical activity promotion - "Innsbruck"

PRINCIPLES OF PHYSICAL ACTIVITY PROMOTION IN PUBLIC HEALTH, THE IDEA OF HEPA EUROPE

Racioppi, F., IT

Without abstract submission.

ENVIRONMENT AND PHYSICAL ACTIVITY

van Poppel, M., den Hertog, F., van Mechelen, W.

VU University Medical Center, Netherlands

The relationship between the built environment and physical activity has received much attention in the past few years. In this presentation, a short overview of will be given of the insights gained so far. This will be put into the context of the European situation.

Furthermore, the results of a study conducted in four residential districts in Amsterdam will be presented. In this study, about 440 adult residents filled out a questionnaire about their perceived living environment, determinants of physical activity (attitude, social support and self-efficacy), and their actual physical activity behaviour. Furthermore, their height and weight were measured. Objective data on characteristics of the built environment in the four residential areas were gathered as well. From preliminary results, it appeared that the number of parking places in combination with the number of facilities (shops, restaurants, etc) have an important influence on walking and cycling. Active transport was used more often in districts with few parking places and many facilities. More results from this study will be presented. Furthermore, the relative contributions of environmental characteristics and individual factors to physical activity levels will be addressed.

HEALTH ECONOMIC CONSEQUENCES OF PHYSICAL ACTIVITY

Sørensen, J.B.

University of Southern Denmark, Denmark

Although there is ample evidence of the health benefits from physical activity, the health economic consequences have rarely been documented. This presentation will describe an analysis that was undertaken for the Danish National Board of Health. The analysis was based on a cohort study of 10.000 people who had indicated their level of leisure time physical activity. The cohort had been followed for an average of 25 years with respect to both hospital-treated illness (diagnosis) and mortality. A health economic model was developed to describe the differences in life expectancy and quality-adjusted life-years (QALYs) between individuals who were physically active and those who were physically inactive. The consequent use of health care resources was assessed in terms of gains in productivity and additional future consumption.

The model estimated that a 30-year-old physically inactive male would gain an additional 2.8 life years if he became physically active. A woman would gain 4.6 life years. Furthermore, the man would gain 2.4 years without illness and the woman 2.7 years. They would gain 3.2 and 4.7 QALYs, respectively, by becoming more physically active.

The net present value of increased production was estimated at 800-1200 Euros using the friction method and 8.667-10.400 Euros using the human capital method. The net present value of reduced consumption of health care resources due to better health was estimated at 3.600-3.860 Euros and should be off-set by the increased use of health care due to the life-years gained estimated at 2.400-3.200 Euros. In a sensitivity analysis these numbers were re-estimated using different modelling assumptions.

These health economic data provide a good basis for conducting policy scenario analysis and analyzing cost-effectiveness of interventions aimed at increasing the level of physical activity in sub-populations. The application of cost-effectiveness analysis will be illustrated based on preliminary data from an evaluation of a Danish intervention provided to elderly people. Based on the numbers of participants who start, leave, and complete the training programme the model estimates the intervention cost, the health benefits and the future consumption of health care resources. Results from such cost-effectiveness analyses can be used as a basis for assessing "value for money" and considering suitable target groups for the interventions.

SPORTS PARTICIPATION IN THE UK: THEORETICAL REVIEW AND EMPIRICAL ANALYSIS

Downward, P., Riordan, J.

Loughborough University, United Kingdom

Raising sports participation is a public policy priority. Appropriate policy requires understanding the mechanisms that promote participation. A variety of theoretical perspectives explaining participation exist, which draw upon economics, sociology and psychology (Downward, 2004). Drawing upon critical realist philosophy, this paper reappraises these theoretical perspectives and produces a synthetic account of participation in which cause reflects the interaction of human agents and social structures.

An important implication of this theoretical and conceptual review is that, for empirical analysis, focus shifts from either individual decisions, or social constraints but, instead, their interaction and suggests the need to explore causes in society 'as a property of complex and contingent mechanisms in reality…Can we get anywhere with cause if we think in this way? …by exploring and comparing cases …we might be able to say something about causes.' (Byrne, 2003 pp105-106).

This approach to empirical work is undertaken using data from the 2002 General Household Survey (GHS) that records the decision of 14, 819 adults aged 16 or over to participate or not in the last 4 weeks in 40 sports. First, a cluster analysis is undertaken to isolate groups of cases of similar behaviour of respondents using a large array of variables measuring individual and social, economic and sporting characteristics. Socially defined lifestyles are identified. 3 'fuzzy' clusters identify those with a predisposition to participating in leisure activities; those mostly in recreational activities and those in team sports or specialist activities. Logistic regression analysis is applied to each cluster to explore the individual's decision to participate. The data are weighted to account for responses being gathered within households and inference proceeds using Huber-White 'robust' standard errors.

It is argued that the results support the agency-structure model of participation. For example it is shown that there is strong evidence of interdependent demands, but distinct patterns of behaviour emerge. Whilst health appears to be important for participation in any sport (anysport) and walking generally, this is not the case for the family oriented activities of swimming, cycling and football or competitive sports. In contrast it is significant for activities such as keep-fit, weight-training and jogging. The paper thus concludes by examining the policy ramifications of these findings in connection with policy targets identified for the UK by Sport England (2004).

References:

Byrne, D. (2003) Interpreting Quantitative Data, London: Sage.

Downward, P.M. (2004) Assessing Neoclassical Microeconomic Theory via Leisure Demand: A Post Keynesian Perspective, Journal of Post Keynesian Economics, Vol 26, No 3, pp371-395.

Sport England (2004) The Framework for Sport in England.

Invited symposium (IS)

IS2-03 High altitude medicine EFSM exchange symposia - "St. Moritz"

HIGH ALTITUDE MEDICINE: CLINICAL OVERVIEW

Bärtsch, P.

University Hospital Heidelberg, Germany

Acute mountain sickness (AMS), high altitude cerebral edema (HACE) and high altitude pulmonary edema (HAPE) are illnesses that occur in otherwise healthy mountaineers during the first days after rapid ascent to high altitude. Headache, nausea, dizziness and peripheral edema are the most frequent symptoms of acute mountain sickness (AMS). They occur with a latency of several hours after exposure to altitudes ≥ 2500 m. With adequate behaviour/treatment they normally resolve spontaneously within 1 or 2 days. They can, however, particularly with further ascent despite symptoms of AMS, progress to high altitude cerebral edema (HACE) which may, if untreated, lead to death within 1 or 2 days. The prevalence of AMS increases with altitude and with the rate of ascent. It also depends on the degree of pre-acclimatization and individual susceptibility. In most cases, AMS can be prevented by slow ascent or by acetazolamide 2x250 mg daily. Treatment consists of a day of rest with mild AMS and of descent with more severe AMS. In advanced cases, supplemental oxygen and/or dexamethasone (4-8 mg every 6 hours) is necessary to enable descent. High altitude pulmonary edema (HAPE) is a non-cardiogenic pulmonary edema that occurs after rapid ascent of non-acclimatized individuals to altitudes ≥ 3000 m. The prevalence is about 7 % in an unselected population ascending rapidly to an altitude of 4500 m and it increases to 60 – 70 % in individuals susceptible to HAPE. It is a hydrostatic pulmonary edema caused by an excessive rise of the pressure in pulmonary arteries and capillaries. Slow ascent is most effective for prevention and supplemental oxygen and/or rapid descent with early symptoms of HAPE are the treatment of choice. If these measures are not immediately possible, pulmonary vasodilators such as nifedipine (3 x 20 mg/day) or tadalafil (2x10 mg/day) can be used for prevention or initial treatment until descent is possible.

A ROLE FOR REACTIVE OXYGEN SPECIES IN THE PATHOPHYSIOLOGY OF HIGH ALTITUDE ILLNESS?

Bailey, D., Knauth, M., Bärtsch, P.

University of Glamorgan, University of Goettingen, University of Heidelberg, United Kingdom

Background: High-altitude cerebral edema (HACE) has been identified as predominantly vasogenic in origin thus implying some degree of disruption to the blood-brain barrier (BBB). Since HACE is considered the end-stage of acute mountain sickness (AMS), it is plausible that headache and nausea, its principle symptoms, may be caused by mild oedema subsequent to barrier failure. What causes barrier disruption is not presently clear despite widespread support for the "mechanical hypothesis" implicating overperfusion of cerebral capillaries analogous to autoregulatory breakthrough in hypertensive encephalopathy. However, emerging evidence suggests that free radicals may play a complementary role in what is rapidly evolving as the "chemical hypothesis" of AMS. The current presentation will describe a series of novel experiments designed to examine the source and mechanisms of free radical generation in hypoxia and subsequent implications for barrier function and susceptibility to AMS.

Experimental paradigms: We have employed various strategies designed to challenge redox homeostasis and barrier function. The first paradigm involved the experimental induction of oxidative stress and barrier disruption "prior" to hypoxia (priming strategy). Prior exposure to heat-stress and in a separate study, exercise-induced tissue damage, increased free radicals and BBB permeability confirmed as an increase in the electron paramagnetic resonance signal intensity of spin-trapped species and S100β respectively. Compared to the control trials, this paradigm increased susceptibility to AMS during subsequent exposure to hypoxia (8h at 12%O2). In the second paradigm, we tested the effects of antioxidant supplementation during an active ascent to terrestrial high-altitude (protective strategy). Compared to the placebo condition, antioxidants reduced free radical generation and susceptibility to AMS. The final paradigm combined T2 and diffusion weighted MRI with the direct measurement of free radicals in cerebrospinal fluid (CSF) following 18h passive exposure to 12%O2 (direct strategy). While AMS was not defined by any differences in barrier function or regional CSF concentration of free radicals, we did detect a selective increase in systemic oxidative stress. We also detected mild cytotoxic and to some extent, vasogenic oedema, independent of neuronal damage. This oedema may have contributed to the selective elevation in brain to intracranial volume ratio previously identified as an "anatomical risk factor" for AMS ("tight-fit" hypothesis).

Conclusions: These findings suggest that when combined with physical exercise, inspiratory hypoxia can compound oxidative stress, compromise barrier function and increase susceptibility to AMS. The pathophysiological significance of brain swelling in the setting of reduced intracranial reserve volume deserves critical consideration.

NO, THE KEY TO UNDERSTANDING THE PATHOPHYSIOLOGY OF HIGH ALTITUDE PULMONARY EDEMA

Scherrer, U., Sartori, C.

Botnar Center for Extreme Medicine, Switzerland

High-altitude pulmonary edema (HAPE) is a life-threatening condition occurring in predisposed, but otherwise healthy subjects, and, therefore, allows to study underlying mechanisms of pulmonary edema in humans, in the absence of confounding factors. Over the past decade, evidence has accumulated indicating that HAPE results from the conjunction of two major defects, augmented alveolar fluid flooding resulting from exaggerated hypoxic pulmonary hypertension on the one hand, and impaired alveolar fluid clearance related to defective respiratory transepithelial sodium transport on the other hand. Here, we will focus on the mechanisms underlying the exaggerated hypoxic pulmonary hypertension. We will provide experimental evidence for the hypothesis that an acquired and/or genetic defect of pulmonary vascular endothelial and respiratory epithelial nitric oxide synthesis and/or bioavailability may represent the central underlying defect predisposing HAPE-prone subjects to exaggerated hypoxic pulmonary vasoconstriction and alveolar fluid flooding. We will also review data based on this concept suggesting that pharmacological interventions designed to augment pulmonary nitric oxide bioavailability may be useful for the prevention of exaggerated hypoxic pulmonary hypertension and HAPE during high-altitude exposure in susceptible subjects.

Invited symposium (IS)

IS2-04 An Update of Female Athlete Triad (sponsored by Gatorade) - "Albertville"

ENERGY AVAILABILITY AND MENSTRUAL DYSFUNCTION

Manore, M.

Oregon State University, United States

This paper will review the scientific advances in the Female Athlete Triad (Triad) since the Triad was described in a position paper published by the American College of Sports Medicine (ACSM) in 1997. Initially the Triad was described as 3 inter-related clinical disorders (eating disorders, amenorrhea, and osteoporosis) observed in female athletes and other physically active girls and women. Since this first position paper, there has been much debate about the prevalence of the Triad and its underlying cause(s). Currently research indicates that low energy availability (e.g. not eating enough to match energy expenditure/needs and/or an eating disorder) is the primary underlying factor that initiates the Triad disorders. Low energy availability initiates a cascade of metabolic processes that suppress menstrual function, either completely (amenorrhea) or sporadically (e.g. oligomenorrhea, anovulation). The reduced availability of reproductive hormones, combined with high stress, high exercise training and low energy and nutrient intakes can negatively impact bone health and in extreme cases cause osteoporosis. We now know that the Triad might better be described as a spectrum that spans each of the components of the triad (low energy availability, menstrual function and bone strength) ranging between health and disease. Thus an individual athlete could present with different degrees of each of the disorders, depending on her diet and exercise habits. This paper will discuss in the energy availability issues related to the Triad and the resulting menstrual dysfunction. Currently there are no pharmacological agents that can adequately restore low bone mineral density in women with amenorrhea and/or disordered eating. The following two speakers will address eating disorders and bone health related to the Triad in detail and also discussion treatment and prevention. The new ACSM Position Stand on the Female Athlete Triad should be published in late 2006 in Medicine and Science in Sport and Exercise (MSSE).

References:

1. Beals KA, Manore MM. Disorders of the female athlete triad among collegiate athletes. Int. J. Sport Nutr. Exerc. Metab. 12(3):281-294, 2002.

2. De Souza MJ, Miller BE, Loucks AB, et al. High frequency of luteal phase deficiency and anovulation in recreational women runners: blunted elevation in follicle-stimulating hormone observed during luteal-follicular transition. J. Clin. Endocrinol. Metab. 83:4220-4232, 1998.

3. Loucks AB, Thuma JK. Luteinizing hormone pulsatility is disrupted at a threshold of energy availability in regularly menstruating women. J. Clin. Endocrinol. Metab. 88(1):297-311, 2003.

4. Manore MM. Dietary recommendations and athletic menstrual dysfunction. Sports Med. 32:887-901, 2002.

DISORDERED EATING IN ATHLETES

Sundgot-Borgen, J.

The Norwegian School of sports science, Norway

Jorunn Sundgot-Borgen

Disordered Eating in Athletes

There is a continuum model of disordered eating (DE) ranging from abnormal eating behaviours to clinical eating disorders (EDs) such as anorexia nervosa and bulimia nervosa. Athletes with DE often attempt to lose weight or body fat by inducing a negative energy balance and or using a wide range of DE practices. Negative energy balance and energy drain occur for female athletes when the energy consumed is insufficient to cover the energy costs of daily living, exercise training and competition, building and repair of muscle tissue, menstrual function, and any additional energy costs related to life stressors, such as illness or psychological stress. DE among athletes must go beyond focusing on those who meet formal diagnostic criteria for an ED, and should include athletes who are in a negative energy balance, engage in unhealthy weight control practices that have clinical significance and that can severely compromise health and performance. Energy deficiency and DE practices impair health and physical performance. Problems result from depletion of muscle glycogen stores, dehydration, and loss of muscle mass, hypoglycemia, electrolyte abnormalities, anemia, menstrual dysfunction and loss of bone mass. Problems associated with binging and purging are also depressive symptoms, low self-esteem and anxiety. Studies have suggested a higher frequency of eating problems in athletes competing in leanness sports compared to athletes in sports focusing less on this and non athletes.

To prevent DE and EDs, the athletes have to know and practice healthy eating and make sure the energy intake cover her energy needs. Also, the team staff and parents must be able to recognize the physical symptoms and psychological characteristics indicating "at risk" for or clinical EDs.

References:

1. Beals KA, Manore MM. Disorders of the female athlete triad among collegiate athletes. Int. J. Sport Nutr. Exerc. Metab. 12(3):281-294, 2002.

2. Otis CL, Drinkwater B, Johnson MD et al. American College of Sports Medicine Position Stand on the Female Athlete Triad. Med. Sci. Sports Exerc. 29(5):i-ix, 1997.

3. Sundgot-Borgen J, Torstveit MK. Prevalence of Eating Disorders in Elite Athletes is higher than in the General Population. Clinical Journal of Sport Medicine 14(1): 25-32, 2004.

BONE HEALTH

Meyer, N.L., Manore, M., Sundgot-Borgen, J.

The Orthopedic Specialty Hospital, United States

Female Athlete Triad Update: Bone Health

Bone strength reflects the integration of bone mineral density (BMD) and bone quality. Effects on bone strength are both indirect via hypoestrogenism and direct through substrate and metabolic hormone alterations under the condition of low energy availability. Low energy availability and subsequent reduced bone formation, and estrogen deficiency associated with amenorrhea, lead to low bone mass. Low bone mass in young athletes should not be expected, as BMD is generally 5-15% higher in athletes compared with non-athletes in the absence of menstrual dysfunction. Although there are no clear signs of low bone mass other than recurring stress fractures, an athlete who has experienced amenorrhea, had multiple occurrences of oligomenorrhea, and/or has had several stress fractures may indicate compromised bone mass. The preferred method for the assessment of bone mass is dual energy x-raw absorptiometry. The interpretation of the results is based on the normal distribution of BMD among young normal Caucasian women. According to the International Society of Clinical Densitometry, BMD results of premenopausal women, and particularly those younger than 20 years of age, should be viewed using Z-scores (average scores of healthy women of their own age) rather than T-scores (average scores of healthy young women). T-scores are used by the World Health Organization to determine risk for osteoporosis in post-menopausal women. Although the criteria for risk classification in premenopausal women vary slightly among organizations, it is generally accepted that in the young female athlete, a Z-score below -1.0 should be of concern and initiate referral to treatment. To be diagnosed with osteoporosis, a female athlete needs to present with low BMD in combination with hypoestrogenism, nutritional deficiencies, stress fractures and/or other clinical risk factors for fracture.

Treatment and Prevention

Treatment of low bone mass in an athlete with menstrual dysfunction should occur primarily through the restoration of energy balance, using a team approach (physician, sports dietitian, psychologist). Triad prevention strategies should include screening, rapid intervention in case of early signs, and education targeting athletes, parents, and coaches.

References:

1. Ilhe, R. and Loucks, A.B. Dose-response relationships between energy availability and bone turnover in young exercising women. J Bone Miner Res. 19:1231-1240, 2004.

2. International Olympic Committee Medical Commission. Position Stand on The Female Athlete Triad, 2006. http://multimedia.olympic.org/pdf/en_report_917.pdf.

3. Leib, E.S., Lewiecki, E.M., Binkley, N., and Hamdy, R.C. Official positions of the International Society for Clinical Densitometry. J Clin Densitom. 7:1-6, 2004.

4. World Health Organization. Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. Geneva: WHO, 1994.

TREATMENT AND PREVENTION

Meyer, N.L., US

Without abstract submission.

Invited symposium (IS)

IS2-05 Testing of athletes - waste or value - "Berlin ABC"

AIMS AND LIMITS OF TESTING IN (ENDURANCE) SPORTS

Hartmann, U.

Faculty of Sport Science, Germany

It is assumed that for each sport and discipline the performance limiting factors are well known, that an exact demand profile is established and also a plan of a performance build up is existent. But mostly phenomenological descriptions of the performance demand exist: p.e. the description of a 1000m competitive race is mainly done by terms from training methodology and very rarely from physiology. Another example is the (wrong) opinion, that high lactate values attest a high anaerobic "capacity". - Those phenomenological based assumptions lead to unique views and self fulfilling opinions in test interpretation and training methodology. Under the aspect of cyclization and periodization they have an important and unlucky influence to training schedules and -programs. For a differentiate examination and interpretation for endurance performance tests and testing the following (practical) recommendations for a test evaluation could be given:

- Competition simulation test to acquire "sport specific necessities"; this test is in accordance with the structure and duration of the sport specific competition load. It is to determine the sport specific performance and its individual limits.

- Determination of the "maximal oxidative" (aerobic) performance (VO2max test); this test part contains of multiple steps, each with a short duration and a rapid increase of the load (vita max test) to estimate the real and absolute VO2max.
- Determination of the "maximal glycolytic" (anaerobic) performance (estimation of lactate formation rate; (VLAmax)); the test is characterised by a short duration, a supramaximal load for a very short time (5–10 s) for estimating the VLAmax.
- Determination of the endurance performance ability ("endurance capacity"); long duration of each step (minimum 5 min, if possible even longer) and a small increase of the load; aim of this test part is to estimate that what is called "endurance" or those metabolic conditions which are close to the metabolic „steady state / maxLass" conditions.
- If possible a computer based simulation for interpretation of the given test results should be done.

Many of the (common) laboratory test procedures and the way how they are used are partly or in total not fulfilling the basic quality criteria in performance testing! The „simple" transfer of laboratory findings, as it is momentary existing in practice, is not very helpful and deserves an evaluation and sophisticated studies! But it would be necessary to give up the existing point of view and proceedings, after what by the help of a single (metabolic) test an abundance of questions according to the (correct) training load should be answered! Only as good as we feel up and as we are willing, to evaluate existing points of view in a critical way!

References

Heck H (1990): Hofmann, Schorndorf

Mader A (1994) in: Clasing D et al [eds.]: Stellenwert der Laktatbestimmung in der Leistungsdiagnostik. Fischer, Stuttgart, Jena, New-York: 133-152.

PSYCHOLOGICAL DIAGNOSTICS AND EVALUATION IN ELITE SPORTS

Amesberger, G.

University of Salzburg, Austria

Interventions in sport psychological programmes should be based on diagnostic information. Nevertheless the discussion on diagnostic processes highlighting the effect on interventions is not that comprehensive (Duda, 1998; Strauß & Tenenbaum, 2003;Tenenbaum & Strauß, 2006).

The presentation focuses different aspect of diagnostics, evaluation and ethical problems in testing and assessing.

There are four main reasons for diagnostics: (1) to efficiently and accurately asses the characteristics of athletes, (2) to create hypothesis about appropriate intervention methods (3) to measure the progress of behavioural changes and (4) to gather professional information for research, development and teaching (see Etzel et al., 1998, 425). Measurements in order to guide and evaluate sport psychological training will be discussed by examples from different projects:

- Anamnestic Interview
- Quantitative Questionnaires (mental skills, self-esteem, locus of control, mood, ...): Computerized psychological testing
- Objective tests (reaction time, concentration, tracking, peripheral awareness, anticipation, …)
- Biofeedback

One of these projects is "Challenge 2008": In order to prepare the Austrian soccer team for the European Championship 2008 about 40 players have been selected for additional individual training. Among other individual supports all players are psychologically tested and those how want, get supports in sport psychological training. Results and specific problems will be reported.

Another Project: Starting with 2006 in Austria all elite athletes sponsored by Top Sport Austria for sport psychological training take part in an evaluation project on the outcome of psychological training. The method of this evaluation will be presented and ethical problems of handling the results will be discussed. The interest of coaches in psychological diagnostics increased in resent years. But there are serious reasons for sport psychologists to be very carefully and to act professionally with diagnostic information in order to keep the athletes rights and dignity as a main goal of psychological ethic codes. In this case diagnostic and assessment are not means to find out the truth about the character of an athlete but to enhance the personal potentials.

References:

Duda, J.L. (Ed.). (1998). Advances in sport and exercise psychology measurement. Champaign, IL: Human Kinetics.

Etzel, E., Yura, M.T. & Perna, F. (1998). Ethics in assessment and testing in sport an d exercise psychology. In J.L. Duda, (Ed.).. Advances in sport and exercise psychology measurement. Champaign, IL: Human Kinetics. 423-432.

Strauß, B., & Tenenbaum, G. (Eds.) (2003). Diagnosis in sport psychology. International Journal of Sport and Exercise Psycholog, 1(1).

Tenenbaum, G. & Strauß, B. (Eds.). (2006). Themenheft: Diagnostik in der Sportpsychologie. Zeitschrift für Sportpsychologie. (1).

THE USE OF SUB-MAXIMAL AND MAXIMAL YO-YO INTERMITTENT ENDURANCE TESTS IN SOCCER

Krustrup, P., Mohr, M., Heiner-Møller, A., Krustrup, B., Poulsen, A., Bangsbo, J.

Institute of Exercise and Sport Sciences, Denmark

A series of recent studies have used the Yo-Yo intermittent endurance level 2 test (Yo-Yo IE2) in order to evaluate the intermittent exercise performance of male and female elite soccer players at different playing positions, competitive levels and seasonal periods. The maximal version of the Yo-Yo IE2 lasts for 4-25 min and consists of 2x20 m shuttles performed at gradually increasing speeds, interspersed by 5-s periods of recovery. In relation to playing position, Yo-Yo IE2 performance was observed to be better ($p<0.05$) for elite female midfield players (1656±121 (±SEM), n=16) than for goal keepers (775±182, n=4), defenders (1331±77, n=14) and attackers (1347±207, n=6). It has also been found that Yo-Yo IE2 performance varies markedly between competitive levels both for female and male players. Yo-Yo IE2 performance was 24% better ($p<0.05$) (1654±100, n=18) for the best than for the fourth best (1338±98, n=16) team in the Danish female top-league. The performance of recreational male players, sub-elite male players and Scandinavian elite male players was 834±55 m (n=35), 1551±101 m (n=14) and 2692±83 m (n=20), respectively. The test has also been used to study the effect of sub-elite and recreational soccer training. A group of untrained subjects improved ($p<0.05$) their Yo-Yo IE2 performance by 98% during a 6-month period with 2 weekly soccer training sessions (982±119 vs. 496±43 m, n=15). Likewise, a sub-elite male team improved ($p<0.05$) performance by 21% during a 2-month pre-seasonal preparation period (1551±101 vs. 1283±130 m, n=14). A sub-maximal version of the Yo-Yo IE2 test lasting 4 min (600 m, elite female players) or 6 min (920 m, elite male players) has recently been introduced. This test utilizes heart rate recordings during, and in recovery from, a given number of shuttles. A few studies have investigated the reproducibility and validity of the sub-maximal Yo-Yo IE2 test. In one study, heart rate was measured during two 6-min tests performed 3 days apart. The end-test heart rates were 164±5 and 165±5 b.p.m., respectively, with a CV value of 1.4%. A recent study showed that %HRmax after 4 and 6 min is correlated

with Yo-Yo IE2 test performance (r=0.80 and 0.75, respectively, p<0.05, n=19-32). For the Danish national male team, a significant correlation was observed between %HRmax after 6 min of the Yo-Yo IE2 test and the peak values for high intensity running performed by the midfielders in a 15-min (r=0.75, n=17) and 45-min period (0.77, n=11). Five weeks prior to Euro 2004, end-test HR of the Danish national team players (n=18) was 177±2 b.p.m, but decreased (p<0.05) to 173±2 b.p.m. after 2 weeks of intense training (n=18). Sixteen of 18 players had a decrease in end-test HR during this period. In summary, the maximal Yo-Yo IE2 test appear to be a sensitive tool to evaluate the intermittent-exercise performance of male and female soccer players at different playing positions, playing standards and in various seasonal periods. A sub-maximal version of the test may be used for frequent, non-exhaustive testing.

Oral presentation (OP)

OP2-01 Physiology 5/10 - "Oslo"

GREATER LEG LACTATE EFFLUX VERSUS PYRUVATE EFFLUX DURING STEADY-STATE CYCLING IN BOTH NORMOXIC AND HYPEROXIC CONDITIONS

Stellingwerff, T., LeBlanc, P.J., Hollidge, M.G., Heigenhauser, G.J., Spriet, L.L.

1 University of Guelph, 2 McMaster University 3 Brock University, Canada

During intense exercise it is believed that lactate is the major by-product of carbohydrate metabolism to leave the muscle. However, a recent study reported similar rates of net lactate and pyruvate efflux from leg muscles during cycling at 65% VO2peak. We examined this issue by measuring the major fates of pyruvate in leg muscle: 1) oxidation via pyruvate dehydrogenase (PDH), 2) reduction to muscle lactate, 3) lactate efflux, 4) pyruvate accumulation, and 5) pyruvate efflux. We also examined these five fates while subjects breathed both normoxic and hyperoxic air. Hyperoxia decreases muscle glycogenolysis, which results in decreased pyruvate and lactate production and decreased muscle lactate efflux. PURPOSE: To quantify the fates of muscle pyruvate and compare the rates of pyruvate and lactate efflux, during steady state cycling under normoxic and hyperoxic conditions. We hypothesized that; 1) lactate efflux would be greater than pyruvate efflux regardless of inspired O2 content, and 2) breathing 60% O2 would decrease pyruvate production leading to decreased pyruvate and lactate efflux as compared to 21% O2. METHODS: Seven active male subjects cycled for 40 min at 70% VO2peak on two occasions while breathing 21 or 60% O2. Arterial and femoral venous blood samples and blood flow measurements were obtained throughout each trial, and muscle biopsies were taken at rest and following 10, 20 and 40 min of exercise. RESULTS: On average, during normoxic exercise, we found a 4.7-fold greater rate of leg lactate efflux as compared to pyruvate efflux (4.7 ± 1.1 vs.1.0 ± 0.1 mmol/min/leg). During hyperoxic exercise, muscle glycogenolysis was reduced by 16% which translated into a significant 15% reduction in total pyruvate production (60%: 735 ± 85 vs. 21%: 870 ± 86 mmol/leg) and decreased pyruvate efflux over 40 min of cycling. Decreased pyruvate production with hyperoxia had no effect on pyruvate oxidation (PDH activity) (60%: 3.02 ± 0.50 vs. 21%: 3.03 ± 0.39 mmol/wet muscle/min) or muscle pyruvate accumulation, but decreased (P<0.05) muscle lactate accumulation by 22%. Leg lactate efflux was also reduced in hyperoxia but remained higher than pyruvate efflux (1.8 ± 1.0 vs.0.7 ± 0.1 mmol/min/leg), although the ratio of lactate to pyruvate efflux was decreased to 2.5. CONCLUSION: Contrary to a recent study, we found greater rates of lactate efflux, as compared to pyruvate efflux, regardless of inspired O2 content. A greater rate of pyruvate reduction to lactate and eventual lactate efflux out of contracting skeletal muscle, versus direct pyruvate efflux, may serve to maintain cytoplasmic redox state (NAD+/NADH) during exercise. Hyperoxia decreased total pyruvate and lactate production by 16 and 56% respectively. This larger decrease in lactate production vs. pyruvate production seemed to have a greater effect on decreasing lactate efflux, as there were relatively smaller decreases in pyruvate efflux during the hyperoxic trial.

CAFFEINE REDUCES EFFECTS OF HYPERTHERMIA IN CENTRAL FATIGUE DURING EXERCISE IN THE HEAT

Del Coso, J., Estevez, E., Baquero, R., Mora-Rodriguez, R.

Universidad de Castilla-La Mancha, Spain

Introduction

The combination of dehydration and hyperthermia induced by prolonged cycling in the heat reduce maximal knee extension force (2). The attenuation in maximal force production with hyperthermia is associated with a reduction in central activation drive (2). When hyperthermia is prevented by the ingestion of a carbohydrate electrolyte solution (CES) cycling power is longer maintained (1). Moreover, caffeine supplementation increases central activation drive (3). However, it is unknown if caffeine could counteract the effects of prolonged exercise in the heat in the CNS despite sustained hyperthermia. The purpose of this study was to evaluate if the ingestion of fluid (to reduce hyperthermia), carbohydrate (to supply extra energy) and/or caffeine (to act as a CNS stimulant) will progressively reverse the effects of dehydration and hyperthermia on maximal leg force.

Methods

Seven endurance-trained and heat acclimated males volunteered for this study. They pedaled at 63% VO2max (176±15W) in a hot-dry environment (36ºC; 29% rh) during 120 min in six different double-blind trials: 1) no fluid ingested (DEH); 2) caffeine supplementation (CAFF; 6mg/kg BW); 3) rehydrating 90% sweat loss with water (WAT); 4) rehydrating with water+caffeine (WAT+CAFF); 5) rehydrating with a 6% carbohydrate-electrolyte solution (CES) and 6) rehydrating with CES+caffeine (CES+CAFF). Immediately before and after each trial right knee maximal isometric voluntary contraction (MVC) and central activation ratio (CAR; superimposed electrical stimuli) were measured. In addition, muscle contractile function was assessed via tetanic electrical stimulation (EL). Data were analyzed using ANOVA.

Results

The no-fluid trials (DEH; CAFF) induced to hyperthermia (39.0ºC) while fluid ingestion maintained rectal temperature at 38.3ºC. After 120 min of exercise MVC declined 76 N in DEH, 39 N with WAT and less in the rest of trials (14, 20 N and 14 N increase in CES, WAT+CAFF and CES+CAFF, respectively; P<0.05). Of note during the CAFF trial MVC decreased 14N despite hyperthermia. The reductions in CAR (index of CNS drive) followed the trend of MVC; (r= 0.52 between MVC and CAR; P<0.01). EL evoked muscle contraction force was not reduced after 120 min of pedalling in any of the trials.

Discussion

In agreement with previous data (2) prolonged exercise inducing hyperthermia reduced MVC. This reduction was mainly due to a reduction in CAR (decreased central drive) since force evoked by EL was unchanged. The effects of fluid, carbohydrate and caffeine on the

preservation of MVC after exercise seemed additive. CAFF (6 mg/kg) counteracted the effects of hyperthermia on MVC preserving CAR which suggests an important role of CNS stimulants for heat induced fatigue.

References

1. Fritzsche RG, et al (2000) J. Appl. Physiol.
2. Nybo L and Nielsen B. (2001) J. Appl. Physiol.
3. Kalmar JM and Cafarelli E. (1999) J. Appl. Physiol.

VO2 KINETICS DURING HIGH INTENSITY CONSTANT EXERCISE : A FOURTH PHASE?

Leclair, E., Thevenet, D., Cretual, A.l., Prioux, J.

UFR STAPS Nantes, France

Introduction: During a continuous exercise at high and constant intensity, a VO2 decrease before exhaustion has been observed (Nummela and Rusko, 1995; Perrey et al., 2002). The aim of this study was to verify the VO2 kinetic fourth phase existence and the involvement of respiratory muscle fatigue in this phenomenon. Methods: Seven endurance trained males (19.6 years (0.4)) performed 5 field-tests until exhaustion: 1) an incremental test to determine their maximal oxygen uptake (VO2max-58.6 ml.min-1.kg-1 (1.4)) and maximal aerobic velocity (MAV-18.5 km.h-1 (0.2)), 2) a 100% of MAV constant exercise (tlim100(1)), 3) 4) and 5) in a randomized order, 2 constant exercises at 95% of MAV (tlim95(1) and (2)) and a second tlim100 (tlim100(2)). Running speed was maintained constant thanks to an examiner on bicycle that the subject followed. This examiner was provided with mp3 reader which gives imposed time every 20 meters. Moreover, a second examiner took care of the subject position on a level with the bicycle and of lap time. The cardio-respiratory values were averaged on a 2s period. Data were analysed with Matlab® software and a single exponential model was applied to VO2 kinetics. A kalman filter was used in order to detect the changes of model relatively to VO2 kinetic. When a series of changes was detected at the end of VO2 kinetic, the software applied a linear phase after the third phase described. Respiratory muscle fatigue was appreciated using maximal inspiratory and expiratory pressures (Plmax-PEmax) measure. This measure was realized by the same examiner during each constant load exercise at rest, then 3 minutes, and 24 hours after the end of the test. In each case, Plmax and PEmax were measured 5 times respectively at residual volume and at total pulmonary capacity. Results: Our study results highlight a VO2 decrease before exhaustion for 3 of all subjects. No significant difference was found between each tlim100 and between each tlim95. Plmax and PEmax mean values do not present significant differences between each condition. Conclusion: In our study, tests results allowed us to highlight a VO2 kinetic fourth phase for 3 of our 7 athletes while running speed was maintained constant. VO2 decrease observed cannot be explained by a running speed decrease and Plmax and PEmax measures results do not show significant variation. Moreover, tidal volume and respiratory frequency kinetics are not linked to a ventilation decrease. In this way, the respiratory muscle fatigue hypothesis seems to be rejected.

References

Nummela A, Rusko H (1995) Time course of anaerobic and aerobic energy expenditure during short-term exhaustive running in athletes. Int J Sports Med 16(8): 522-7.

Perrey S, Candau R, Millet GY, Borrani F, Rouillon JD (2002) Decrease in oxygen uptake at the end of a high-intensity submaximal running in humans. Int J Sports Med 23(4): 298-304.

SEX DIFFERENCES IN MUSCLE ENERGETICS DURING INCREMENTAL KNEE-EXTENSOR EXERCISE IN 9-12 YEAR OLD CHILDREN

Barker, A.R., Welsman, J.R., Armstrong, N.

University of Exeter, United Kingdom

There is strong evidence indicative of sex differences in the muscle metabolic response during high intensity and at maximal exercise, but not during submaximal intensities in pre/early pubertal children. The purpose of this study was to examine whether during knee-extensor exercise to the limit of tolerance, sex differences were evident in the intramuscular metabolic response, as determined by 31P-magnetic resonance spectroscopy.

Eighteen girls (mean age 10.6 y, height 1.41 m, body mass 36.3 kg) and 15 boys (mean age 10.8 y, height 1.43 m, body mass 35.0 kg) completed a single leg knee-extensor incremental exercise test to exhaustion whilst lying prone in the bore of a whole-body scanner (Philips 1.5T). Following 2 min rest for baseline measures, masses were added to a custom designed ergometer at 0.5 kg·min-1 to ensure exhaustion occurred in ~8 min. Dynamic changes in phosphocreatine (PCr), inorganic phosphate (Pi), Pi/PCr and intracellular pH were resolved every 1.5 s via a 6 cm 31P transit-receive surface coil placed under the subjects' right quadriceps muscle. Spectra profiles were averaged every 30 s and determination of 31P metabolites was performed using jMRUI. Each subject's Pi/PCr and pH profiles were plotted against power (W) for subjective determination of intracellular thresholds (ITPi/PCr and ITpH). Potential between sex differences in muscle metabolic parameters were explored using independent Student t-tests. Values are reported as mean ± standard deviation (SD).

At rest no significant sex differences in metabolic concentrations were present ($P>0.05$). Peak power achieved at maximal exercise was not significantly different between sexes (14.5 ± 3.2 vs. 13.9 ± 3.6 W; $P=0.582$). However, the boys displayed a significantly lower increase in Pi (286 ± 59 vs. 372 ± 90 %; $P=0.004$), decrease in PCr (51 ± 12 vs. 39 ± 18 %; $P=0.039$) and increase in Pi/PCr (0.94 ± 0.33 vs. 1.95 ± 1.28; $P=0.006$) compared to girls at end exercise. End exercise pH tended ($P=0.058$) to be lower in girls (6.92 ± 0.11) compared to boys (6.98 ± 0.05). The power outputs at the ITPi/PCr and ITpH displayed no sex differences ($P>0.05$), but the girls demonstrated significantly ($P<0.05$) greater changes in Pi/PCr and pH as a function of work rate following the ITs.

These results suggest that in response to incremental exhaustive exercise, sex differences in the quadriceps metabolic response are clearly discernible during the region of high-intensity exercise. Although quadriceps muscle peak power was comparable between sexes, the intramuscular metabolic perturbation was greater in girls following the ITs, resulting in a greater anaerobic component and subsequently a higher accumulation of Pi, PCr degradation and intracellular acidosis at end exercise. Mechanisms relating to the delivery of and/or utilization of oxygen at the myocyte may be compromised during high intensity/exhaustive exercise in young girls.

SKELETAL MUSCLE OXYGENATION TRENDS, MOTOR UNIT RECRUITMENT PATTERNS AND TIME-LIMIT AT POWER OUTPUT CORRESPONDING TO VO2MAX FOLLOWING MAXIMAL LACTATE STEADY STATE IN CYCLISTS

Lajoie, C., Polasek, N., Gurd, B., Kowalchuk, J.M., Grenier, S., Serresse, O.

Laurentian University and University of Western Ontario, Canada

The primary purpose of this study was to investigate the mechanisms involved in the upward trend in pulmonary O2 uptake (VO2; i.e. VO2 slow component) while exercising at a constant workload corresponding to the Maximal Lactate Steady State (MLSS). We hypothesized that the progressive rise in VO2 at MLSS is the result of an increase in motor unit recruitment and O2 utilization at the level of the exercising muscle. Moreover, to better understand the mechanisms that limit endurance capacity, immediately following MLSS, subjects were asked to pedal until exhaustion (T-limit), at a power output expected to elicit VO2max. Along with measures of pulmonary VO2 and blood lactate concentration, surface electromyography (sEMG); mean (MPF) and median (MDPF) power frequency, and near-infrared spectroscopy (NIRS)-derived measures of deoxy- (HHb), oxy- (O2Hb) and total-hemoglobin/myoglobin (HbTOT), were recorded from the vastus lateralis of 12 trained cyclists (VO2max = 63.3 ± 8.6 ml/kg/min) when cycling for 1 hour at MLSS and at T-limit. As expected, VO2 increased ($p<0.05$) by 13% from 10 to 60 min at MLSS (final VO2 represented 78% VO2peak) and increased ($p<0.05$) further at T-limit (time-to-fatigue; 91 sec), although subjects could only achieve a maximum value corresponding to 81% of the VO2peak. NIRS-derived HHb increased by 36% ($p<0.05$) relative to its initial response throughout the MLSS, with an additional increase of 11% ($p<0.05$) during T-limit. After increasing rapidly at the onset of exercise within the first 10 min, HbTOT rose more gradually ($p<0,05$) between 10 min and 45 min, and remained steady for the remainder of the MLSS. During the subsequent T-limit period HbTOT tended to decrease, but not significantly. During MLSS, O2Hb remained relatively constant throughout the MLSS, but decreased ($p<0.05$) by 20% during the T-limit. sEMG demonstrated an increase ($p<0.05$) in muscle fiber conduction velocity as showed by a 12% and 16% increase in MPF and MDPF respectively at MLSS, whereas at T-limit, MPF and MDPF remained unchanged compared to the MLSS 60th min. These findings lend further support to the theory that the VO2 slow component derives mostly from local events occurring within the exercising muscle, by change in motor unit recruitment type and an increase in HHb, independent of lactate accumulation (4.65 ± 0.97 mmol/L at 10th min to 4.9 ± 1.1 mmol/L at 60th min of MLSS). Failure to reach maximal VO2 during the very heavy constant workload (i.e. Tlim) may represents a limitation of the circulatory system to deliver adequate amount of O2, rather than the muscles capability to utilize O2.

Oral presentation (OP)

OP2-02 Training and Testing 2/7 - "Turin ABC"

KINEMATIC MATCH ANALYSIS IN BEACH SOCCER

Trauner, T., Lederhilger, B., Schwameder, H.

University of Salzburg, Austria

Beach soccer is a young and growing sport with 20 national teams currently in Europe. It is played barefoot on a sand-pitch (38x28m) with 4 players and a goalkeeper in each team. The specific format (three periods of 12 min each, free substitutions, free kicks without barrier, 'always a winner' and high goal average) make the sport dynamic and attractive for the spectators (www.beachsoccer.com). A game lasts about 1 hour with an average playing time of 36±8 min per player.

The scientific research regarding kinematic characteristics and game activities in beach soccer is limited. Beach soccer is often compared with soccer and therefore it is important to know whether or not the specific demands and training programs for soccer can be transferred to beach soccer.

The purpose of the present study was to analyse paths, type of locomotion, velocities and game activities of the Austrian and Swiss beach soccer national teams (17 players total) during two games. Heart rate and lactate profiles were collected simultaneously (Lederhilger 2006). Furthermore, the results were compared with data from soccer (Reilly 1993, Müller & Lorenz 1996, Sainz & Cabello 2005) and basketball (McInnes et al, 1995).

Two stationary digital video cameras were used to film the players' locomotion. The estimated center of mass was manually digitized and transformed into position-coordinates. A third digital camera traced all the players' actions with the ball. The results of the two games and teams were averaged.

The mean distance covered was 3.1±0.6 km with an average velocity of 1.5±1.2 m/s. On average the players' locomotion were: 47% walking (1.5±0.3 km / 27±6 min), 41% jog trotting (1.3±0.2 km / 8±2 min), 11% running (0.3±0.1 km / 1±0.5 min) and 1% sprinting (40±20 m / 5±3 sec) of the total distance. There was a change of type of locomotion every 3 s with an average distance of 5 m. 12% of all movements were higher than 4m/s and players covered 4% of total distance in ball possession. On average a player performs 142±62 different actions with the ball: 36% ball receptions, 11% shots on goal, 14% dribblings and 39% passes.

Compared to soccer beach soccer shows shorter total distances, more frequent changes in locomotion, in ball possession (Reilly 1993, Sainz & Cabello 2005) and higher percentage in walking and jog trotting (Müller & Lorenz 1996). McInnes et al (1995) reported similar values for basketball. According to these results as well as regarding heart rate and lactate production (Lederhilger 2006) the profile in beach soccer was found to be different from soccer and, consequently, specific training programs and scientific studies have to be established to improve the efficiency of this new sport.

Lederhilger (2006). Univ. Salzburg.

McInnes et al (1995). JSS, 387-397.

Müller & Lorenz (1996). Leistungssport, 59-62.

Reilly (1993).Sci&Fo II, 3-11.

Sainz & Cabello (2005).Sci&Fo V, 353-356.

THE EFFECT OF A ONE-PIECE COMPETITION SPEED SUIT DURING THE SWIM-CYCLE INTERACTION OF A SPRINT DISTANCE TRIATHLON

Peeling, P., Landers, G.

The University of Western Australia, Australia

This study investigated the thermoregulatory response to wearing a one-piece competition speed suit (Rival Force, Rosebery, NSW) during the swim-cycle (SC) interaction of a sprint distance triathlon. Eight highly trained, male triathletes completed three separate laboratory sessions comprising one graded-exercise test, and two SC sessions. Each SC included a 750 m time trial paced swim followed by 30 min of cycling at an intensity corresponding to 95% of the lactate threshold. Throughout each SC testing session, the athletes were required to wear either regular cut, standard swimming bathers only (SCB), or the one–piece competition speed suit (SCS). The 750 m swim was conducted in a 25 m outdoor pool heated to 27.75 ± 1.35°C. Data was collected for the athlete's swim time, stroke rate (SR) and stroke length (SL). Subsequent cycling was performed on a wind-braked cycle ergometer inside a climate regulated chamber set to 30.05 ± 0.83°C and 60.45 ± 1.03 % humidity. Such conditions are similar to those experienced by the elite men competing at world championship races. Eight hours prior to each SC session, subjects were required to swallow a telemetric temperature measurement pill (CorTemp™, HQ Inc, Palmetto FL). At the conclusion of the swim and for the duration of the ride, the temperature pill, in association with a series of skin thermistor leads allowed the determination of core temperature (Tc), and skin temperature (Tsk). Blood lactate (BLa), heart rate (HR) and ratings of thermal comfort (RPE) were also collected during the cycle discipline. The SCS swim time (10:04.97 ± 0:58.65) was significantly faster ($p<0.05$) than SCB (10:25.45 ± 1:01.33). This time improvement incurred no between group differences in SL, SR, BLa or RPE ($p>0.05$). During the 30 min cycle, the power output between SCB (279.03 + 40.54 W) and SCS (279.13 + 38.73 W) were not significantly different ($p>0.05$). Furthermore, there were no differences between the recordings of Tc, Tsk, HR, BLa or RPE ($p>0.05$). The use of a one-piece Rival Force speed suit during the swim leg of a triathlon may be beneficial in improving an athletes swim time as a result of a reduced passive drag through the water. Additionally, it was shown that the speed suit has no effect on an athletes' thermoregulatory response during a SC interaction. Hence, wearing the suit in extreme environmental conditions does not place the athlete at a greater risk of incurring a heat related illness. Further investigation is warranted however, in the assessment of how this response continues during the subsequent running discipline.

DROP JUMPING ABILITY IMPROVEMENT INDUCED BY BACKWARD-DOWNHILL PLYOMETRICS

Kannas, T., Amiridis, I.G.

Laboratory of Neuromuscular Control and Therapeutic Exercise, Greece

DROP JUMPING ABILITY IMPROVEMENT INDUCED BY BACKWARD-DOWNHILL PLYOMETRICS

Kannas Th and Amiridis IG

Laboratory of Neuromuscular Control and Therapeutic Exercise, Departement of Physical Education and Sports Sciences at Serres, Aristotle University of Thessaloniki

In the interest of improving jumping ability, we are interested to define an optimal training method for increase plantarflexors performance. According to their force-length relationship, these muscles produce their greater force at extremes angles towards dorsiflexion (Kawakami et al, 1998). It is hypothesized that backward plyometrics on decline ground are more efficient than classic plyometric training on a plane. Thirty six male students (age=18.7±0.6years, mass=77.68±9.01kg, height=180.9±9.3cm) were divided into Decline (150) Group (DG, n=13) Plane Group (PG, n=11), and Control Group (CG, n=12). DG and PG performed 12 training sessions (3sessions/week, 4 weeks) including 10 sets (2min rest between sets) of 10 consecutive maximal jumps. Before and after training, jumping ability was tested using Drop Jumps (DJ) from 20, 40 and 60cm performed on a Kistler (9821C, Switzerland) force plate (1000Hz). Ground reaction forces and take off velocity of the best performance using two jumping (bounce DJ and counter DJ) techniques were analyzed. Bipolar surface electrodes (Motion Control Inc., USA) were used to determine Electromyographic (EMG) activity of Rectus Femoris, Semi-Tendinosus, Tibialis Anterior and Medial Gastrocemius (MGAS). Analysis of Variance (ANOVA) with repeated measures was conducted to determine the changes in the jumping ability ($p<0.05$). After training, regardless of jump height, Ground Reaction Force (GRF) during the bounce DJ, but not the counter DJ, was greater for the DG. Similarly, take-off velocity during all DJ significantly ($p<0.05$) improved for the same group. Oh the other hand, after training, GRF and take off velocities remain unaltered for the PG. No differences were noted after training concerning EMG activities of all muscles examined for both experimental groups. However, only for the DG, the ratio of iEMG of MGAS during the concentric phase/total iEMG was significantly ($p<0.05$) increased after training. It is concluded that, downhill backward plyometric training could improve jumping ability, especially during fast DJ. Neuromuscular adaptations seem to be presented very early after this specific training. Athletes and trainers have to take into consideration these observations in order to improve jumping performance and reactivity of the calf muscles.

Kawakami, Y., Ichinose, Y. and Fukunaga, T. Architectural and functional features of human triceps surae during contraction (1998). J Appl Physiol 85: 398-404.

SUITABILITY OF MAXIMAL ECCENTRIC STRENGTH TRAINING IN ATHLETICS

Scholz, K.

German Sport University Cologne, Germany

Motivated by the German crisis in the athletic sprinting and jumping events the present study tries to shed some light on the question, whether or not maximal eccentric strength training (MEST) is or should be used in athletic training. In addition, practicable ways of producing such high force eccentric loads in daily training are compared and evaluated. Besides reviewing the literature, the study features interviews on MEST with renowned scientists, athletic national coaches, and physiotherapist from Germany.

Athletics is characterized as a sport that produces maximal demands on the neuro-muscular system. Muscles like the hamstrings (,the adductors, etc.), which are not extensively used eccentrically in daily life, have to produce very high forces in sprinting and jumping (as biomechanical and medical date indicates).

For this study MEST is defined as a training, where the athlete, employing maximal voluntary effort, tries to stop an overpowering outer resistance that moves at medium speed. In research studies this resistance is usually produced by computer-controlled isokinetic strength training machines. But these are usually not accessable for day to day training, because they are expensive and difficult to use.

A first session of MEST is usually followed by severe D.O.M.S. and a loss of muscle force, mainly caused by disruptions on the molecular level. These effects are much smaller after a second session or a longer training phase of MEST (repeated bout effect). But the initial

destructions – occuring especially in fast muscle fibres – can also be interpreted as a trigger for adaptations. In the long run, there seem to be hints that MEST strengthens the intramuscular connective tissue and the passive filaments within the muscle cell. The number of contractile proteins after MEST might by increased via hypertrophy, hyperplasia, and/or the seriell addition of sarcomeres. Excitation-contraction coupling is effected by the disruption connected to MEST and an increased total excitation and a change of neural excitation patterns might be part of the adaptation process.

From a funtional point of view muscle pain, acute loss of muscle force, increased short-term injury occurance and overtraining are possible negative effect of MEST. Increased eccentric and relative strength, decreased long-term injury occurance, improved force transmission and increased contraction velocity could be positive effects.

It is concluded that there seem to be good reasons to include MEST in an athletic preparation phase. Manual resistance seems to be the most practical option to produce maximal eccentric loads in daily training. Repetitions should be started from maximal preactivation. Training volume experts and respective literature typically mention 1 to 3 sets of 1 to 8 repetitions.

Practical ideas for implementing MEST into athletic training have been demonstrated on a video-CD.

IS VERTICAL JUMP HEIGHT A VALID INDEX OF MUSCLE POWER?

Markovic, G., Jaric, S.

Faculty of Kinesiology, University of Zagreb, and University of Delaware, Croatia

Introduction

Explosive movements like vertical jumps have been often applied in assessment of both rapid movement performance and muscle power (P) (2,4). However, relatively moderate relationships between the recorded performance and directly assessed P question the validity such an approach of assessment of P (1). We believe that this problem could be the result of differential influence of body size on P compared to rapid movement performance (3). Thus, the aim of this study was to test the hypothesis that the performances of rapid movements represent body size independent indices of P.

Methods

Physical education subjects (n = 159) were tested on various vertical jump and leg extensor strength tests. Both jump height and average power were calculated from the ground reaction force during jumping. The relationship among various indices of P calculated from vertical jump tests, vertical jump heights, leg extensor strengths and body size indices, both before and after the normalization of strength and power tests for body size (i.e. division with mass0.67), were calculated using a Pearson product moment method. The corresponding inter-correlation matrices of all selected variables were factorized using principal components factor analysis (PCA).

Results and Discussion

The PCA applied on all vertical jump measures, leg extensor strength tests and body size indices revealed a complex and inconsistent structure of the three extracted principal components were the jump height and P loaded different components, while muscle strength and power partly overlapped. When the indices of muscle strength and power were normalized for body size using theoretical predictions of geometric similarity (i.e. divided by mass0.67), a simple and consistent structure of principle components was in line with the hypothesis. Specifically, the recorded height and P calculated from the same jumps loaded the same components, separately for the jumps predominantly based on concentric and jumps based on rapid stretch-shortening cycle of leg extensors. The third and fourth extracted principal components represented leg extensor strength and body size, respectively.

Conclusion

We conclude that the recorded height of vertical jump can be considered as a body size independent index of P. If supported by similar results obtained from other rapid movements, the finding that the performance of rapid movements assess the same physical ability as properly normalized tests of P could be of exceptional importance for designing and interpreting the results of batteries of physical performance tests, as well as for understanding some basic principles of human movement performance.

References

1. Aragon-Vargas LF, Gross M. (1997). J Appl Biomech. 13: 24-44

2. Harman EA, et al. (1991). J Appl Sport Sci Res. 5: 116-120.

3. Markovic G, Jaric S. (2005). Eur J Appl Physiol. 95: 11-19.

4. Markovic G, et al. (2004). J Strength Cond Res. 18: 551-555.

EFFECTS OF A BICYCLE SPECIFIC STRENGTH ENDURANCE TRAINING WITH AND WITHOUT VIBRATION

Kleinöder, H., Remppel, T., Yue, Z., Mester, J.

German Sport University Cologne, Germany

Effects of a bicycle specific strength endurance training with and without vibration

Kleinöder Heinz, Remppel Titus, Yue Zengyuan, Mester Joachim

Institute for Training Science and Sport Informatics, German Sport University Cologne, Germany

Introduction

Vibration training is performed in many sports since positive effects on various factors such as speed, maximal strength, strength endurance could be shown (cp. e.g. Issurin et al 1999). Especially strength endurance is important in many cycling disciplines. Cyclists usually train this ability on a ergometer against variable resistance. A new approach is to add vibration to the above described typical training on a specially developed vibration ergometer.

Methods

30 male persons (sport students, 1.84 cm +- 6.2 cm, 77.5 kg +- 5.6 kg) were equally randomized in 3 groups. These consisted of 2 training groups (1 with and 1 without vibration) and 1 control group. Both training groups performed 8 strength endurance training units in 4 weeks on a Cyclus 2 Record ergometer by Avantronic. Each training unit lasted 31 min (i.e. 5 min warm up (80 watt, 90 rpm), 3 times 5 min training (60 - 70% individually adjusted, 50 rpm), with 3 min active regeneration in between (80 watt, 90 rpm) and 5 min cool down (80 watt, 90 rpm). During the 3 training intervals the vibration group trained with 4 mm amplitude and 30 Hz frequency. A 2 min ergometer test and 3 strength tests (isometric and dynamic) of bicycle specific muscles (m. quadriceps femoris, m. biceps femoris und m. triceps surae) were performed at the beginning and the end of the training period.

Results

T-tests were performed to establish changes within and between groups. The vibration group improved significantly from pre-test to post-test in the 2 min test, 2 isometric strength tests (leg extensors and calves) and the dynamic test for the calves. The conventional training group showed significant improvements only for the 2 min test and 1 isometric strength test (leg extensors). Between both training groups significant differences occurred for the leg curl strength test (dynamic and isometric) in favour of the vibration group. No significant differences could be found for the control group. Individually there were high scores of improvement for various test esp. for the vibration group.

Discussion/Conclusion

The results show that the training on the vibration bicycle has potential which should further be developed in order to find out guidelines for the appropriate training load. Since it was the first approach and training conditions were safety-oriented, the results are quite promising as well as the positive feedback of the vibration group. Therefore training against different resistances, with different duration and different intervals need to be tested in the near future.

References

ISSURIN, V. B.; TENENBAUM, G. (1999): Acute and residual effects of vibratory stimulation on explosive strength in elite and amateur athletes. In: J. Sport Sc. 17, 177-182.

Oral presentation (OP)

OP2-03 Nutrition 1/2 - "Berlin DE"

CO-INGESTION OF PROTEIN AND LEUCINE STIMULATES MUSCLE PROTEIN SYNTHESIS IN YOUNG AND ELDERLY MEN

Koopman, R., Verdijk, L.B., Manders, R.J., Gijsen, A.P., Wagenmakers, A.J., van Loon, L.J.

Nutrition and Toxicology Research Institute Maastricht (NUTRIM), Maastricht University , Netherlands

Aging is associated with a progressive loss of skeletal muscle mass, which is attributed to a disruption in the regulation of skeletal muscle protein turnover, which results in a chronic imbalance between muscle protein synthesis and breakdown rate. Knowledge of differences in responses of young and elderly subjects under normal daily living conditions are of crucial importance to our understanding of the etiology of sarcopenia and are currently lacking in the literature.

Purpose: We investigated the response to the ingestion of carbohydrate with or without protein and free leucine following simulated activities of daily living (ADL) on whole-body protein balance and mixed muscle protein synthesis rates. Methods: Eight elderly (75±1 y) and eight young (20±1 y) male subjects were randomly assigned to 2 trials in which they consumed either carbohydrate (CHO) or carbohydrate, protein and free leucine (CHO+PRO+leu) after performing 30 min of standardized ADL activities. Primed, continuous infusions with L-[ring-13C6]phenylalanine and L-[ring-2H2]tyrosine were applied, and blood and muscle samples were collected to assess whole-body protein turnover as well as fractional protein synthetic rate (FSR) in the vastus lateralis muscle over a 6 h period. Results: Plasma insulin responses were significantly higher in the CHO+PRO+leu trial than in the CHO trial in both the young and elderly subjects ($P<0.05$). Whole-body phenylalanine and tyrosine fluxes were significantly higher in the young versus the elderly ($P<0.01$). Protein balance was negative in the CHO trial, but positive in the CHO+PRO+leu trial in both groups. In the CHO trial, muscle FSR was significantly lower in the elderly compared with the young subjects ($P<0.05$). Mixed muscle protein synthesis rates were significantly greater in the CHO+PRO+leu compared with the CHO trial in both the young (0.082±0.005 %∙h-1 vs. 0.060±0.005 %•h-1, respectively; $P<0.01$), and elderly subjects (0.072±0.006 %∙h-1 vs. 0.043±0.003 %∙h-1, respectively; $P<0.01$), with no differences between groups. Conclusion: Co-ingestion of protein hydrolysate and leucine with carbohydrate following ADL activities improves whole-body protein balance and increases muscle protein synthesis rates to the same extent in young and elderly men.

THE EFFECT OF ANTIOXIDANT VITAMIN SUPPLEMENTATION FOR 4 WEEKS ON OXIDATIVE STRESS AND IMMUNOENDOCRINE RESPONSES TO PROLONGED CYCLING

Davison, G., Gleeson, M.

Loughborough University, United Kingdom

Antioxidant supplementation may modulate systemic cortisol and IL-6 responses to prolonged exercise (Fischer et al. 2004). It is unclear if such effects are also associated with a reduction in the magnitude of immunodepression. The aim of the present study was to examine the effects of daily antioxidant supplementation (vitamin C 1000 mg/day and vitamin E 400 IU/day) on cortisol, IL-6, oxidative stress and neutrophil functional responses to prolonged exercise. Twenty healthy males cycled for 2.5 h at 60% VO2max after 4 weeks of placebo (PLA, n = 10) or antioxidant (AO, n = 10) supplementation. Blood samples were taken before supplementation (Baseline), immediately pre, post and 1h post-exercise (Rest, Post-Ex and 1h Post-Ex, respectively). Results, presented as means (standard deviation), were analysed with 2-way ANOVA. There was a significant post-exercise increase in plasma free 8-isoprostane but this was not different between groups (interaction $P = 0.609$). A significant trial x time interaction was observed for plasma cortisol concentration ($P = 0.008$) and the post-exercise increase above baseline was greater ($P < 0.05$) in the PLA compared with AO group. Furthermore, 1-way ANOVA on each trial independently revealed a significant increase post-exercise in the PLA group ($P < 0.05$) but no effect of time in the AO group ($P = 0.392$). The values were 415 (174), 352 (165), 702 (274) and 620 (371) nM in the PLA group and 455 (87), 465 (66), 573 (202) and 451 (144) nM in the AO group at Baseline, Rest, Post-Ex and 1h Post-Ex, respectively. Plasma IL-6 was significantly increased post-exercise ($P < 0.001$) to a similar extent in both groups (interaction $P = 0.167$). The values were 1.2 (0.3), 5.4 (2.8) and 4.9 (2.0) pg/ml in the PLA group and 1.6 (0.6), 4.0 (1.8) and 3.7 (1.6) pg/ml in the AO group at Rest, Post-Ex and 1h Post-Ex, respectively. Blood neutrophil count was significantly increased ~ 4-fold post-exercise ($P < 0.001$) but was not different between groups (interaction $P = 0.459$). The neutrophil in vitro bacteria-stimulated elastase release per cell was significantly decreased post-exercise ($P < 0.001$) to a similar extent in both groups (interaction $P = 0.423$). The values were 428 (163), 144 (55) and 134 (44) fg/cell in the PLA group and 407 (90), 147 (61) and 185 (48) fg/cell in the AO group at Rest, Post-Ex and 1h Post-Ex, respectively.

These results suggest that 4 weeks of AO supplementation may blunt the cortisol response to a single bout of prolonged exercise independently of changes in oxidative stress or plasma IL-6 concentration. Furthermore, it was not effective at modulating the exercise-induced neutrophilia or depression of neutrophil function. It is possible that greater IL-6 responses are required (as observed with the

longer exercise protocol used by Fischer et al. 2004) in order for AO supplementation to modulate IL-6 and immune function changes with exercise.

References

Fischer, C.P. et al. (2004) J Physiol 558: 633-645.

GENETIC POLYMORPHISM AND INDIVIDUALIZATION OF YOUNG ATHLETES' NUTRITION

Topanova, A., Ahmetov, I., Mozhayskaya, I., Dondukovskaya, R., Golberg, N.

St Petersburg Research Institute of Physical Culture, Russia

Genetic individuality of the person determines the features of the optimum diet preventing development of diseases and promoting maintenance of a high level of working capacity. The D allele of ACE gene is known to be associated with hypertension, left ventricular hypertrophy, heart attack and vascular hypertrophy. The Ala allele of the common Pro12Ala polymorphism of PPARG gene is associated with a 25% reduced risk for type II diabetes. The effect of this polymorphism is probably mediated by increased insulin sensitivity, which may be secondary to more efficient suppression of free fatty acids release from fat tissue, where PPARG is exclusively expressed. As to PPARA genetic polymorphism, the C allele carriers had greater progression of atherosclerosis than did G allele homozygotes [1]. Uncoupling protein-2 and -3 are mitochondrial proteins expressed in skeletal muscle, an important site of thermogenesis in humans. The Val/Val genotype of the UCP2 polymorphism was positively related to type II diabetes [2]. The UCP3 TT genotype was associated with a higher atherogenic profile and modified the risk for the development of type II diabetes [3]. The purpose of the present study was to reveal the risk of development of metabolism diseases by detecting genes polymorphisms for correction of young athletes' nutrition.

Young bicyclists (n=61, aged 13-16) were participated in the study. DNA was extracted from mouthwash samples. PPARA G/C, PPARG Pro12Ala, ACE I/D, UCP2 Ala/Val and UCP3 -55C/T polymorphisms were determined by PCR and restriction enzyme digestion.

We found that the frequencies of risk alleles for metabolism diseases such as D allele of ACE, C allele of PPARA, Pro allele of PPARG, Val allele of UCP2 and TT genotype of UCP2 genes were 43.4%, 19.7%, 87.2%, 46.7% and 8.7%, respectively. Genotypes distributions amongst young athletes were similar to that observed in other reported groups of the European population. In conclusion, the group of high risk of development of metabolism diseases was identified amongst young athletes, for which the diet was corrected. Applying the genetic data for athlete's diet correction is believed to prevent metabolic diseases and enhance their physical performance.

References

1. Flavell D.M, et al. Circulation 2002; 105:1440-1445

2. Yu X., et al. Clinical Chemistry 2005; 51:1451-1456.

3. Meirhaeghe A., et al. Diabetologia 2000; 43:1424-1428.

NUTRITIONAL INTERVENTION IN TRACK AND FIELD JUMPERS, MIDDLE DISTANCE RUNNERS AND DECATHLETES

Torres, A., García, A., Garrido, G.

Faculty of Physical Activity and Sport Sciences (U.P.M.), Spain

Introduction

Track and field events require the development of different motor skills: race walking, running, jumping and throwing. Single events need the development of one of them; decathlon is a multi-event and is the most complex athletic activity.

Diet composition was analyzed in elite athletes competing in three different events: jumpers (J), middle distance runners (MD), and decathletes (D). After this evaluation an individual nutritional report advice was given to each of them. To verify possible changes after this intervention a new diet composition evaluation was performed (one month later) in a group of them chosen randomly. The goal of this study was to compare different nutritional patterns in athletes competing in different events (J, MD and D) and verify possible changes in dietary practices after intervention.

Methods

Subjects were 25 Spanish young elite athletes (9J, 8MD, 8D). Age=22.9(3.9), 23.3(5.7), 22.9(4.3)yr, ht=178.5(0.1),173.3(0.1),185.4(0.0)cm;wt=70.1(10.7),59.9(8.6),80.7(10.2)kg;BMI=21(1.9),19.8(1.6),23.4(2.3)kg/m2 respectively. Diet composition was estimated by food weighing (Mettler-Toledo 1g accuracy) for a 5 day period. During the same 5 day period, athletes completed a 24h activity questionnaire to estimate physical activity level (PAL). Our intervention was to provide a diet composition report with individualized advice to improve diet quality. A random group of them (n=7) repeated diet composition evaluation by food weighing for 5 days in the same training period.

Results

Comparison data between the three groups: energy intake Kcal/day (2544[668]; 2425[567]; 3076[433]) was similar in J, MD and D and we found a negative energy balance (740 Kcal) according to estimated energy requirements (EER) by DRI's (2002).

EER were significantly lower in MD 3124(135) than the other two groups due to a lower body weight. Protein expressed as % energy intake (18.0 [2.0] vs 14.1[1.7]) and relative to weight (g/Kg) (1.8[0.3] vs 1.3[0.4]) were significantly higher (p≤0.001) in D vs J.

Comparing D to MD, energy intake was significantly higher in D at lunch (p≤0.01) and dinner (p≤0.05). Fat (g) (109[27] and 82[23]) (p≤0.05) and cholesterol (mg) intakes (512[114] and 278[88]) (p≤0.001) respectively, were also significantly higher.

Marginal intake with respect to the recommendations (DRI's) for: calcium (J), magnesium (J,MD,D); vitamin E (J,MD) and folate (J,MD) were detected.

After intervention we found a lower percentage of energy from fat (34% vs 28%) and reduced cholesterol (mg/d) content (401 vs 352). Micronutrient intakes (Ca, Mg, vitamin E and folate) were still suboptimal after intervention.

Discussion/Conclusion

The negative energy balance found in each group leads us to question the validity of the EER formula used for this population.

A simple dietary report is not an effective intervention for improving diet composition. More in depth strategies are probably needed combined with a closer relationship with athletes to effect changes in diet quality.

MUSCLE GLYCOGEN SYNTHESIS WITH COMBINED GLUCOSE AND FRUCTOSE INGESTION AFTER EXHAUSTIVE EXERCISE

Wallis, G.A., Hulston, C., Mann, C., Roper, H., Tipton, K., Jeukendrup, A.E.

University of Birmingham, United Kingdom

Restoration of muscle glycogen after exercise is crucial to the recovery of endurance exercise capacity. Systemic carbohydrate availability has been suggested as a major limitation to muscle glycogen synthesis in the early post-exercise recovery period (< 8 h) (1). Compared to when only one form of carbohydrate is ingested (e.g. glucose), carbohydrate delivery from ingested carbohydrate solutions can be increased during exercise with combined glucose and fructose ingestion (2). Whether ingestion of large amounts of this combination of carbohydrates can have a similar benefit to muscle glycogen synthesis after exercise is unknown. Therefore, the effect of combined glucose and fructose (GF) ingestion on short-term (4 h) post-exercise muscle glycogen storage was compared to glucose only (G) ingestion. On two separate occasions, 7 endurance trained men performed an exhaustive glycogen depleting exercise bout followed by a 4 h recovery period. Muscle samples were obtained from the vastus lateralis muscle ~30 min after exercise. Immediately thereafter, and at 30 min intervals for the next 4 h, subjects ingested carbohydrate solutions containing G (90 g/h) or GF (G, 60 g/h; F 30 g/h). Further muscle samples were obtained at 1 and 4 h after the first drink was consumed. Post-exercise muscle glycogen concentrations were similar between the trials (G, 115±25 mmol/kg dm; GF, 103±16 mmol/kg dm; P>0.05). Total glycogen storage over the 4 h recovery period was 165±30 and 150±26 mmol/kg dm for G and GF respectively (P>0.05). Accordingly, mean muscle glycogen synthesis rates did not differ between the two conditions (G, 41±8 mmol/kg dm/h; GF, 38±7 mmol/kg dm/h; P>0.05). Venous plasma glucose and serum insulin responses during the recovery period were similar in both conditions, although plasma lactate concentrations were significantly elevated during GF compared to G (by ~0.8 mmol/l, P<0.05). In conclusion, immediate and regular consumption of carbohydrate promoted rapid muscle glycogen synthesis during the initial hours of recovery from exercise. Moreover, muscle glycogen storage was equally effective when glucose alone or combined glucose and fructose were ingested simultaneously during post exercise recovery.

1. Jentjens, R & Jeukendrup, AE. (2003). Sports Medicine, 33, 117-144

2. Jeukendrup, AE. (200). Nutrition, 20, 669-677.

Oral presentation (OP)

OP2-04 Molecular Biology 1/2 - "Turin DE"

EFFECTS OF HIGH-INTENSITY TRAINING ON MCT1, MCT4 AND NBC1 EXPRESSION IN SKELETAL MUSCLE IN RATS

Thomas-Junius, C., Bishop, D., Moore-Morris, T., Mercier, J.

Laboratoire de Physiologie, Bvd Henri IV, 34 060 Montpellier, France

A large part portion of lactate and H+ removal from skeletal muscle is mediated by the monocarboxylate transporter (MCT) proteins : MCT1 and MCT4 [2, 3, 6]. Recently it has been shown that lactate/H+ cotransport is increased when MCT1 is expressed together with the sodium bicarbonate cotransporter (NBC) in Xenopus oocytes [1]. NBC [5] and MCT1 and MCT4 [2, 3, 6] are expressed in the skeletal muscle of rats and humans. However, while MCT expression has been reported to increase with contractile activity [2, 3], no data are currently available for NBC. Due to their functional cooperation, we hypothesized that both NBC and MCT expression would be regulated by physical activity, and that there would be a relationship between their expression. Furthermore, as high-intensity exercise induces large changes in metabolic process and these transport proteins are involved in pH regulation [4], we investigated the expression of NBC and MCTs after high-intensity training.

24 Male Wistar rats performed an incremental test to exhaustion on a treadmill inclined to 15o (starting at 10 m/min with increments of 3 m/min). They were then matched on time to fatigue and randomly assigned to the control or high-intensity training group. Training consisted of 6 (1st wk) -12 (5th wk), 2-min intervals (interspersed with 1 min of rest) performed 3x/wk for 5 wk. The intensity of the intervals was initially set at 80% of the peak speed reached during the incremental test and was increased by 10% each week. MCT1, MCT4 and NBC1 expression were measured by Western blotting in soleus (predominantly oxidative) and EDL (predominantly glycolytic) muscles. Results were analysed with student t-tests and Pearson product moment correlations (P<0.05).

After high-intensity exercise training, compared to controls, the expression of MCT1, MCT4, and NBC1 proteins increased significantly in the soleus (P<0.01), with no significant change in the EDL. Only MCT1 expression was correlated to NBC1 expression in the soleus (r=0.53, P<0.01).

These results suggest that 1) high-intensity training altered MCT and NBC1 expression and with a fiber-type specificity; 2) NBC1 expression is related to MCT1 expression in oxidative, but not glycolytic, muscle. In consequence, we can speculate that lactate transport could be facilitated by NBC in oxidative skeletal muscle. Transporting bicarbonate into the muscle would then help to suppress the build up of intracellular H+ and maintain the pH gradient required for continued MCT1 activity.

References

1 Becker et al. Biophys J 2004; 86: 235-247

2 Bonen et al. Am J Physiol Endocrinol Metab 2000; 279: E1131-1138

3 Dubouchaud et al. Am J Physiol Endocrinol Metab 2000; 278: E571-579

4 Juel C. Acta Physiol Scand 1998; 162: 359-366

5 Kristensen et al. Acta Physiol Scand 2004; 182: 69-76

6 McCullagh et al. Am J Physiol 1996; 271: E143-150.

THE MECHANO-SENSOR FOCAL ADHESION KINASE (FAK) GOVERNS THE SLOW OXIDATIVE EXPRESSION PROGRAM IN ANTI-GRAVITATION RAT SOLEUS MUSCLE

Durieux, A.C., Desplanches, D., Freyssenet, D., Flück, M.

University of Bern, Switzerland

Background & Significance: Maintenance of skeletal muscle function critically depends on the mechanical stimuli. The basic mechanisms underlying mechanosensation and its integration into a phenotypic muscle response are not understood. In this regard, the mechanically-induced expression and activation of the costameric protein tyrosine kinase FAK and its role in myogenesis suggest that FAK operates as a governor of the contraction-dependent myocellular program of muscle fibers [1, 2].

Hypothesis: We hypothesized that overexpression of FAK in the anti-gravitational soleus muscle induces the expression of transcripts related to the slow-oxidative program in a loading-dependent fashion.

Methods: The right soleus muscles of 3-month old female Wistar rats were transfected with L19-tagged FAK via gene electrotransfer [3]. Transfection of the left soleus muscle with the L19-tag alone served as internal control. Overexpression of FAK protein vs. the contralateral soleus was evaluated immunochemically as described [2]. Changes in muscle loading were induced in the hindlimb suspension-reloading model [4]. Transcript levels alterations were monitored with custom-available cDNA microarrays as described in [4].

Results: Seven days after gene transfer, overexpression of FAK was detected in 20% of soleus muscle fibers and on the level of total protein in cage control and suspended animals. Concomitantly, enhanced mRNA levels of numerous factors associated with the oxidative metabolism as well as voltage-gated membrane-depolarization were noted in the FAK-transfected muscles of cage controls. The effect on gene expression of oxidative factors was reduced after 7 days of unloading when overexpression of FAK was diminished vs. cage controls. With 1 day reloading, FAK-transfected muscles were 12% heavier than contralateral control and FAK protein levels were enhanced. Concomitantly, numerous factors involved in myogenic control and protein turn-over were up-regulated.

Conclusions: The combined application of transcript profiling technology and somatic gene transfer highlights that skeletal muscle is an excellent model to map signaling pathways in vivo. The data imply that FAK is part of a mechano-sensory cascade which conditionally integrates mechanical loading and contractile activity of soleus muscle into mitochondrial biogenesis and protein turnover.

References:

1) Gordon S.E., Flück M., Booth F.W. J. Appl. Physiol. 90(3):1174, 2001.

2) Fluck M, Ziemiecki A., Billeter R., Muntener M. J. Exp. Biol. 205(Pt 16):2337, 2002.

3) Durieux A.-C., Manissolle C., Bonnefoy R., Freyssenet D. Biochem. Biophys. Res. Commun. 296(2):443, 2002.

4) Fluck M. Schmutz S., Wittmer M., Hoppeler H. Am. J. Physiol. 289(1):R4, 2005.

REGULATION OF MUSCLE FIBER TYPE COMPOSITION BY GENE POLYMORPHISMS

Ahmetov, I., Glotov, A., Lyubaeva, E., Glotov, O., Astratenkova, I., Druzhevskaya, A., Fedotovskaya, O., Rogozkin, V.

St Petersburg Research Institute of Physical Culture, St Petersburg State University, SSC RF Institute for Biomedical Problems, Moscow. , Russia

Human skeletal muscle demonstrates a remarkable plasticity, adapting to a variety of external stimuli. However, there exists a large variation in the magnitude of adaptability between individuals. Such variability partly explains the marked differences in aspects of physical performance between individuals (all individuals have different capacities to perform aerobic or anaerobic exercise, partly depending on their muscle fiber composition), as well as the relationship of skeletal muscle fiber type composition to certain chronic disease states, including obesity and insulin resistance. In untrained individuals, the proportion of slow-twitch (ST) fibers in the vastus lateralis muscle is typically around 55% (range 5-90%) and their conversion to fast-twitch fibers under several conditions is limited, indicating that muscle fiber type composition is determined by individual genetic program. The purpose of the present study was to investigate the association between gene polymorphisms and muscle fiber type composition of untrained subjects.

Samples of m. vastus lateralis of 43 young healthy men were obtained with the Bergstrem needle biopsy procedure. The immunoperoxidase technique was employed for immunohistochemical identification of myosin isoforms. Fiber distribution was expressed as a ratio of the number of fibers of each type in a section to the total number of fibers. DNA was extracted from mouthwash samples. Genotyping for 13 muscle- and cardiovascular-specific genes (PPARA intron 7 G/C, PPARG Pro12Ala, PPARD +294 T/C, PGC1A Gly482Ser, ACE I/D, eNOS 4a/b, ACTN3 R577X, AMPD1 C34T, UCP2 Ala55Val, UCP3 -55C/T, CnB 5I/5D, TSHR D727E, IGF-I CA-repeat promoter) was performed by polymerase chain reaction (PCR) and restriction enzyme digestion. Detection of eight polymorphisms of another 7 genes (REN G/A, AGT M235T, AGTR1A/C, AGTR2 C/A, BKR2 T/C, MTHFR C/T, ADBR2 A/G and C/G) was performed by using multiplex PCR with subsequent hybridization on the biochip. Mutations were discriminated by analyzing fluorescence intensities from separate units on the biochip.

We found that GG-PPARA, TC-PPARD, DD-ACE and C-AGTR2 subjects had significantly higher percentages of ST fibers than CC-PPARA (53.5±2.4% vs 38.5±2.3%; P=0.014), TT-PPARD (61.9±2.7% vs 46.0±1.8%; P=0.0001), II-ACE (56.6±2.5% vs 44.9±3.3%; P=0.008) and A-AGTR2 (54.8±2.3% vs 44.4±2.3%, P=0.0026) subjects, respectively. Furthermore, mean percentages of ST fibers in Gly/Gly PGC1A, CC AMPD1, Val/Val UCP2, CC UCP3 homozygotes were slightly higher than in Ser/Ser, TT, Ala/Ala and TT homozygotes, respectively, but this correlation was nonsignificant. In conclusion, PPARA G/C, PPARD +294 T/C, ACE I/D and AGTR2 C/A polymorphisms were associated with muscle fiber type composition of m. vastus lateralis in untrained males, which may be a mechanism for the association between the PPARA, PPARD, ACE and AGTR2 genotypes and physical performance.

RELOCALIZATION AND UPREGULATION OF HSP70 AFTER MUSCLE DAMAGING ECCENTRIC EXERCISE

Bayer, M.L., Paulsen, G., Ugelstad, I., Hallén, J., Kalhovde, J.M., Raastad, T.

Norwegian School of Sport Sciences, Norway

Heat Shock Proteins (HSPs) are upregulated in cells exposed to stress, playing an essential role in assistance to maintain and regain cellular homeostasis. Earlier, we have shown a translocation of HSP27 to myofibrillar proteins immediately after high-force eccentric exercise (Paulsen et al., 2005). HSP70 is the main stress-inducible member of the HSPs and of interest if this type reacts similar to HSP27, i.e. translocating to the site of damage. Therefore, the aim of this study was to investigate the HSP70 response to muscle damaging eccentric exercise. In particular, we wanted to examine HSP70 localisation (cytosolic vs. myofibrillar-bound) at different time points after high-force exercise.

Eleven healthy male students (27.5±3.5 yr, 180±8 cm, 82.6±6.4 kg) performed a leg workout, consisting of 300 maximal isokinetic eccentric repetitions with the quadriceps muscle. Biopsies from m. vastus lateralis were collected 30 minutes, 4, 8, 23, 95, and 167 h after exercise from both the exercised and control leg. Muscle samples were homogenized and analyzed applying ELISA (cytosolic fraction), western blot (WB; myofibrillar fraction) and immunohistochemistry (cross sections).

Thirty minutes after exercise, there was a shift in the HSP70 localisation from the cytosolic (18±2% decrease) to the myofibrillar fraction (314±88% increase). This was supported by immunohistochemistry, showing scattered HSP70 stain in the exercised muscle. Thereafter, HSP70 in the cytosolic fraction rose to 194±40% of control muscle 23 h after exercise. This increase was still persistent after one week. In the myofibrillar fraction, HSP70 further increased to 979±240% of control 95h after exercise, remaining elevated one week after exercise. ELISA and WB results were supported by an increased number of HSP70 positive fibres on cross sections (24±8% of counted fibres 95 h after exercise). Moreover, we report a significant correlation between acute reduction in force-generating capacity and the later increase in HSP70 levels in cytosolic ($r=0.77$, $p<0.05$) and myofibrillar fraction ($r=0.94$, $p<0.05$).

The decreased levels of cytosolic HSP70 and a concomitant increase in myofibrillar bound HSP70 immediately after exercise suggests a rapid relocalisation of HSP70. The relationship between changes in muscle function and the following HSP70 response indicate that HSP70 is upregulated proportionately to the degree of muscle damage. Thus, the subsequent upregulation of HSP70 in both the cytosolic and myofibrillar fraction indicates need for cellular protection in general and at the site of damage. We suggest HSP70 to be actively involved in refolding, chaperoning and transporting of newly synthesized proteins.

Paulsen et al. (2005) Rapid Hsp27-response to high-force eccentric exercise. The 10th annual ECSS, Belgrade.

SHORT-TERM EFFECTS OF NORMOBARIC HYPOXIA AND EXERCISE ON ANGIOGENIC/VASCULOGENIC GROWTH FACTORS AND ENDOTHELIAL PROGENITOR CELLS

Wahl, P., de Marées, M., Schmidt, A., Bloch, W., Mester, J.

German Sport University, Germany

Introduction

In competitive sports high altitude training is used to increase EPO concentrations and the number of erythrocytes and thus to improve O2-transport capacity in blood. Additionally hypoxia seems to be a powerful stimulus for angiogenesis because like EPO, vascular growths factors (e.g. VEGF), are also controlled by HIF-1α.

For many years the prevalent view was that the formation of new blood vessels in adults can only occur by angiogenesis, i.e. the sprouting of existing blood vessels. Today numerous studies showed that bone marrow derived progenitor cells (EPCs), released to the circulation, can contribute to regeneration and formation of new blood vessels, a process called vasculogenesis [1]. Recently, several groups were able to show the stimulating effects of exercise on EPC mobilization [2]. Hypoxia could play an important role in mobilizing EPCs from bone marrow. Up to now, it is unknown, what kind of exercise (duration/intensity) under what kind of environmental conditions induces (level of altitude) a vascular adaptation by mobilizing EPCs and which changes in angiogenic/vasculogenic growth factors are associated.

Methods

Seven subjects participated in this study. Each subject was exposed to five different conditions for 90 minutes. Condition 1: Normobaric hypoxia (2000m); Condition 2: Normobaric hypoxia (4000m); Condition 3: cycling exercise at sea level; Condition 4: cycling exercise under normobaric hypoxia (2000m); Condition 5: cycling exercise under normobaric hypoxia (4000m). Blood samples were taken pre training, 0h and 3h after altitude/exercise. Angiogenic/vasculogenic growth factors (EPO, VEGF, IL-6, IL-8, IGF-1) were measured by ELISA. The blood samples were also used for migration assay of EPCs.

Results

EPO (2000m, 4000m) and IL-6 (NN, 2000m, 4000m) showed a significant increase 3h and 0h after exercise respectively. For IL-6, IL-8 and VEGF no changes were measured. The migratory activity of EPC was not stimulated after various treatments. There was no correlation between any growth factor and the migration of EPCs.

Especially the combination of hypoxia and exercise should have induced, according to the current state of knowledge, a mobilization of EPCs. Although there was an increase in EPO and IL-6 concentrations no changes in migratory activity of EPCs were observed. It appears as if the exercise stimuli were not intense enough to mobilize EPCs or other additional factors, not determined in this study are responsible for mobilization.

References

1. Asahara T, Murohara T, Sullivan A, Silver M, van der ZR, Li T, Witzenbichler B, Schatteman G, Isner JM. Isolation of putative progenitor endothelial cells for angiogenesis. Science 1997; 275: 964-967.

2. Laufs U, Urhausen A, Werner N, Scharhag J, Heitz A, Kissner G, Bohm M, Kindermann W, Nickenig G. Running exercise of different duration and intensity: effect on endothelial progenitor cells in healthy subjects. Eur J Cardiovasc Prev Rehabil 2005; 12: 407-414.

Oral presentation (OP)

OP2-05 Rehabilitation, Physiotherapy and Traumatology 1/2 - "Turin FG"

ANALYSIS BETWEEN DECOMPENSATED GLOBAL MUSCULAR STRETCHING AND PROPRIOCEPTION ACTIVITY IN THE POSTURE AND EQUILIBRIUM CONTROL

Cairo, S., Ceciliani, A., Ghiretti, M., Tentoni, C.

Faculty of exercise and Sport Sciences of Bologna University, Italy

Aim of this study was to check the efficacy of 3 different activities for postural and balance control improvement. The first activity was represented by the Decompensated Global Muscular Stretching (DGMS) using Pancafit®, the second one by Proprioception activity (using Prokin 324®, Trial equilibrium-board, Fitball – tapis-roulant Aimachine®) and the third one by the fusion of the 2 preceding activities.The working hypothesis was that the combination of 2 different activities (DGMS and Proprioception), could be more effective than one single activity.

Methods: In each group there were 8-9 volunteers (17 female and 19 male) aged from 20 to 37 yrs (av.24.6).The activities that were carried out were the following: Experimental group: both DGMS and Proprioception activity (P.A.);Group1:onlyDGMS activity;Group2:only P.A.; Group3:no activities at all. Each group practised for 10 training sessions (1 hour each) 2 times a week.

The following tests were performed: postural test (surface e.o. r=0,30 e.c. r=0,35 p<0,05 and length e.o. r=0,60 e.c. r=0,60 p<0,05) with Correckta BR/2034; Vertical Barrè test (r=0,56 p<0,05); Fukuda Test (r=0,65 p<0,05); Proprioceptivity Prokin test (r=0,64 p<0,05) .

The collected data were analysed by the T-student test. Data distribution were analysed by the kurtosis,asymmetry,average,SD (av.+3DS, av.-3DS).

Analysis:data analysis,showed that group1 had obtained the best results in all the tests. Experimental group and group2 had even worse results in the Fukuda test. Group3 didn't show improvement in any test. In the proprioceptivity test, the group1 showed less improvement, than the group2 and the experimental group. In the Vertical Barrè test the group1 showed the most improvement compared with the other groups. In the Fukuda test only the group1 showed improvement. Group3 didn't show any improvement.

Data analysis show us that the DGMS is the best method for the recovery of the postural and balance control. The single P.A. does not resolve problems of postural nature but helps only the control of the equilibrium. That means that the improvement of such control has repercussions, in the sense of the assimilation of negative habits adaptations denied to you, on the posture.

That is demonstrated by the worsening in the test of Fukuda.

ConclusionsDGMS activity seems to be the first step in any activity of functional re-education. The importance of the reduction of the muscular retractions is the turning point in encouraging a correct posture that acts as inevitable condition for the other methods. Probably the mixed group didn't improve as much as we expected, because the DGSM activity has not been enough or has been compromised by the P.A. that has not facilitated the reduction of the muscular retractions.

References: P.Fransson et al "Analysis of adaptation in anteroposterior dynamics of human postural control"-Gait and posture7(1998)64-74. F.Tjerstron et al.

RECONSTRUCTION OF TALAR OSTEOCHONDRAL LESIONS WITH MOSAICPLASTY FROM THE KNEE JOINT

Leumann, A., Valderrabano, V., Pagenstert, G., Hintermann, B.

Lower Extremity Orthopaedics, Switzerland

Introduction

Osteochondral talar lesions are frequent injuries in ankle sprains and may lead to persistent pain, constriction of range of motion, sports stop, or even degenerative joint disease. Many surgical therapies have been described for talar osteochondral lesions treatment: chondrozyte transplantation, mosaicplasty, retrograde drilling, microfacturing, and others. However, despite this variety of methods, no mid- and long-term results in the modern treatment of talar osteochondral lesions are available.

Methods

Between 02/2000 and 10/2005 22 patients with a symptomatic osteochondral talus lesion Berndt and Harty grade II-IV were treated with a mosaicplasty (Hangody et al. JBJS 2003). The osteochondral grafts were harvested at the ipsilateral knee joint. The analyzed variables were: pain (VAS, 0-10), AOFAS hindfoot score for functional assessment (points 0-100; Kitaoka et al. FAI 1994), clinical examination of donor side morbidity, arthritis grade (x-ray), chondropathy grade (Outerbridge I-V), magnetic resonance imaging and diagnostic arthroscopy.

Results

22 patients with an average follow-up of 4 years and one month were evaluated after reconstruction (range: 4-72 months; average age 34 years (range: 19-51 years old)). The lesions measured in average 1.8 cm2 (range: 0.25-9cm2). 2/3 were located on the lateral edge of the talus, 1/3 on the medial side. 2.5 cylinders were used in average (range: 1-6) between 4.6 and 12.7 mm in diameter. Six patients (27%) showed postoperative knee pain that needed further treatment. Nine patients (40%) showed concomitant chronic ankle instability that was corrected in the same operation. Further results will be discussed at the conference.

Discussion

The ideal therapy for talar osteochondral lesions remains unsolved. One of the options is the reconstruction with autologous bone-cartilage transplantation (mosaicplasty) from the knee joint as described in this report. Although long-term results are lacking concerning function, pain and secondary osteoarthritis, "knee-to-talus mosaicplasty" showed restricted results, and – in the opinion of the authors – causes significant donor side morbidity.

THE PERCUTANEOUS SUTURE FOR THE RUPTURE OF THE ACHILLES' TENDON IN A MODIFIED TECHNIQUE - A USEFUL ALTERNATIVE FOR AVOIDANCE OF DAMAGE OF THE SURALIS NERVE-

Baraliakos, X., Meyer, O., Mieles, A., Godolias, G.

St. Anna Hospital Herne, Germany

Introduction:The percutaneous suture of the ruptured Achilles' tendon, as described by Ma et al. is a useful alternative surgical technique for this indication. The benefits and disadvantages of this technique, as compared to the open suture technique or also the primary functional (conservative) treatment has been reason for discussions of the 'adequate' treatment of this injury since several years.

Objectives: In this prospective study, we analysed the clinical outcome of the percutaneous rupture of the Achilles' tendon in athletes, as described by Ma et al. Furthermore, we developed a modified technique with variation of placement of the incisions in order to minimize the intraoperative risk of damage of the suralis nerve. For performance of the suture, an unbowed needle was used as a further technical variation to the techniques described in the literature.

Materials and Methods: Overall, 93 athletes with rupture of the Achilles' tendon have been treated in our clinic between January 1998 and December 2003. All injuries occurred during warming up or full exercise. All athletes were treated by using the percutaneous technique; the first 23 (24.7%) were treated with the original technique and the other 70 (75.3%) with the modified technique, as proposed in this study. Follow-up examination was performed after a mean of 29 months (range 19-33 months)

Results: Overall, 84/93 (90.3%) of the athletes reported a 'good' or 'very good' clinical and functional outcome at follow-up. Full activity levels could be reached after a mean of 18.3 weeks and 81/93 (87.1%) of the athletes reported similar activity levels as before injury. Intraoperative damage of the suralis nerve was found in 7/93 (7.5%) and in 3/93 (3.2%) of the athletes when using the original technique and the modified technique, respectively, and recurrence of hypaesthesia was seen in 9 of these 10 patients (90%). Achillodynia during exercise was reported in 14/93 (15.1%) of the athletes. There was no athlete complaining functional dysfunction postoperatively. However,

rerupture of the Achilles' tendon occurred in 3/93 (3.2%) of the subjects and had to been treated with open suture surgery. Overall, no infections, no wound healing failures and no thrombosis occurred in any of the patients.
Conclusions: Percutaneous suture of the ruptured Achilles' tendon of the athlete is a very promising alternative, as compared to the open surgical technique. By using the modification proposed here, the risk damage of the suralis nerve can be considerably decreased.

EXPOSURE IN ALPINE SKI RACING - REASONS FOR KNEE INJURIES AND OTHER SEVERE TRAUMAS

Spitzenpfeil, P., Lipfert, S., Burger, S., Waibel, K.-H., Hartmann, U.
TU Munich, Faculty of Sport Science, Germany

INTRODUCTION
From the very beginning alpine ski racing has been regarded as a sport characterized by high exposure (Crim 2003). Apart from the classic anterior cruciate ligament (ACL) injury, an increase of complex injuries coupled with nearby-joint fractures of the lower limb, such as tibial condyle fractures, have been observed lately. Results on injury mechanisms or causal relationships, however, are not available at this time. Most previous studies were more concerned with statistical analyses of accidents in recreational skiing or biomechanical relationships regarding ACL-injury (Greenwald et al. 1997; Pecina 2002). Until this day there is a lack of extensive multidisciplinary studies on complex knee joint injuries including nearby-joint fractures. Based upon previous studies (Spitzenpfeil et al. 2005) this paper tries to focus on causes and consequences of overbalance situations for potential knee injuries by analyzing video recordings of downhill races from 1999-2003.
METHODS
Video tapes of nearly all elite downhill and super giant slalom ski races of the winter seasons 1999/2000 until 2002/2003 were digitized, compressed and stored. Based upon our previous studies a scheme of four overbalance categories (minor instabilities, major instabilities, almost crash, crash) was further developed and transferred into a SIMI Scout project. Additionally a new scheme of categories was developed to analyze crashes and their respective progression.
Additional data obtained for each overbalance situation were processed using the software SPSS to receive frequency counts. Comparisons were made between this data and that obtained in the previous studies.
RESULTS AND DISCUSSION
An increase of overbalance situation from 1999 (21%) to 2003 (49 %) could be detected. It is more dramatical in men than in women. The category "minor instabilities" recently occurs more frequently than crashes and almost crashes. Concerning potential reasons for ACL-injuries 20 % of the observed situations would fit into typical injury mechanisms like "phantom foot" (6%) or "boot induced" (20%). Dominating terrain for "phantom foot" related situations was the straight gliding phase facilitating the cause "false cutting". Detailed data concerning the progression of crashes will be presented at the congress.
References
Crim, J.R.(2003). Winter sports injuries. The 2002 Winter Olympics experience and a review of the literature. Magn Reson Imaging Clin N Am., 11(2), 311-21.
Greenwald, R.M., Swanson, S.C., McDonald, T.R. (1997). A Comparison of the Effect of Ski Sidecut on Three-Dimensional Knee Joint Kinematics During a Ski Run. Sportverl Sportschad., 11, 129-33.
Pecina, M. (2002). Injuries in Downhill (Alpine) Skiing. Croat Med J., 43(3), 257-60.
Spitzenpfeil, P., Lipfert, S., Gaebe, M., Waibel, K.-H., Burger, S., Hartmann, U. (2005). Causes and consequences of overbalance in alpine skiracing – a qualitative video analysis since 1994.

11:40 - 13:10

Invited symposium (IS)

IS2-06 The World Antidoping Code: from implementation to future challenges - "Athene"

INTERNATIONAL STANDARDS FOR LABORATORIES

Saugy, M.
Swiss Laboratory for doping analyses, Switzerland

The purpose of the International Standard for Laboratories is to ensure production of valid test results and evidentiary data and to achieve uniform and harmonized results and reporting from all accredited laboratories.
All laboratories are certified under the ISO 17025 rules. The World Anti-doping Agency has the duty to control the efficiency of the Laboratory network. External round tests are organized in order to improve the overall system and to be sure that the detection methods are fitting for the purpose defined in the World Anti-doping code. The chain of custody for any anti-doping sample must be strictly followed in order to prevent any formal discredit of a result. In some case, a second opinion on an adverse analytical result can be requested to assure an optimal result management. Research and development in the doping analyses are now formally part of the accreditaion scope of the accredited laboratories.
These international standards have been created in order to guaranty to the athletes similar treatment of their biological sample from the analytical point of view all over the world.

INTERNATIONAL STANDARD FOR TUE, A MEDICAL APPROACH OF THE FIGHT AGAINST DOPING

Garnier, A., CH

Without abstract submission.

INTERNATIONAL STANDARD FOR THE PROHIBITED LIST, THE VIEW OF INTERNATIONAL FEDERATIONS

Alonso, J.M.

Inernational Association of Athletics Federations, Spain

The Prohibited List (List) was first published in 1963 under the leadership of the International Olympic Committee. Since 2004, as mandated by the World Anti-Doping Code (Code), WADA is responsible for the preparation and publication of the List. The List is a cornerstone of the Code and a key component of harmonization. It is an International Standard identifying Substances and Methods prohibited in-competition, out-of-competition, and in particular sports. Substances and methods are classified by categories (e.g., steroids, stimulants, gene doping). The use of any Prohibited Substance by an athlete for medical reasons is possible by virtue of a Therapeutic Use Exemption. Guidelines for the annual review and consequent publication of the List are outlined in the Code. The agreed process for the annual consideration of the List includes three meetings (see timeline below) of the WADA List Committee with a draft discussion List being published and circulated for consultation in June, following the second meeting.At its third meeting, the List Committee, in September, following full and proper consideration of the submissions received from the consultation process, recommends the new List to the Health, Medical and Research Committee which in turn makes recommendations to the WADA Executive Committee. The Executive Committee at its September meeting finalizes the List. The updated List is published by October 1 and it comes into effect on January 1 the following year.

CHANGES IN PUBLIC PERCEPTION OF DOPING IN SPORT IN SWITZERLAND 1995-2004

Kamber, M., Stamm, H.P., Mahler, N., Lamprecht, M., Marti, B.

Federal Office of Sports, Magglingen, Switzerland

Objective:

To assess the changes in the public awareness of doping in sport and its prevention issues over a period of 9 years in Switzerland and to compare some of the results with the answers from a survey with top level athletes.

Design:

The surveys were carried out with population-based representative telephone surveys in the years 1995, 1998, 2001 and 2004 as well as with a written questionnaire for top level athletes in 2006. The core questions in the telephone surveys remained the same throughout the observation period. The topics covered doping and ethics in sports. The time to conduct the telephone surveys was always late summer and fall and there was never any particular media attention to doping issues during these periods. The questionnaires had eight (1995), twenty-five (1998) twelve (2001) and nineteen (2004) items. The questions were pretested for each run on a smaller number of respondents. The questions concerning doping and ethics were embedded in the telephone surveys of 1998, 2001 and 2004 within broader surveys about the respondents' physical activity behavior. The survey with top level athletes was carried out at the end of 2005 and beginning of 2006.

Setting:

Population of Switzerland and top level athletes in the Swiss registered control-pool.

Participants:

1201 (1995), 800 (1998), 1535 (2001) and 2114 (2004) respondents between 18 to 74 years old, selected by stratified random sampling and top level athletes (2006).

Main Outcome Measures:

When asked about the main problems in sports (survey of 2004).

Invited symposium (IS)

IS2-07 Physical activity promotion through primary care - "Innsbruck"

REDUCING RISK FACTORS BY EXERCISE IN GENERAL PRACTICE

Fritz, T., SE

Without abstract submission.

A QUALITATIVE APPROACH TO THE DEVELOPMENT OF PHYSICAL ACTIVITY PROMOTION IN PRIMARY CARE

Bize, R., Cornuz, J., Martin, B.

Federal Office of Sports, Magglingen, Switzerland

Introduction: A number of physical activity promotion models for primary care have been developed in Switzerland over the last few years. None of them has however been taken up by general practitioners on a wider scale.

Objective: To assess opinions, beliefs and behavior of a sample of Swiss physicians regarding physical activity (PA) promotion in a primary care setting, in order to develop, together with the results of focus groups interviews, a widely acceptable concept and the material for PA counseling in this particular setting (written booklets for patient, manual for physicians training, and a prescription form).

Methods: We conducted a qualitative study with semi-structured interviews among 16 physicians in the French speaking part of Switzerland. Nine were primary care physicians (GPs), four were mainly involved in preventive medicine, and three mainly involved in the field of physical activity.

Results: The main themes that were explored are presented below.

Screening for sedentary lifestyle and counseling practices - History regarding physical activity is consequently taken with new cases, but not in a systematic manner. Counseling is more likely to be delivered if other cardiovascular risk factors are present.
Counseling techniques - According to some interviewees, more emphasis should be put on well-being as a motivational tool, rather than on disease prevention.
Barriers to counseling - Lack of time, lack of reimbursement, lack of clear guidelines
Interventions advocated by GPs for PA promotion in a primary care setting – Screening for sedentary lifestyle, booklets accompanying physician counseling, patient orientation to structured fitness programs or to specially trained counselors.
Effectiveness of counseling – Most physicians describe themselves as rather pessimistic in their perception of counseling effectiveness.
Management of the numerous prevention topics – Practical continuing education directed to motivational interviewing skills and topic-specific tools are requested.
Conclusions: In order to find wider acceptance in primary care settings, the conception of physical promotion should take into account physicians' attitudes and expectations, address their perceived barriers (lack of time, reimbursement and clear guidelines) and try to improve their self-efficacy in physical activity counseling. Such an approach is currently being developed jointly with the Swiss College of Primary Care Medicine. Its feasibility, acceptance and use, will be further tested among a sample of family physicians.

EXERCISE ON PRESCRIPTION (EOP) - DANISH EXPERIENCES

Puggaard, L., DK

Without abstract submission.

Invited symposium (IS)

IS2-08 High altitude training - "St. Moritz"

ALTITUDE TRAINING: IS HIGH-HIGH OR HIGH-LOW BETTER THAN LOW-LOW?

Friedmann, B.

University Hospital Heidelberg, Germany

Altitude training is frequently performed by elite endurance athletes assuming that an increase in total hemoglobin mass (red cell volume) and/or muscular adaptations, both of which are typical for altitude acclimatization, might outlast the altitude sojourn and cause an improvement in sea-level performance. The results of controlled studies on the effects of classical altitude training with living and training at moderate altitude (High-High) are equivocal. Especially in elite endurance athletes, there is a lack of scientific evidence for High-High being superior to equivalent training at sea level (living low-training low, Low-Low). It was reasoned that reduced training intensity at altitude due to the decrement in aerobic capacity has detrimental effects on sea level performance. Therefore, living at moderate altitude and training at low altitude (High-Low) was introduced as an alternative form of altitude training to acquire the advantage of altitude acclimatization without the need to adapt the training program to hypoxic conditions. As there are only a few natural sites where High-Low can be performed with reasonable daily travelling altitude rooms and hypoxic tents are often used for the realization of High-Low. However, the findings of a few controlled studies investigating the effects of this training regimen on sea level performance are controversial while the results of only one study which compared the effects of High-Low with High-High suggest that High-Low is superior to High-High.
Some methodical problems exist for all altitude training regimens. Especially, randomized controlled studies with a sufficient number of elite athletes (VO2max of at least 70 ml/kg*min) are difficult to perform and are therefore lacking. Furthermore, in most studies on the effects of training at altitude, little or no attention was paid to the fact that there is a great inter-individual variation in the reduction of performance and heart rate at equivalent exercise intensities compared to sea level. It seems possible that in some studies sea-level performance was not improved because of suboptimal training during altitude exposure. One essential question is which endpoint should be used in altitude studies. In elite athletes it has to be performance capacity in a discipline which is also chosen in competition. VO2max – which undoubtedly can be increased by an augmentation of total hemoglobin mass – has frequently been used as a measure for performance capacity. However, VO2max is only one component for performance in endurance sports and performance at the maximum steady state intensity, exercise economy and anaerobic capacity must also be considered. Therefore, time trials might be the most suitable tests. As only few studies meet some of these criteria further investigation is needed to answer the question if High-High or High-Low is better than Low-Low.

POTENTIAL MECHANISMS ACCOUNTING FOR PERFORMANCE IMPROVEMENT BY HIGH-HIGH OR LOW-LOW

Bärtsch, P.

University Hospital Heidelberg, Germany

Classic high altitude training and the training modality Live-High-Train-Low (LHTL) both lead to ventilatory acclimatization and to an increase in red blood cell mass (RBCM), given that the exposure to hypoxia is ≥ 14 hours at an ambient PO2 equivalent to at least 2500 m in LHTL. Double-blind controlled studies of erythropoietin administration demonstrate that a 10 % increase of RBCM leads to a 7 % improvement in VO2max. Thus, if living at real or simulated high altitude leads to an increase of RBCM in the order of 10 %, a significant effect on aerobic performance can be expected, while ventilatory acclimatization is most likely not relevant for sea-level performance. Additional effects have been suggested to account for an improved sea level performance after LHTL or classic high altitude training, such as improved anaerobic capacity due to increased buffer capacity and increased mechanical efficiency due to preferential carbohydrate utilization in hypoxia. The results of various studies, many of which were uncontrolled, yielded controversial results. Furthermore, buffer capacity can also be increased by high training intensity at low altitude and the relevance of both proposed mechanisms for sea level performance has not yet been clearly established.

TRAINING IN HYPOXIA FOR SEA LEVEL PERFORMANCE: POTENTIAL MECHANISMS AND EVIDENCE

Vogt, M., Angermann, M., Graber, F., Flück, M., Hoppeler, H.

University of Bern, Switzerland

Altitude training is very popular among endurance athletes. It is used to increase endurance exercise performance or to prepare for competition at altitude. Although well controlled studies showed increases of performance determining variables, endurance athletes in general respond very differently to acute altitude exposure and to altitude training. For example there are individual differences in the altitude dependent decrement of maximal oxygen consumption and exercise performance as well as in the response to hypoxia challenges.

Mechanisms which lead to this individual response are not well known. To search for possible muscular factors explaining individual differences of the acute performance decrement at altitude we recently tested Nordic combined skiers under simulated hypoxic conditions corresponding to an altitude of 3200m. High decrement of maximal oxygen consumption at altitude was associated with high intramuscular lipid content and low myofibrillar density in deltoideus muscle. These results suggest that ultrastructural characteristics of skeletal muscles may explain at least to a part the altitude dependent loss of aerobic performance in trained athletes.

Currently, there are two seemingly opposite training paradigms proposed to use altitude (or hypoxia) as an ergogenic aid. Beside "live high – train low" by which an improvement of the oxygen transport capacity is expected, the concept of "live low – train high" has also received attention. For this latter regime, athletes train under simulated or natural hypoxic conditions, while recovery time is spent at sea-level or normoxia. Several studies show that aerobic and anaerobic endurance performance can be improved with "live low – train high". Molecular analysis reveals that a transcription factor called Hypoxia-Inducible Factor 1 (HIF-1) acts as a master gene in the regulation of hypoxia dependent gene expression. In human skeletal muscle "live low – train high" induces the expression of glycolytic enzymes, antioxidative enzymes, the angiogenic factor VEGF, myoglobin as well as the increase of capillarity and mitochondrial content in parallel to the induction of the HIF-1 system. In trained human skeletal muscle, these adaptations cause a shift of substrate selection to an increased oxidation of carbohydrates as well as to an improvement of the conditions for transport and utilization of oxygen.

We gained experience with using hypoxia in the training of top-level athletes. This training mode may have practical implications of using hypoxia as an ergogenic aid.

Invited symposium (IS)

IS2-09 Decision making in collective sport - "Albertville"

ASSESSING COLLECTIVE DECISION MAKING IN SPORT BY A POSTERIORI METHODS: CASE STUDY IN TEAM HANDBALL

Lenzen, B. 1, Theunissen, C. 2, Cloes, M. 2

1 University of Geneva (Switzerland), 2 University of Liège (Belgium), Switzerland

Team sports provide a big challenge in term of decision making for players and pupils, coaches and teachers, and researchers. Most of the research on decision making in sport has been conducted in connection with expertise, and the majority of researchers working on cognitive expertise have adopted an information-processing framework for studying decision making in simulated settings. In contrast, we prioritized a posteriori methods within the framework of the ethnomethodologic approach of situated action. Three aspects of this theory are of particular interest for research on decision making in sport: (a) the relation between planning and action; (b) the perception-action coordination; and (c) the distinction between first person and third person representations. The first one is expressed by the distinction between strategy and tactics in team sports. The second one results in the recommendation that perception and action should be coupled for the analysis of performance. Finally, the third aspect deals with the risk of confusion between the frame of reference of the decision maker and the one of the scientist studying him or her, and means to reduce it.

Aiming to demonstrate the interest and the validity of a posteriori methods for exploring the relation of knowledge and action to the particular and ever-changing circumstances of complex sport situations, we submitted six elite female handball players to self-confrontation interviews about two previously played and video recorded championship matches. Players were notably asked the following questions: (a) Can you describe what happened at this moment (the moment illustrated by a previously selected video sequence)? (b) Which information did you take into account? (c) What was the principle that you applied? (d) What is the origin of this principle?

Findings emerging from the qualitative analysis of players' retrospective verbalizations may be distinguished depending on whether they (a) provide help understanding how subjects make decision in already studied simulated settings or (b) prefigure novel variables that can be used for further model specification. We describe as non-situated elements those referring to strategy, which influence players' decision making independently of the context of the game situation (e.g., visual cues, offensive/defensive tactical concepts) and as situated elements those which depend strongly on the context of the game situation (e.g., auditory/tactile cues, knowledge about oneself's weakness/strengths, knowledge about teammates' weakness/strengths, knowledge about the opponent's usual play, difficulty of the match). The latter deal more deeply with the collective aspects of the decision making process. These situated elements need to be further addressed before models in decision making can be applicable to real-world sport settings, in a way to develop on this basis more effective training and teaching sessions.

DECISION-MAKING OF ELITE RUGBY PLAYERS IN GAME SITUATIONS

Mouchet, A.

Université Paris XII, France

We are interested by complexity and subjectivity in the decision making of elite rugby players in game (Mouchet, 2005a). An interbreeding method contributes to enlighten the private and public dimensions of decisions, by articulating the player point of view and the researcher point of view (Mouchet, Bouthier, in press). We do in case studies a data triangulation between:

- Player's conceptions about the general movement of the game, with a semi-steered interview before the match.
- Actions description in a game sequence extracted of the match and chosen by the researcher. We use video-computer analysis.

- Subjective lived of the player in the considered actions with an "explicitation interview" (Vermersch, 2004) after the match. This interview is the most important, because it allows us to accede to the details of the action by the player's own logic. We can understand by the player's point of view the meaning of his game situation elaboration, and his decisions.

The major results underline many points about the decision making activity.

- Players' subjective relations to shared elements of the team, as game project often elaborated by trainers.
- Peculiar and subjective mobilization of the different sources of influence, as decisional background which includes for example the player's experience in other situations or strategies defined for the match.
- Flexibility in the decisions which are emergent or more deliberated. It's often depends of the defence pressure on the ball bearer. This flexibility can be considered as factor of creativity, and is interesting for the articulation between strategy and tactics (Mouchet, 2005b).
- Subjectivity in the attention dynamics of the ball bearer. For instance in his own construction of configuration of play.

Methods and results allow us to draw some tracks for training. We try to mobilize verbalisation for the development of players' competences, and for the construction of a common repository in the team.

References

Mouchet, A. (2005a). Modélisation de la complexité des décisions tactiques en rugby, E-Journal de la Recherche sur l'Intervention en Education Physique et Sport, 7, 3-19.

Mouchet, A. (2005b). Subjectivity in the articulation between strategy and tactics in team sports: an example in rugby., Italian Journal of Sports Sciences, 12, 24-33.

Mouchet, A., Bouthier, D. (in press). Prendre en compte la subjectivité des joueurs de rugby pour optimiser l'intervention, STAPS, 72.

Vermersch, P. (2004). L'entretien d'explicitation, Paris : ESF.

FOOTBALL PLAYERS' MENTAL REPRESENTATIONS OF GAME SCENARIOS: DOES EXPERTISE COUNT? A PSYCHOLINGUISTIC INVESTIGATION

Gygax, P.

University of Fribourg, Switzerland

In order to progress through a competitive sporting event, athletes need to build a mental representation of the event. The information included in such a representation will determine an athlete's behavioural and mental responses. In this paper, we present two studies exploring the mental representations of Swiss football players at different levels of expertise, when presented with textual information. In Study 1 (off-line), 1st Division and 5th Division players were asked to write about performing in competitive scenarios after being provided an introductory sentence constraining the scenario. The results were analysed using a recurrent category coding system. Most importantly, the results showed that players of less expertise were more self-oriented and included more emotional content in their mental representations. In Study 2a and 2b (on-line), we presented players of three different levels of expertise with different scripts (National League, 1st Division and 5th division), constructed with the information provided in Study 1, and measured the participants' reading times focussing on the orientation of focus (self-orientated vs other-oriented) and sentences with an emotional valence. Although we found differences between 1st Division players and 5th Division players, suggesting that 1st Division players' mental representation more easily includes others and less readily includes emotions, we found that National League players were very similar to 5th Division players in their mental representations of game scenarios. It is suggested that although the results from the 5th Division and the National League were similar, different cognitive processes underlie the construction of the players' mental representation.

Invited symposium (IS)

IS2-10 Sport and rehabilitation engineering for feel and control - "Berlin ABC"

MATHEMATICAL MODELS IN SPORT PHYSIOLOGY

Quarteroni, A., D'Angelo, C.

EPFL (Ecole Polytechnique Fédérale de Lausanne), Switzerland

Physical exercise involves extremely complex physiological processes. For instance, it is known that several biochemical phenomena with a number of chemical reactants take place during efforts such as running, swimming and almost all sport activities. They are highly interdependent, and the way they interact changes with respect to workload and other physiological parameters. Performing an accurate analysis of sport physiology based on individual characteristics is therefore a difficult task. Due to the intrinsic interest of such analysis for a number of applications, for instance in the pharmacological study of drug administration, we propose some mathematical models, aiming at obtaining relevant informations about the response of the body to the effort condition.

The main actors among the physiological processes sustaining exercise are

1. the biochemical reactions in skeletal muscle;
2. the substrate (oxygen, glucose, lactate, . . .) transfer between blood and tissues;
3. the cardiovascular feedback with respect to the arterial pressure and substrate concentrations (i.e. the baroreflex and chemoreflex effect).

We describe suitable models for these three phenomena and show how they can be coupled together. The coupled models can describe the autoregulation effects

that typically affect the cardiovascular system and the metabolism of tissues. Our approach involves lumped models as well as distributed models.

Lumped models feature several compartments that describe different parts/organs of the human body (skeletal muscles, blood vessels, other tissues, ...).

The variables of such models are averaged quantities on each compartment rather than spatial distributions, so that the computational cost of simulation is reduced. To apply the model, the identification of unknown parameters related with metabolism and biochemical reactions is required: typically they are obtained by optimization techniques.

Distributed models are proposed for flow analysis and chemical transport processes in blood vessels. They is able account for the geometry of vessels or tissues; on the other hand, they have a more pronounced computational cost. We show some examples of the use of the so-called 1D models for analysing blood flow and mass transport, and of more complex 3D/1D models.
Some typical applications will be discussed as well.

BODY FIXED SENSORS AND THEIR APPLICATION IN SPORT SCIENCE

Aminian, K., Favre, J.

Ecole Polytechnique Fédérale de Lausanne, Switzerland

Camera based motion capture, force-plate and instrumented walkway are the most commonly used system for movement analysis. Systems using these technologies are available on the market, but they provide information for a limited period of time and could be used only in a closed environment. In order to overcome limitations of these technologies, some investigators attached sensors on body segments to measure kinetics or kinematics features. Body fixed sensors (BFS) have several advantages. First, they allow mobile and outdoor motion capture. Second, they can provide information over extended periods of time. Third, frequency sampling is higher and several hundred hertz can be reached with existing datalogger. Finally, BFS approach is very similar to sensory system used in human movement control.
Here we review the use and application of the main BFS such as goniometers, foot pressure sensors, accelerometers, earth magnetic sensors and gyroscopes in human ambulatory monitoring. We outline the advantage of new technologies based on BFS and particularly the possibility to perform field measurement and during the actual condition of the subject. The relevance of intelligent computing and its potential to enhance those features hidden in biomechanical signals are reviewed. An emphasis is made to show the results produced by these sensors when used alone and new possibilities offered when the information from different type of BFS are fused. We provide some applications related to sport science where BFS are used to improve athlete performances, training or rehabilitation. The first application is the assessment of spontaneous physical activity in order to provides valuable information about posture allocations (sitting, standing, lying, walking, …) and allowing a better evaluation of moving ability and energy cost of the subjects. The second application concerns the 3D evaluation of body segments and joints. 3D knee function obtained in this way gives many outcomes for ligament rupture evaluation before and after surgery. The third application is related to jump performance where our results demonstrate that a simple ambulatory system provide a precise analysis of the principal parameters of the vertical jumps such as velocity, force, power, height, takeoff. Finally, using BFS, we provide a new approach to estimate multi-segment joint coordination during cyclic movement such as walking.
Based on these results, we believe that new technologies using BFS are well adapted for field measurement in sport science and provide outcomes which can be used for training, rehabilitation and physical activity monitoring.

FUNCTIONAL COMPOSITE MATERIALS FOR IMPROVED FEEL AND CONTROL

Fischer, C., Bourban, P.-E., Michaud, V., Manson, J.-A.

Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland

High-end alloys and polymer composites are extensively used in sporting goods. Recently, the development and integration of "smart"- and "active" materials into composite structures have been a major topic of interest. These novel materials could improve the human-material interaction and thus provide better feel and comfort when practicing sports involving an equipment.
To illustrate this concept, it is generally accepted that classical design changes that cause an increase in damping will cause corresponding reductions in stiffness and strength. Thus, the integration of adaptive materials into composite structures to better control vibration and stiffness represents an area of considerable interest. Structures based on well-established "smart" systems (e.g. containing predeformed shape memory alloy (SMA), electro-rheological (ER) and magneto-rheological (MR) fluids) provide means of modifying vibrational properties via external stimuli in a wide range of applications. To avoid the need for an external power source, a material that changes its properties according to the loading conditions would be ideal. Such behavior is characteristic of shear-thickening fluids (STFs), which show a marked increase in viscosity beyond a critical shear rate. In the framework of this project, we have shown that the incorporation of a tailored STF into sandwich structures simultaneously lead to stiffness and damping changes of the structure under certain dynamic loading conditions. Such properties are thought to be very interesting for highly deformed structures such as alpine skis, and a first attempt to integrate STFs into skis showed promising results.
Beyond the activities focusing on materials development, we have recently developed a methodology to determine the influence of several characteristics of a sports equipment on the athletes' perception, in the perspective to assess the influence of novel materials on the users' "feel and control". Using alpine skis as a case study, this method has shown to provide a tool that relates the subjective evaluation of the athlete to the intrinsic mechanical and dynamic properties of sports equipment.
This project is part of the Sports and Rehabilitation Engineering program (SRE) at EPFL, and is being carried out in collaboration with scientists from the Brain Mind Institute (BMI).

Oral presentation (OP)

OP2-06 Physiology 6/10 - "Oslo"

BODY PLETHYSMOGRAPHY AT HIGH ALTITUDE (4559 M): NO EVIDENCE FOR INTERSTITIAL PULMONARY EDEMA IN MOUNTAINEERS WITH AND WITHOUT ACUTE MOUNTAIN SICKNESS

Schendler, G., Luks, A., Menold, E., Berger, M.M., Bärtsch, P., Swenson, E.R., Dehnert, C.

University Hospital Heidelberg, Germany

Blood gas analysis and measurement of vital capacity (VC) have yielded indirect evidence that acute mountain sickness (AMS) is associated with mild interstitial pulmonary edema.
Since interstitial pulmonary fluid accumulation should also alter pulmonary compliance and airway resistance especially in the smaller airways, the aim of our study was to perform extensive pulmonary function testing by body plethysmography and compliance measure-

ment. After baseline measurement at low altitude, 34 healthy subjects ascended to 4559 m within 24 h and were tested 2-4 h (HA-day1), 20 h (HA-day2) and 44 h (HA-day3) after arrival. Severity of AMS was assessed by Lake-Louise-score and ESQ-C-score, additionally chest radiographs were taken to diagnose HAPE at each time point.

HAPE was diagnosed by clinical examination and chest x-ray in 4 subjects, which were excluded from the further analysis presented here. AMS was diagnosed in 16 (53%) of the 30 remainder subjects. None showed any sign of HAPE. Pulmonary function testing showed no differences between low altitude and measurements at high altitude for total lung capacity, vital capacity, forced expiratory volume in the first second, airway resistance, and dynamic and static compliance. Differences from low altitude were found in peak expiratory flow at HA-day1, HA-day2 and HA-day3 and for mid-expiratory flow at 75% of vital capacity at HA-day1 (ANOVA, post hoc t-test, $p < 0.05$). There was no correlation in any parameter of pulmonary function testing and severity of AMS.

The fact, that lung volumes, airway resistance, and pulmonary compliance are unchanged at high altitude indicates that no relevant interstitial fluid accumulation occurred in these subjects. The lack of correlation of AMS-scores and pulmonary function testing suggests that the development of AMS is not associated with interstitial pulmonary fluid accumulation and that the reported deterioration in gas exchange efficiency in AMS must have some other cause.

EFFECT OF COLD WATER IMMERSION ON CORE BODY TEMPERATURE, MUSCLE FUNCTION, AND LOWER LIMB BLOOD FLOW FOLLOWING PROLONGED ENDURANCE CYCLING IN THE HEAT

Peiffer, J., Abbiss, C., Peake, J., Nosaka, K., Suzuki, K., Laursen, P.

Edith Cowan University, Australia

The benefits of cold water immersion as a means of aiding recovery from prolonged exercise in the heat has been, to date, largely anecdotal. PURPOSE: This study was conducted to examine the influence of cold water immersion on indices of muscle function, body temperature and femoral blood flow following prolonged cycling in the heat. METHODS: Ten well-trained male cyclists (Age: 27+/-7 yrs, Height: 181.1+/-6.4 cm, Weight: 77.9+/-6.6 kg, %body fat: 8.5+/-2.7%, VO2max: 61.7+/-5.0 ml/kg/min, Peak power: 343+/-24 Watts) completed two exercise trials consisting of 90min cycling at a constant power output (64+/-3.6% peak power) followed by a 16.1km time trial in the heat (32DegC, 40% relative humidity). Following the trial, subjects were assigned in a randomized crossover fashion to complete either 20 min of cold water immersion (CWI; 14DegC) or control condition (CON) consisting of sitting in a thermo neutral room (~21DegC; 40%rh). Rectal temperature (Tre) was measured continuously throughout the duration of the trials with values averaged every 5 min. Femoral artery and vein diameter (FAD and FVD, respectively) were measured at the right femoral artery bifurcation (FAB) and right mid-thigh (RMT) using ultrasonography, and maximal voluntary contractions (MVC) and electrically stimulated (1sec, 80volts, 100Hz, square wave) MVC (SMVC) were performed pre-exercise, 5 min post-exercise, 45 min post-exercise (5 min post CWI) and 90-min post-exercise. All data were analyzed using a repeated measures ANOVA with significance set at $P<0.05$. RESULTS: Tre was significantly lower in CWI (37.1+/-.7DegC) versus CON (37.4+/-.7DegC) at 55 min post-exercise which persisted throughout the remainder of the trial ($P<0.05$). MVC and SMVC decreased significantly from the pre-exercise values at all time points for both CWI and CON trials ($P<0.05$). MVC and SMVC were significantly less at 45 (218+/-57.4 vs. 234.8+/-48.3, 208.7+/-58.7 vs. 212+/-59.8 N*m) and 90 min (218.6+/-57.4 vs. 234.8+/-48.3, 212.7+/-59.8 vs. 242.6+/-45.0 N*m) in the CWI vs. CON condition ($P<.05$). While FVD at FAB was not significantly different at any of the time measurements in the CWI versus CON condition, the FAD at FAB was significantly decreased 90 min post-exercise in the CWI vs. CON trial (0.68+/-0.09 vs. 0.74+/-0.11 cm; $P<0.05$). FVD at RMT was significantly decreased in the CWI vs. CON trial at 45 min post-exercise (0.87+/-0.15 vs. 0.95+/-0.16 cm; $P<0.05$), but no significant differences were observed between the CWI and CON trial for FAD at RMT . CONCLUSION: 20 min of cold water immersion (14DegC) following prolonged cycling in the heat significantly lowered Tre. Decrements in MVC and SMVC were apparent for up to 45 min post CWI. Decreases in FAD and FVD may affect blood flow to and from exercised muscle which could have negative consequences for acute muscular recovery. It does not appear that cold water immersion is effective for a short-term recovery from exercise in the heat.

TIME COURSE OF MUSCULAR, CONNECTIVE TISSUE AND NEURAL ADAPTATIONS TO UNILATERAL LOWER-LIMB UNLOADING

de Boer, M., Seynnes, O.R., Maganaris, C.N., Narici, M.V.

Manchester Metropolitan University, United Kingdom

Unloading of the musculoskeletal system leads to muscle wasting and weakness both in humans and in lower mammals (1). Although the mechanisms behind the loss in muscle function are not fully understood, muscle atrophy only partly explains the decrease in maximal voluntary strength (2). Recently, simulated microgravity has also been shown to leads to tendinous adaptations (3) represented by a decrease in tendon stiffness. This phenomenon could potentially contribute to the loss of muscle function by affecting the length tension relationship of the muscle-tendon unit. Although the quantitative changes of muscle mass to unloading are reasonably well known, the question of whether these adaptations precede, follow, or take place pari passu with those of the tendon has never been addressed. Hence the appreciation of the size and speed of the changes affecting both tissues seems fundamental to understand the mechanisms involved in muscle weakness associated with prolonged inactivity.

In the present study, neuromuscular and tendinous adaptations to 23 days of unilateral lower limb suspension (ULLS) were assessed in 9 healthy men (aged 18 to 20 yr). Measurements were performed on day 14 and 23 of ULLS.

Knee extensors (KE) MVC, measured at 80 deg (optimum angle) of knee flexion, decreased by 25% ($p<0.001$) within 14 days of ULLS and did not decrease thereafter. Maximal voluntary activation, based on twitch interpolation, decreased by 4.1% ($p<0.05$) after 14 days and did not decrease thereafter. KE CSA, determined by magnetic resonance imaging at the distal 6/10 of femur length, decreased by 8.1% ($p<0.001$) after 14 days and by 14.0% ($p<0.001$) after 23 days. Patellar tendon stiffness and Young's modulus decreased by 21.1% and 21.5% ($p<0.05$) respectively, after 14 days and by 39% and 41% ($p<0.05$) respectively, after 23 days. The similarity between changes in tendon stiffness and Young's modulus indicated that the deterioration in tendon stiffness was due to changes in tendon material and not dimensions. Expressed as rate of daily loss, the decline in tendon material properties (Young's modulus) was 1.8%/day compared to a rate of loss of KE CSA of 0.6%/day. The results show that muscle atrophy and decreased activation accounted at best for ~3/4th of the decrease in torque, while the decrease in tendon stiffness accounted mainly for the remaining loss of MVC by having the muscle fascicles operate on a shorter length.

In essence, these findings indicate for the first time that the tendinous adaptations to unloading are about three times faster than those of skeletal muscle. We expect these diverse time courses to be reflected in differences in collagen and myofibrillar protein synthesis rates which are currently being investigated.

1. Edgerton and Roy, In: Handbook of Physiology Environmental Physiology (1996) 721–763
2. Tesch, P.A. et al. (2005) Eur J Appl Physiol 93: 463-68.
3. Reeves, N. D.et al. (2005) J Appl Physiol. 2005 Jun; 98(6):2278-86.

ORAL ADMINISTRATION OF VITAMIN C JEOPARDIZES TRAINING EFFICIENCY IN RATS AND IN HUMANS

Gómez-Cabrera, M.C., Domenech, E., Romagnoli, M., Borras, C., Arduini, A., Viña, J.

Catholic University of Valencia; University of Valencia; University Polytechnics of Valencia, Spain

Introduction

Physical exercise generates reactive oxygen species (ROS) (1). These are generally considered as harmful to the cells and thus supplementation with antioxidant vitamins is recommended (2). However, results from a number of laboratories indicate that ROS are signals (3) which serve to up-regulate the expression of a number of genes (4). In this work we tested the hypothesis that supplementation with vitamin C decreases training efficiency by interfering with the cellular signalling network that leads to cellular adaptations to exercise.

Material and methods

Animals

Thirty six male Wistar rats were randomly divided into 3 groups: rest (n=12), exercised (n=12) and exercised but treated with a daily dose of vitamin C (n=12). The dose used was equivalent to 500 mg per kg of body weight (5). Endurance-trained animals were exercised 5d/wk during 6 weeks. After the last training session an endurance test was administered to each rat. The time to exhaustion was recorded for each animal.

Humans

Subjects were randomly divided into three experimental groups: rest (n=6), exercised (n=5) and exercised but treated with a daily dose of vitamin C (1g) (n=5).Each subject participated in two experimental tests (before and after eight weeks of training). After the initial VO2max test all the subjects underwent a regular exercise programme of 3d/wk for 8 weeks on a static bike.

Results

Training increased VO2 max in humans by 30% but this was prevented when subjects were supplemented with vitamin C (P≤0.05). In the animal model training increased the maximal running time from 100 minutes to approximately 300 minutes (P≤0.01). This was prevented by supplementation with vitamin C. To provide a molecular explanation for this inconvenient effect of vitamin C, we tested the antioxidant and the mitochondriogenic pathways. We found an increased expression of the genes for MnSOD and Gpx with the exercise that was completely prevented by supplementation with vitamin C. The mitochondriogenic pathway that we have studied is: PGC-1→ NRF-1→ mTFA → Citrate Synthase. All these factors were up-regulated by training and all of these adaptations were prevented by vitamin C administration.

Conclusion

A major conclusion can be drawn from these experiments: small increases in the level of oxidants produced by exercise have favourable effects because they increase catalytically the antioxidant defences and the mitochondrial content. Preventing these hormetic (6) effects is inconvenient to the cell and therefore supplementation with vitamin C prevents the adaptation of the cell to oxidative stress and lowers the training efficiency.

References

1. K.J. Davies et al,. Biochem. Biophys. Res. Commun. 107,1198(1982)
2. M.J. Jackson, Proc. Nutr. Soc.46,77(1987)
3. McArdle et al., J. Physiol. 561,233(2004)
4. L.L. Ji et al., FASEB J. 18,1499(2004)
5. J. Sastre et al., Am.J. Physiol.32,R992(1992).

EFFECTS OF HYPOXIA ON EXERCISE-INDUCED DIAPHRAGMATIC FATIGUE IN HIGHLY TRAINED ATHLETES EXHIBITING EXERCISE-INDUCED ARTERIAL HYPOXEMIA

Athanasopoulos, D., Vogiatzis, I., Zakynthinos, S., Georgiadou, O., Golemati, S., Kostikas, K., Koskolou, M.D., Garagouni, C., Wagner, H., Wagner, P.D., Roussos, C.

University of Athens, Greece

Diaphragmatic fatigue occurs in highly trained athletes during exhaustive exercise. Since approximately half of these athletes also exhibit arterial hypoxemia during exercise (EIAH), we investigated the effects of different degrees of arterial hypoxemia on exercise-induced diaphragmatic fatigue in this population. Eight cyclists (mean±SD: VO2max: 65±7 ml/kg/min) randomly completed one hyperoxic (FIO2: 0.26), one normoxic and two hypoxic (FIO2: 0.17 or 0.13) 5-min exercise tests at intensities equal to a:90±7%, b:85±10%, c:80±8%, d:67±8% of normoxic maximal work rate, respectively, designed to produce the same ventilation at each FIO2. Bilateral phrenic nerve stimulation was used to determine reduction in twitch transdiaphragmatic pressure (Pdi,tw) during recovery. Mean exercise arterial oxygen saturation varied with FIO2 as expected(a:96±1%, b:93±2%, c:86±3%, d:70±4%;P<0.01). All tests induced significant post-exercise reduction in Pdi,tw(a:23±4%, b:24±4%, c:24±5%, d:24±5%)however, the degree of this reduction was not dependent on FIO2. Neither mean ventilation sustained during exercise(a:124±18, b:117±14, c:121±15, d:123±9 l/min) nor end-exercise arterial lactate(a:10.7±2.6, b:9.5±3.9, c:9.5±3.6, d:11.9±3.8 mmol/l)differed among the four tests. In highly trained athletes exhibiting EIAH the degree of diaphragmatic fatigue at similar respiratory muscle load and lactate concentration is unaffected by manipulating FIO2 over an extreme range. We suggest that either: a)the diaphragm is not sensitive to oxygenation at these muscle loads, or b) hypoxemia is compensated by increasing diaphragmatic perfusion as oxygenation falls.

Oral presentation (OP)

OP2-07 Training and Testing 3/7 - "Turin ABC"

EFFECTS OF WHOLE BODY ELECTRO STIMULATION TRAINING AND TRADITIONAL STRENGTH TRAINING ON VARIOUS STRENGTH AND BLOOD PARAMETER IN JUVENILE ELITE WATER POLO PLAYERS

Kreuzer, S., Kleinöder, H., Mester, J.

Institute for Training Science and Sport Informatics, Germany

Introduction:

For many years local electromyostimulation (EMS) has been used in top sport and rehabilitation with various aims. These are the support of hypertrophy and the prevention of athrophy after injuries in particular. Up to now, EMS was limited to superficial muscles.

In this investigation a whole body electrostimulation (WB EMS) apparatus (Bodytransformer) was applied. This allows complex and deep stimulation of the whole horizontally striped muscles within one training unit.

This study intends to compare the effects of 4 week long WB EMS training with a traditional strength training (TST). Parameters were isometric maximal force (IMF) and power (P) of various trunk muscles. Moreover, kreatinkinase (CK) was analysed.

Methods:

27 juvenile top water polo players (age 16,07 +/- 1,18; weight 79,3 +/- 12,36) took part in the investigation. They were equally randomized in three groups. The training of each group was as follows: 1st group 2 times/week WB EMS, 2nd group 1 time/week WB EMS und 1 time/week TST, 3rd group 2 times/week TST. Each WB EMS training unit lasted 25 min: 2 min warm up (impulse time: 1 sec, pause interval: 1 sec, impulse frequency: 50 Hz, impulse width: 200 μs), 20 min training interval (4 sec, 4 sec, 85 Hz, 350 μs) and 3 min regeneration (1 sec, 1 sec, 50 Hz, 200 μs).

The TST consisted of 8 different strength exercises with stress on the trunk muscles.

Diagnostics consisted of a pre-test, a post-test and a re-test two weeks without training later. The pre-test comprised a medical check with an investigation of body composition (Tanita), electrocardiogram (Vicardio) and a blood count. IMF and P were measured with special force and distance sensors (mechaTronic) at Gym 80 strength machines. CK was measured in training unit 3, 5 and 7 taking blood samples shortly before training, 45 minutes and 24 hours after training.

Results:

The CK values of group 1 and 2 after the 3rd training unit are 25% resp. 70% higher than the standard values whereas group 3 shows no significant difference. The last measurement after training unit 7 shows a constant of CK in group 3 (average 214 U/l) whereas group 1 and 2 individually reveal a further increase of CK (average 921 U/l).

The strength tests also showed significant improvements for several muscle groups, i.e. isometrically for the abdominals and the chest muscle and dynamically for the abdominals. Within groups we found individual adaptations to WB EMS, i.e. back muscles pre-test to post-test increase of 7% and post-test to re-test increase of 17%.

Conclusion:

According to the CK values of the WB EMS groups the training intensity was very high in contrast to traditional strength training. Since it was one of the first approaches to use WB EMS with well-trained athletes the outcome is promising. There were several significant improvements in favour of the WB EMS group and many individual improvements. Further research in this area should help to work out guidelines for the use of this training form.

SHORT TERM EFFECTS OF SENSORIMOTOR TRAINING ON POSTURAL REFLEXES IN PARKINSON'S DISEASE

Turbanski, S., Haas, C., Schmidtbleicher, D.

Johann Wolfgang Goethe-University of Frankfurt/Main, Germany, Germany

It has been shown in numerous studies that sensorimotor training results in improved postural control. Furthermore it is well known that postural instability (PI) is a hallmark of Parkinson's disease (PD). Due to the fact that medication fails to improve postural control in PD (Bronte-Stewart et al. 2002) evaluation of training strategies should be dealt with priority in therapy (Bloem et al. 2001). Some studies have proven beneficial effects of physical activity in PD (Reuter et al. 1999, Ellis et al. 2005). Accordingly the aim of this study was to evaluate short term effects of sensorimotor training on postural reflexes in PD.

52 PD patients participated in this study divided equally into one experimental group (E) and one control group (C). We analyzed balance-correcting responses following a postural perturbation consisting of a standardized acceleration of support surface which was hanging on four springs. Each disturbance of postural stability was preceded by a random delay. The displacements of support surface were measured by an acceleration sensor attached to the platform. Moreover EMG measurements were recorded from the muscle Tibialis anterior. We evaluated pre-motor-time (PMT) which is the time between the perturbation stimulus and the onset of electromyographic (EMG) activity.

First three pre-tests were assessed in all subjects. Afterwards the treatment was applied to subjects of group E while control subjects had a rest. Finally all participants were retested in three post-tests. The sensorimotor training in group E was based on random whole-body vibration (amplitude: 3 mm, average frequency: 6 Hz +/- 1 Hz) using a SRT-medical machine. Participants performed 5 series lasting 60 seconds each.

Comparison of pre- and post tests showed more efficient balance-correcting responses in post-tests in group E ($p=0.02$) but not in group C ($p=0.26$). Analyses of group differences supported the assumption of treatment effects ($p=0.03$). But these effects could not be confirmed by our EMG-data. There was no significant pre-post difference in PMT, whether in group E ($p=0.50$) nor in group C ($p=0.09$). The main finding from this study is that a sensorimotor training based on random whole-body vibration improves balance-correcting responses in PD spontaneously.

One can speculate about modified neuromuscular coordination based on two different physiological aspects: on one hand corrective torque could be generated quicker. On the other hand we hypothesised a reduction of inadequate overproduction of corrective torque (Peterka and Loughlin 2004). Besides effects on rigidity and muscle stiffness in PD are to take into account (Haas et al. 2006).

Bloem BR et al. (2001) Neurol 248: 950-958

Bronte-Stewart HM et al. (2002) Brain 9: 2100-2112

Reuter I et al. (1999) Med Sci Sports Exerc 31:1544-1549
Ellis T et al. (2005) Arch Phys Med Rehabil 86: 626-632
Peterka RJ, Loughlin PJ (2004) J Neurophysiol 91: 410-423.

ADIPOCYTOKINE RESPONSE TO ROWING AT INDIVIDUAL ANAEROBIC THRESHOLD

Mäestu, J., Jürimäe, J., Hoffmann, P., Purge, P., Jürimäe, T., Wonich, M., Pokan, R., von Duvillard, S.P.

Univesity of Tartu, Estonia

The published acute exercise (Ferguson et al., 2004) investigations with adiponectin suggest that submaximal exercise alone does not alter adiponectin concentration. However, similar to plasma leptin concentration, larger energy expenditure with high metabolic strain of the organism may be needed to alter plasma adipocytokine concentration. The purpose of this investigation was to study plasma leptin and adiponectin response to constant load rowing at individual anaerobic threshold. Eight college level male rowers (21.5±4.5 yrs, 184.9±5.0 cm, 78.5±8.4 kg, 11.8±1.2 %body fat, 5.01±0.43 L/min) took part in this investigation. The subjects were asked for: 1) incremental rowing exercise on rowing ergometer; and 2) for 30 minutes constant on-water single scull exercise on individual anaerobic threshold. During the incremental rowing ergometer exercise the individual anaerobic threshold was measured using the linear regression point analysis (Hoffmann et al., 1994). Two regression lines were calculated for heart rate (HR) and ventilation and the intersection points between both optimized regression lines were taken as the heart rate turn point (HRTP) and second ventilatory turn point (VTP2). HR at HRTP was used as the target HR for single scull rowing. If the differences between HRTP and VTP2 were greater than five beats lower HR was used. During constant rowing on single sculls the subjects were told to row a distance of 6.5 km (approximately 30 minutes) at the given target HR (range 5 beats/min). Blood samples for adiponectin, leptin, glucose and insulin were taken before exercise, immediately post exercise and 30 minutes post exercise.

Mean HR during constant rowing (167.7±6.9 beats/min) was not significantly different from the upper target HR but significantly higher than lower target HR. Adiponectin was significantly increased above the resting value 30 minutes post exercise (+14.7%; $p<0.05$), while not immediately post exercise (+11.6%; $p>0.05$). Similar to adiponectin, leptin was not changed after 30 minutes of rowing but was significantly decreased 30 minutes post exercise ($p<0.05$). Plasma insulin was significantly decreased post exercise and remained significantly lower 30 minutes post exercise. Glucose increased with exercise and returned to the pre-exercise level after 30 of recovery.

In conclusion, 30 minutes of rowing at individual anaerobic threshold level is above the threshold that is needed to detect significant decrease in the plasma leptin and adiponectin levels.

References.

1. Ferguson MA., White LJ., McCoy S., Kim HW., Petty T., Wilsey J. Plasma adiponectin response to acute exercise in healthy subjects. Eur J Appl Physiol, 2004, 91: 324-329.

2. Hofmann P., Bunc V., Leitner H., Pokan R., Gaisl G. Heart rate threshold related to lactate turn point and steady state exercise on cycle ergometer. Eur. J. Appl. Physiol. 69: 132-139, 1994.

A QUANTITATIVE AND QUALITATIVE STUDY OF VOLLEYBALL DEVELOPMENT IN THE OLYMPIC GAMES

Salimi Avansar, A., Lames, M.

Instituts of sport science, Germany

A Quantitative and Qualitative Study of Volleyball Development in the Olympic Games

Alireza Salimi Avansar & Martin Lames

University of Augsburg, Institute of Sports Science, D-86135 Augsburg, Germany

1. Introduction

Because of the multidimensional development of sport sciences and also very intensive competence of the high international players and teams in world cups and Olympic games, sport researchers try to discover, from different aspects, what elements lead players and teams into success or failure and to explain scientifically and experimentally the results. In this regard, this research tries to study men and women's volleyball teams participating in the Olympic games 2004 Athens from the viewpoints of anthropometrics, physical fitness, technique and tactics, and consequently, to make a statistical comparison between the players' performance and the final results. This study also aims at comparing men and women's teams from different perspectives and at analyzing the results. Ultimately, the total results of this research are compared with those of the previous Olympic games (1992,1996,2000) to demonstrate the development of volleyball on the high level.

2. Methods

The data (age, height, weight and high jump) of all participating volleyball teams in the Olympic tournament 2004 Athens (12 men's teams and 12 women's teams including 144 men und 144 women) were collected. The exact points and time of each set and each game (38 men's games including 144 sets and 38 women's games including 141 sets) were taken from the international volleyball website (www.fivb.org).

For the first time, more than 60000 ball contacts (28123 ball contacts for men and 32056 ball contacts for women) were quantitatively and qualitatively analyzed to compare the performance of the participating teams and also to find a new norm to predict the logical limits of success or failure of each volleyball technique in high level games.

The results of the researches carried out upon the previous volleyball Olympic games (1992, 1996, 2000) were found in sport data banks (e.g. IAT, Bisp) and were compared with those of this research dealing with the Olympic games 2004 Athens.

3. Results

The results are presented in four parts: the first part is concerned with the anthropometric analysis and physical fitness of the participating teams and their relationship with the final standing. In the second part, the significance of the game results and the time of each set and each game is explained. The third part includes the comparison of the techniques and the final standing. At last, the volleyball development from the past Olympic games until now is illustrated.

Keywords: olympic Games, Volleyball, data analysis

SPORT SCIENCE SUPPORT IN ELITE SPORT - IS THERE A LESSON TO BE LEARNED FROM SUCCESSFUL SPORT SYSTEMS AS TO HOW TO GET THE KNOWLEDGE FROM THE LAB ONTO THE TRACK?

Böhlke, N.

Loughborough University, United Kingdom

The convergence in the design of elite sport systems is not a recent phenomenen. Whether it is the Australian or English Institute of Sport, or the Olympiatoppen in Oslo, all of these centres provide a similar spectrum of services which are considered to be crucial to success on the international sporting stage. And the delivery of sport science support is often considered to be one of the core elements in this portfolio.

Despite the similarities in the service portfolio of today's elite sport systems, medal tables reveal that some nations are still more "successful" than others. If services like sport science support are indeed crucial factors in the development of an athlete, this suggests that more successful sport systems might have found better ways to implement this support in the training practice. Hence, this study seeks to investigate the operational management processes which are applied by two successful elite sport systems for the delivery of these services. It is hoped to identify transferable good practice which other systems could learn from.

Data Collection

The Swedish Athletics Association and the cross-country section of the Norwegian Skiing Federation were chosen as the most suitable comparison partners for this study. A total of 45 people from these two federations and their partner organisations were interviewed. The interviewees were selected according to their position in the two systems and specifically included coaches, athletes and diagnostics staff. Over 65hrs of interviews were recorded and analysed with the help of the software solution NUDIST.

Results & Discussion

A striking similarity between both systems is that the integration of sport science support is not necessarily a result of an elaborate management approach but of a general laissez-faire climate in which every coach is allowed to decide in how far he or she wants to make use of the offered support.

Interestingly, cooperation between practitioners and theorists relied heavily upon the latter bringing with them a specific set of personal (soft) skills. In fact, this was considered to be of more importance than subject-specific knowledge. A member of the Swedish Olympic Committee indicated e.g. that he considers "interpreters" to be more important than "kings of specialists". This might suggest a careful (re-) consideration of the recruiting policy for diagnostic staff.

The questions concerning the transferability of the identified practices is a difficult one as they appear to be linked to the Scandinavian context. One of the Swedish interviewees indicated however that their success might not necessarily be due to the fact that the Swedish team is managed in a Swedish way. It may much more be that the "Swedish way" (team work, flat hierarchies, etc.) is simply more suitable for today's generation of athletes and coaches: "That is maybe also a part of our success that our approach is more modern to the kind of people living in the society."

Oral presentation (OP)

OP2-08 Sports Medicine 3/4 - "Berlin DE"

CARDIOVASCULAR (CV) EFFECT OF RECOMBINANT HUMAN ERYTHROPOIETIN ADMINISTRATION IN TRAINED RATS WITH CV RISK FACTOR

Pellegrin, M., Meziri, F., Binda, D., Berthelot, A., Jacqueson, A., Laurant, P.

Unit Research EA3921 Cellular and Metabolic Optimisation, France

Doping drugs such as recombinant human erythropoietin (r-HuEPO) endangers the life of sportmen. Although the abuse of r-HuEPO to improve athletic performance is a major concern in endurance sports, its physiologic effects remains unclear. The aim of this study was to explore the effect of chronic administration of r-HuPEO on blood pressure (BP), mortality and endothelium- and Nitric Oxide (NO)-dependent vasodilatation in trained rats with or without endothelial NO pathway dysfunction. Wistar male rats (8-10 weeks old) were divided into 8 groups (n=10 per group): sedentary control; training group (6-week treadmill exercise; 5 days/week; 60 min/day); L-NAME group (NO synthase inhibitor, 10 mg/kg per day in drinking water); r-HuEPO group (100 UI/kg twice a week, subcutaneous injection); L-NAME+r-HuEPO group; L-NAME+training group; r-HuEPO+training group; and r-HuEPO+L-NAME+training group. BP was measured by an indirect method using a sphygmo-manometer. Acetylcholine (Ach) was used to assess endothelial function in isolated aortic segments. Chronic administration of L-NAME induced hypertension. Exercise prevented the rise in BP in the L-NAME rats. r-HuEPO did not modify BP in sedentary control and L-NAME rats. Exercise induced a slight hypertension in r-HuEPO rats but only after 5 weeks of treatment. Exercise did not prevent BP increase in r-HuEPO+L-NAME rats but on the contrary, BP was the highest in this group. We observed a 57% mortality rate in exercised r-HuEPO+L-NAME rats. Rats died during the exercise and the recovery period. We also observed a prominent reduction of the endurance capacity of the r-HuEPO+L-NAME rats. L-NAME+exercise induced cardiac hypertrophy. r-HuEPO+L-NAME treatment induced a greater cardiac hypertrophy than when given alone. This combined treatment probably produces a "compensatory" cardiac hypertrophy in response to the higher BP and the diminished endurance capacity. The endothelium- and NO-dependent relaxation to Ach was markedly altered in aorta from exercised r-HuEPO+L-NAME group. This finding suggests a profound endothelial dysfunction and the possible presence of CV risk factors in these rats. Chronic administration of r-HuEPO in exercised rats with endothelial dysfunction may exacerbate the endothelial failure. In conclusion, the combined effect of a more severe endothelial dysfunction and cardiac hypertrophy due to injection of r-HuEPO will amplify the CV risk in exercised rats with pre-existing CV risk factors.

SPORT AND GENDER: IS THERE A DIFFERENT INTERACTION ON HEART RATE AND VENTRICULAR REPOLARIZATION?

Zaccaria, D. 1, Bottinelli, R. 1, Stramba-Badiale, M. 3, Rossi, E. 2, Genovesi, S. 2

1 University of Pavia, 2 University of Milano-Bicocca, 3 IRCCS Istituto , Italy

A prolonged QT interval and the presence of a steeper QT/RR slope has been related to increased total mortality and sudden death. It has been observed that in females QTc is longer and QT/RR slope is steeper compared to males. The physical exercise is associated with a reduced mortality after myocardial infarction. The aim of the present study was to assess the effects of exercise training on QT

interval and on its relation with heart rate in men and women. The study was performed in 80 healthy subjects (40 males-40 females) who differed for the degree of physical activity. Four groups of 20 subjects each were studied: trained males(TM),control males(CM),trained females(TF),control females(CF).A 24h ECG Holter monitoring was recorded in each subject.The ECG signals were processed by Elatec Holter analysis software and a dedicated algorithm automatically computed the slope of the linear regression line QT/RR for the entire 24h.The program also provided for each hour the mean and the standard deviation of QT intervals corrected for heart rate according to the Bazett's formula(QTc).Recordings were analyzed separately for the 24h period,daytime and nighttime.Age didn't differ between trained and non-trained subjects. Mean weight,BMI and BSI were significantly greater in men than in women,but no differences were observed between trained and non-trained subjects in both genders.Mean 24h HR of trained subjects was significantly lower compared to the sedentary controls in both genders(62±5vs73±5 bpm TMvsCM and 71±7vs81±6 bpm TFvsCF,p<0.0001).Trained and non-trained women had a higher mean 24h HR than their male counterparts(CMvsCF-TMvsTF,p<0.01). The mean QTc was longer in females than in males in both trained and non-trained subjects(412±16vs399±17 msec and 424±22vs407±17 msec,respectively,p<0.05).The only exception was represented by the value of daytime QTc which showed no significant differences between TM and TF(402±18vs413±16 msec).Exercise training exerted different effects in men and women.While mean 24h QTc was similar in TM and CM, TF showed a shorter QTc than CF(412±16vs424±22 msec,p<0.05),both during the day and the night(413±16vs424±20 msec and 410±16vs424±22 msec,respectively,p<0.05).Gender differences in the relationship between QT and RR interval were observed in both trained and non-trained subjects(0.14±0.02v0.16±0.03,TMvsTF and 0.16±0.03 vs 0.20±0.04, CMvsCF,p<0.05).Exercise training significantly affected the relation between QT and RR interval by reducing the QT/RR slope in both genders(0.14±0.02vs0.16±0.02 TMvsCM and 0.16±0.03vs0.20±0.04 TFvsCF,p<0.05).In our study population the QT interval tended to be reduced in trained subjects, but the ventricular repolarization was significantly shorter only in trained females compared to their controls.Exercise training reduced QT rate dependence in both genders.Our data suggest that physical training might have a protective effect, especially in women, against the risk of arrhythmic events.

CARODIT INTIMA MEDIA THICKNESS IN OBESE CHILDREN AND ADOLESCENTS - A NON INVASIVE DIAGNOSTIC INDICATOR OF CARDIOVASCULAR HEALTH IN REHABILITATIVE INTERVENTION PROGRAMS

Boehm, B., Reiner, N., Strobl, T., Buck, M., Bauer, C.P., Oberhoffer, R., Michna, H.

Technical University Munich, Germany, Germany

Introduction: The intima media thickness (IMT) of the A. carotis communis is established as a valid surrogate marker for the progression of cardiovascular disease in adults. As a number of national studies show, obesity and cardiovascular diseases become a major health issue in children, too. This development is of particular concern since overweight in childhood and adolescence has been linked with increased rates of hypertension1, type II diabetes and early atherosclerotic lesions.2 In this context physical activity and sport intervention programs become of utmost importance. Objectives: Validation of the sonographic method and verification of its feasibility in obese children and adolescents. Additionally, to investigate, if this new parameter correlates with established invasive and physical fitness parameters. Methods: 42 obese children and adolescence (age 9-15yrs., mean height 163.13+-9.02cm, weight 83.4+- 26.43kg) were examined while taking part in a 6-weeks hospitalized rehabilitative intervention program. IMT was measured using GE Logiq Book XP, 10 Mhz linear probe, in B-mode, distal of the carotid artery bifurcation on a segment > 1cm length. Sigma Scan Pro 5.0 was used for IMT offline analysis. Body composition was measured using FUTREX 6100 AL. All subjects performed a standardized and valid physical fitness test. Blood samples were taken during routine examination analysing total cholesterol, high and low density lipoprotein (HDL, LDL) and triglyceride. Results: The IMT sonography is user-friendly (examination time 5 min/patient; offline analysis 8 min/picture). IMT mean for obese adolescents was 0.552 +- 0.044mm. The test-re-test variability was r=0.722, the intra observer variability was 3% (deviation mean approx. 0.017mm). The rehabilitative intervention program had a significant influence on weight, body mass index and body fat (p<0.05). IMT thickness tends to be reduced by the intervention. IMT values correlate with body fat (%), (p<0.05, r=0.503), so do BMI, body fat and blood pressure. A significant negative correlation exists between IMT values and high density lipoprotein (HDL). Regarding physical fitness the subjects had inferior performance on all tests requiring propulsion or lifting of body mass than standard values for non-obese demand. The sport intervention program had a significantly positive effect on the endurance performance (p<0.05). Conclusions: The sonography of the IMT served as a repeatable and reliable method for obese children and adolescents. In advantage to invasive diagnostics, the sonography can demonstrate the effect of the intervention program clearly on the level of the vascular system since it enables an insight of the blood vessel. Further emphasis lies on possible effects of physical activity on arterial wall thickness, in healthy and populations at high risk.

References:

1 Rosner B et al. J.: Am J of Epid 2000, 151, 1007-1019.

2 Steinberger J, Daniels SR. Circulation 2000; 107, 1448-1453.

CLASSIFICATION FOR VISUALLY IMPAIRED ATHLETES - AN INTERIM REPORT

Janda, S., Jendrusch, G., Platen, P., Bolsinger, A., Bach, M., Kaulard, K., Lingelbach, B.

Ruhr-University Bochum; University Eye Hospital Freiburg; Institute of Optometry Aalen, Germany

In an ongoing study we analyzed results of visual function tests and ophthalmological findings in visually disabled athletes. These are contrasted with classification results of these athletes collected before/during international competitions (e.g. paralympic games).

Because classifications of visual impairments are mostly based on visual acuity (VA) so far, but the procedures constituted for the determination of VA do not correspond with the European Norm EN-ISO-8596, we took the International Open German Championships in Athletics in Berlin (2005) to compare the conventional measuring methods with those obtained by modern computerized and standardized methods to assess visual function.

PURPOSE: In the context of a long-term study of new methods for multifactorial visual performance diagnostics in the low-vision-field we intend to optimize, standardize and objectify the classification to a fairer one.

METHODS: Initially the existing classification data of 2035 athletes (73.4% male, 26.6% female) of 98 nations were evaluated. During the classification in Berlin, the Freiburg Visual Acuity and Contrast Test (FrACT), a standardized computer supported forced choice test, was carried out in order to measure VA, while conventional methods (S.O.S.H.-Low Vision Chart) were used for comparison. 19 athletes of the International Championships in Berlin participated in these inquiries (74% male, 26% female; average age: 21.7 ± 6.0 years).

RESULTS: Considering the classification data of 2035 athletes clinical pictures pattern like opticusatrophy, pigmentary retinopathy/macular degeneration, nystagmus and myopia were diagnosed most frequently. The starting classes B1 (blind athletes: 35.4%), B2 (visual im-

paired with less VA: 36.7%) and B3 (visual impaired with more VA: 27.3%) had almost the same quantity. 0.7% of the athletes were categorized as not eligible because of too good visual performance.
The first proving of the FrACT shows that there are high correlations to the results of the conventional measurements of VA (S.O.S.H.). This indicates that the new methods already contribute to the optimization/objectification of the classifying process because of the minimized influence of the classifier and the standardized computer supported realization.
CONCLUSION: The stocktaking shows that the differences in VA between the extreme poles in starting class B2 are obviously bigger than in B3. This unequal distribution of VA-steps requires – at least due to reasons of fairness – a discussion about a new categorization of the starting classes. Besides/in addition to visual acuity, contrast sensitivity, dynamic and peripheral vision is of great relevance in sports, which have stayed unconsidered yet.
The studies were supported by the Federal Institute of Sport Science (BISp), Bonn, Germany (VF08/04/66/2004, VF07/04/03/2005).
Janda S, Jendrusch G, Platen P, Dep. of Sports Medicine and Sports Nutrition, Ruhr-University Bochum; Bolsinger A, IBSA-/IPC-Classifier, Bendorf; Bach M, University Eye Hospital Freiburg; Kaulard K, Lingelbach B, IfAA Aalen.

THE EFFECTS OF PLAYING RUGBY ON NECK FUNCTION

Lark, S.D., McCarthy, P.W.

University of Glamorgan, United Kingdom

The head/neck/face region is the most injured part of the body during rugby, particularly from impacts inflicted during the tackle (Wilson, 1999). However, not all head/neck injuries are disabling or result in acute neural damage, instead it may be the cumulative effects that are cause of latent cervical and balance problems.
The relationship between years of playing rugby and neck function were examined. Active cervical spine range of motion (ACROM) and proprioception were assessed in 14 controls (trained non-rugby playing sports men; 27.9 ± 7 years) and 46 male rugby players (26 rugby forwards, 25.8 ± 5 years; average 14.3 years played: 20 backs, 23.9 ± 5 years; average 13.8 years played). ACROM in flexion, extension, left and right lateral flexion, plus left and right rotation were measured using a cervical range of motion device (CROM: Youdas et al., 1991). The CROM was also used to determine ability of the subject to reposition their head back to a neutral position following head movement with the eyes closed (taken as an estimate of proprioception). Rugby backs and forwards were considered both as a group and separately.
Rugby forwards generally had the lowest ACROM, particularly neck extension (43° vs 55° backs, and 58° controls), in addition this trend was recorded for left (36° vs 40° vs 46°) and right lateral flexion (35° vs 41° vs 43°), left and right rotation (65° vs 71° vs 76° and 63° vs 67° vs 71° respectively). Moderate to large effect sizes (ES) were found for the differences between the rugby forwards and either rugby backs or controls (ES range 0.5 - 1.6). The decline in ACROM in the rugby players (forwards and backs) in relation to the number of years playing rugby was a moderately correlated (flexion $p = 0.01$; left lateral flexion $p = 0.03$; extension $p = 0.05$; left rotation $p = 0.08$). In addition, repositioning was significantly worse in all rugby players after neck extension compared to controls (6° vs 3° in controls; $p < 0.05$).
There appeared to be a decrease in ACROM whose severity related to the number of years playing rugby. The group whose ACROM was affected most was the rugby forwards, who showed similarity to whiplash patients or healthy elderly individuals (Youdas et al, 1991; Trott et al, 1996). In addition to the impaired ACROM, the increased repositioning error in rugby players suggests a compromised proprioceptive ability. These combined results imply that participation in rugby can have an effect on the neck equivalent to chronic disability or ageing. Furthermore, these changes may increase the likelihood of future injury and exacerbate any age-related neck degeneration.
Trott, P. H., Pearcy, M. J., Ruston, S. A., Fulton, I., Brien, C. (1996) Clinical Biomechanics, 11, 201-206
Wilson B. D., Quarrie K. L., Milburn P. D., Chalmers D. J. (1999) Journal Science Medicine in Sport, 2, 153-156.
Youdas, J. W., Carey, J. R., Garrett, T. R. (1991) Physical Therapy, 71, 98-106.

Oral presentation (OP)

OP2-09 Biochemistry 1/1 - "Turin DE"

THE EXPRESSION OF VEGF IN YOUNG AND ELDERLY WOMEN AND MEN

Kadi, F., Ponsot, E., Ekström, V., Lexell, J.

Department of Health Sciences, Sweden

Introduction
Vascular endothelial growth factor (VEGF) is a glycoprotein mitogen acting on endothelial cells and playing an important role in vasculogenesis and angiogenesis. VEGF is considered as a major factor responsible for basal skeletal muscle capillarisation. The effects of aging on VEGF protein expression are poorly understood. Two studies from the same group showed that VEGF expression in vastus lateralis muscle is lower in old men and women compared to young men and women (Ryan et al. 2006; Croley et al. 2005). However, the elderly population participating in these two studies was characterised by a low physical fitness level. The aim of our project was to investigate the question of whether VEGF expression is altered in healthy active elderly.
Methods
Seven healthy active elderly women and men (age range, 70-83 years) were compared to six healthy young women and men (age range, 20-32 years). All individuals participated regularly in recreational sports such as aerobics, jogging, cycling, and ball games, and were considered to have a comparable physical activity pattern. Muscle biopsies were obtained from the tibialis anterior muscle of the dominant leg. After tissue homogenisation and determination of protein concentration, the VEGF protein expression was assessed using western blot analysis using a monoclonal antibody against VEGF. Densitometric analysis was performed with a computerised image processing system (scion software). The protein level of VEGF in all samples was expressed relative to the protein level of a muscle sample that served as control.
Results and conclusion
Analysis of VEGF protein expression in tibialis anterior muscle showed no significant differences between young and elderly. The difference between the present findings and those from the two earlier studies from the same group (Ryan et al. 2006; Croley et al. 2005) likely results from differences in the populations studied and also from the fact that our populations of young and elderly were considered to

have a comparable physical activity pattern. Thus, aging per se is probably not a primary factor involved in the regulation of VEGF protein expression.

References

Ryan et al. (2006). J Appl Physiol, 100:178-185

Croley et al. (2005).J Appl Physiol, 99: 1875-1882.

CHANGES IN SERUM CYTOKINES AFTER REPEATED BOUTS OF DOWNHILL RUNNING

Smith, L., McKune, A., Semple, S., Eisenburg, B., Steele, H., Anderson, R.

Tshwane University of Technology, South Africa

Introduction: An initial bout of damaging exercise has been shown to induce muscle/connective tissue damage, and is associated with increases in indirect markers of muscle trauma. During a subsequent bout, there appears to be significantly less damage, and this is associated with lower levels of indirect markers of damage. Circulating cytokines are molecules associated with tissue trauma and healing. Whether there are alterations after an initial bout of aerobically biased eccentrics, and whether these levels are altered after a subsequent bout, is not clear. Therefore, the primary purpose of this study was to investigate any significant differences in serum cytokines after an initial bout of downhill running (RUN1) compared to a subsequent bout (RUN2).

Methods: Six healthy, active but untrained males volunteered for the study. All were required to run down a -13.5% treadmill grade for 60 min., at a pace that elicited 75% of their pre-determined VO2peak, on a level grade (RUN1); the exercise was repeated 14 d later (RUN2). Blood was drawn before the runs, immediately after, and then every hour for 12 h (14 samples) as well as every 24 h for 6d. Serum was frozen at -80°, until analyses. Samples were analyzed using a multi-plex bead assay (Bio-Rad, CA, USA). A repeated measures ANOVA was used to analyze results (2 x 14, to assess the 12 h period; 2 x 6, to asses 24 h intervals) with $p < .05$, and appropriate post hoc tests.

Results: Most changes (x + se, pg.ml-1) were seen in the initial 12 h period. IL-6 was significantly lower after RUN2 (6 + 1) compared to RUN1 (12.3 + 1). IL-10 was significantly higher after RUN2 (1.6 + .1) compared to RUN1 (.82 + .2). Regarding the chemokines: macrophage chemotactic protein (MCP)-1 was significantly lower after RUN 2 (93+ 1.9) versus RUN1 (103 + 1.9). Surprisingly, macrophage inflammatory factor (MIF)-1β was significantly higher after RUN2 (50 + 1) compared to RUN1 (42 + 1). When comparing the 24 h periods, IL-8 was significantly lower after RUN2 (5.6 + .2) compared to RUN1 (6.1 + .1).

Discussion: Similar to Hirose et al (2004), alterations in circulating cytokines were considerably less than what has been reported after strenuous endurance exercise (Nieman, 2001). Concerning the differences between the two runs, the overall cytokine profile appeared to reflect a reduced systemic inflammatory response after RUN2, with lower levels of pro-inflammatory MCP-1 and IL-8, lower levels of pro/anti-inflammatory IL-6, and higher levels of anti-inflammatory IL-10.

Hirose et al (2004) Immunol Rev 10:75-90

Nieman et al (2001) J Appl Physiol 91: 109-114.

CHRONIC NAHCO3 INGESTION DURING INTERVAL-TRAINING RESULTS IN GREATER IMPROVEMENTS IN MITOCHONDRIAL RESPIRATION AND ENDURANCE PERFORMANCE

Bishop, D., Thomas, C., Moore-Morris, T., Mercier, J.

University of Western Australia, Australia

We have previously shown that NaHCO3 supplementation during interval training results in greater improvements in endurance performance in humans (1). It was hypothesised that this may have been due to a reduced metabolic acidosis during training and greater improvements in muscle oxidative capacity. Previous authors have identified the acute, detrimental effect of a large drop in pH on mitochondrial phosphorylation (2,3). Therefore, a smaller drop in pH (following NaHCO3 ingestion) during interval training may result in a reduced impact on mitochondrial function and promote improved mitochondrial adaptations with training. However, further research is required to investigate the effects of NaHCO3 ingestion during training on chronic changes to muscle mitochondria function. 24 male Wistar rats performed an incremental test to exhaustion on a treadmill (10 m/min + 3 m/min). They were then matched on peak speed and randomly assigned to one of 3 groups (Baseline, Placebo, Bicarb). 48 h later they performed a time to fatigue (ttf) test at the peak speed achieved during the incremental test; this was repeated post-training in the two training groups (Placebo & Bicarb). Placebo ingested NaCl, while Bicarb ingested NaHCO3 (0.05 mg/kg), administered by esophageal catheter, 30 min prior to each training session. Training consisted of 6 (1st wk) - 12 (5th wk), high-intensity, 2-min intervals (with 1-min rest) performed 3x/wk for 5 wk. Mitochondrial respiration was determined on both the soleus (SOL) and EDL, with both pyruvate (PYR) and palmitoyl-carnitine (PC) as substrates. Muscle fibre composition was also determined. Compared to baseline, there was a significant increase in SOL-PYR state 3 respiration with training (14.9 ± 3.3 v 19.4 ± 6.4 v 25 ± 5.8 nmol O2/min/mg dw), with a significantly greater increase in Bicarb. There were no significant changes in the EDL or when PC was used as a substrate. Following training, there was also a significant increase in ttf (6.5 ± 2.5 v 53.5 ± 30.4 v 81.2 ± 24.7 min) with a significantly greater increase in Bicarb. There were no significant changes in fibre composition with training. Consistent with our previous findings, the group ingesting NaHCO3 before each training session had significantly greater improvements in endurance performance, despite performing identical training. The significantly greater increase in state 3 respiration in the soleus muscle of the Bicarb group suggests that an improved endurance performance may be related to greater improvements in muscle oxidative capacity. While it has previously been reported that acidosis acutely impairs oxidative phosphorylation, via a direct effect on the mitochondrial function itself (3), our results suggest that metabolic acidosis during training may also impair chronic mitochondrial adaptations to training.

1. Edge et al (2006). J Appl Physiol (In Press).

2. Rasmussen et al (2001) Pflug Archiv 443: 180-187, 2001.

3. Jubrias et al (2003). J Physiol 533: 589-599, 2003.

STEWART'S SIMPLIFIED ECUATION TO ASSESS THE ACID-BASE STATUS

Peinado, A.B., Díaz, V., Calderón, F.J., Benito, P.J., Martín, C.

Politecnical University of Madrid, Spain

INTRODUCTION: The physical-chemistry conception of the acid-bases status during exercise is fundamental at the time of understanding the factors that affect to [H+] (1). The independent variables that determine the acid-base balance were included by Stewart in the coefficients of an equation of fourth degree (1, 2). The objective of this study was to simplify the mentioned equation and to verify its reliability.

MATERIAL AND METHODS

20 men performance a constant load test of 30 minutes in a treadmill to an intensity corresponding to the mean of the two ventilatory thresholds, previously determined with an incremental test. Capillary blood samples at rest, and at 10th, 20th and 30th were obtained (total of samples = 96). The acid-bases parameters were analyzed with a gasometer and lactate by enzymatic method. [H+] was calculated using the equation of Stewart: A[H+]4+B[H+]3+C[H+]2+D[H+]+E=0 (STW)(1); and using our proposal, a simplification of previous one, easier to solve: A[H+]2+B[H+]+C=0 (SE). Program GNU Octave was used to solve the equation of fourth degree.

A one way ANOVA was used to compare the values of [H+] and pH measured, calculated with STW and calculated with SE. An analysis post-hoc Sheffé was used to find the differences. In order to verify the reliability of SE the coefficient of determination was obtained between the different equations and the measured values. The significant level was set at $p<0.001$.

RESULTS

The difference of the mean between STW and SE was 0.02nmol/L for [H+] and lower for pH, which was not statistically significant. Nevertheless, the difference of mean between STW and SE with the measured values was greater than 8nmol/L for [H+]. These differences were highly significant as for [H+] as for the calculation of pH ($p<0.001$). With the linear regression analysis between STW and SE $r=0.99$ was obtained. Nevertheless, $r<0.60$ was obtained between the measured equations and values.

DISCUSSION

The obtained results show that the proposal SE can be used, since the mathematical complexity is reduced. Nevertheless, the results obtained with the previous equations and the values measured with the gasometer were significantly different. Kowalchuk and Scheuermann obtained differences lower than 3nmol/L for [H+] and $r=0.81$ when comparing values measured and considered with STW (2, 3), which is in discord with our results. The differences can be due to the differences between the type of blood samples, capillary blood samples in our case and arterialized venous blood in the case of the previous authors, as well as to incorrect values in the equilibrium constants and errors when measuring the independents variables (2).

REFERENCES

1. Stewart PA. Modern quantitative acid-base chemistry. Can J Physiol Pharmacol. 1983 Dec;61(12):1444-61.

2. Kowalchuk JM, Scheuermann BW. Acid-base balance: origin of plasma [H+] during exercise. Can J Appl Physiol. 1995 Sep;20(3):341-56.

3. Kowalchuk JM, Scheuermann BW. Acid-base regulation: a comparison of quantitative methods. Can J Physiol Pharmacol. 1994 Jul;72(7):818-26.

SALIVA PROTEIN PATTERN, A NEW LABORATORY INVESTIGATION TOOL FOR ATHLETES

De Palo, E.F., Antonelli, G., Gatti, R., Spinella, P., Chappin, S., Ragazzi, E.

University of Padua, Italy

Introduction. The saliva concentrations of total proteins (sTP) have been investigated as a marker of nutritional status [1] and could be linked to protein hormones [2]. The assessment of the usefulness of saliva to estimate the effect of physical exercise on salivary compounds would be a new investigation approach. Aim. To examine the ability of capillary electrophoresis (CE) pattern as a laboratory tool to study sedentary and athletes before and after a physical exercise. Subjects & Methods. 12 athletes (19±1 y, 69±4 kg, 180±3 cm, BMI 21.5±1.7 kg/m2) were studied, before and after physical exercise (45 min at 60% VO2max). A sedentary control group (n=10, 42±13 y, 61±6 kg, 169±2 cm, BMI 21.2±1.7 kg/m2) was also studied. Saliva was collected by salivette devices, at rest and immediately after the physical exercise test. CE was performed with an uncoated fused-silica capillary (length 47 cm, 50µm i.d.), separation at 5 kV using 150 mM boric acid pH 10.3, detection at 254 nm (typically used for the protein profile assessment). sTP was measured by a colorimetric method. The CE pattern analysis was carried out by a multivariate approach, based on Cluster Analysis and Principal Component Analysis (PCA). Biplot presentation of the PCA data was obtained to assess any correlation among the various peaks obtained in CE profiles. Results. The sTP levels were: athletes 326±156 and 629±345 mg/L ($p<0.001$), pre and post-exercise respectively; sedentary 425±204 mg/L. The multivariate unsupervised analysis of data, carried out by means of Cluster Analysis, showed that the sTP CE absorbance profile, obtained from controls and athletes, before and after exercise, can be separated only in part. By PCA multivariate technique an agglomerate of values, describing both sedentary controls and athletes before exercise, and a second distinct, although spread, group of scores pertaining to the athletes after exercise, was isolated. The biplot PCA values relative to CE peaks showed a strict correlation in the behaviour of four CE peaks (minutes: 17, 20, 22 and 24), suggesting that these peaks could be considered as the most informative for a possible differentiation key among the subjects. Discussion. This is the first study to investigate the saliva CE protein pattern of athletes before and after exercise. Walsh et al. [3] recently demonstrated that sTP and hydration are correlated, and our findings confirm the exercise effect on sTP. Moreover, the salivary CE profiles demonstrated that physical exercise affects some salivary compounds also by the variation of their abundance. The multivariate analysis, here used, provided a promising statistical support to the interpretation of the results, suggesting the more relevant CE peaks for further investigation.

References.

1. Murayama N et al. (1999) Nutr Res 19:979.

2. Antonelli G et al. (2005) ECSS, 194.

3. Walsh NP et al. (2004) Arch Oral Biol 49:149.

Funded by Ministero della Salute – Roma(I) (progetto anti-doping).

Oral presentation (OP)

OP2-10 Physical Education and Pedagogics 1/2 - "Turin FG"

THE ROLE OF PHYSICAL ACTIVITY IN INTEGRATED CHILD'S DEVELOPMENT AND STUDY PERFORMANCE

Zurc, J.

University of Primorska, Science and Research Centre of Koper, Slovenia

The purpose of our study was to analyse the role of physical activity in child's emotional, social and cognitive development. We found out that there is put a great emphasis on the connection between physical activity and cognitive development (Thun-Hohenstein et al., 1991; Williams, & Ericsson, 2005; Gardner, 1997). It is followed by a studies about the connection between emotional development and physical activity (Fagot, & Obrien, 1994; Graziano et al., 1998; Planinšec et al., 2004). However, the most disregarded are the studies about the connection between physical activity and social development (Bandura, 1989; Pellegrini et al., 2002; Parke, 2004).

The integrated development is reflected mostly through study performance (Ismail, 1976; Duda, 1985; Pišot 2003). Therefore we carried out the research on the representative sample of 2023 ten year old Slovenian pupils (48.2% girls, 51,8% boys), average age 10.5. We investigated the connection between physical activity and study performance. The data on the frequency of child's physical activity was obtained with a questionnaire which is the most used method in studying child's behaviour in the area of physical activity (Cavill et al., 2001). The data was processed with SPSS.

The results showed that the frequency of physical activity during their free time is statistically connected with study performance. The best study performance was attained by girls and boys, who were active in free time at least twice a week. With decrease of frequency of physical activity during the free time the study performance also decreases. The results of analysis of children with the best studying results (A-students) showed that most of them (45%) fall into the category of those who are physically active every day or twice to three times a week. The percentage of these falls accordingly with decreased free time motor activity and reaches the lowest point in the category of physically inactive in free time (23.9%). Among physically inactive are those children with average learning performance (C-students) (34.1%) whose percentage decreases rapidly with increased frequency and reaches the lowest value at those who are active twice to three times a week (16.5%) (p=0.000).

On the basis of our findings we concluded that physical activity has a great influence not only on physical and motor development but also on other areas of development. Bandura A (1989) Annals of Child Development

Cavill N, Biddle S, Sallis JF (2001) Ped Exer Sci, 13: 12-25

Duda JL (1985) Inter J Intercul Relat, 9: 131-150

Fagot BI, Obrien M (1994) M-P Quart-J Devel Psy, 40: 378-398

Graziano WG et al (1998) J Pers Soc Psy, 74: 1266-1277

Ismail AH (1976) Kinez, 6: 7-28

Pellegrini AD et al (2002) Am Educ Res J, 39: 991-1015

Parke RD (2004) Child Dev, 1: 1-24

Planinšec J et al(2004) Stud Psy, 46: 89-95

Thun-Hohenstein L et al (1991) Eur J Paed, 150: 562-569

Pišot R (2003) Moloda sportivna nauka Ukraini

Williams AM, Ericsson KA (2005) Hum Mov Sci, 3: 283-307.

LONGER-TERM EFFECTS OF A PLAYGROUND MARKINGS INTERVENTION ON SCHOOL CHILDREN'S PLAYTIME PHYSICAL ACTIVITY

Ridgers, N., Stratton, G., Fairclough, S., Richardson, D.

Liverpool John Moores University, United Kingdom

Playtime provides a daily opportunity for children to engage in moderate-to-vigorous physical activity (MVPA). Environmental interventions such as playground markings may increase playtime MVPA in primary school children. Previous studies have investigated the short-term effects of playground markings on MVPA (Stratton & Mullan, 2005); however, the longer-term effects are not widely reported. The aim of this study was to explore the 6-month effects of a playground markings intervention on boys' and girls' playtime physical activity levels.

Two hundred and twenty-two children from 19 primary schools (15 experimental, n = 170; 4 control, n = 52) participated in the study. Physical activity during playtime was quantified using heart rate telemetry prior to, 6 weeks and 6 months following the playgrounds being painted with multicolour playground markings. Control schools received no markings through the study. The children's heart rate (HR) was recorded every 5 s. The HR threshold of greater than 50% heart rate reserve (HRR) represented MVPA. A 2 x 2 x 3 (sex x group x time) repeated measures ANOVA was used to analyse changes in children's MVPA. The alpha level was set at $p < 0.05$.

Boys (37.9 ± 13.7%) engaged in significantly more MVPA during playtime than girls (27.3 ± 12.2%; $p < 0.001$). The control group (39.9%) was significantly more active than the experimental group (26.9%) at baseline ($p < 0.01$). The time x group interaction was significant ($p < 0.01$). Follow-up tests revealed that MVPA significantly increased by 6.7% in the experimental group between baseline and 6 weeks post test ($p < 0.01$), whilst the control group's MVPA significantly decreased by 9.7% ($p < 0.01$). Experimental boys and girls' MVPA increased 8.2% and 4.3% between baseline and six-weeks follow-up respectively. Between six weeks and six months, the experimental boys and girls' activity decreased by 0.6% and 3.9% respectively, but these decreases were not significant.

These results indicate that painting primary school playgrounds is a suitable environmental intervention for stimulating and increasing children's voluntary MVPA during school playtime, though greater increases were observed and maintained for boys than girls. Observations of school playtime indicated that boys played on the sports markings, whist girls used the skills based markings. The results suggest that additional strategies may need to be implemented during playtime to increase girls' physical activity, whilst painting playgrounds is a suitable stimulus for increasing and sustaining boys' activity levels during playtime. In conclusion, playground markings appear to be a suitable school based intervention that can increase children's participation in MVPA during primary school playtime over the short-term, and sustain the increase in boys' physical activity over 6 months.

Stratton, G. & Mullan, E. Prev Med,41, 828-833, 2005.

BURNOUT LEVELS AND THEIR DETERMINANTS IN A SAMPLE OF ITALIAN PE TEACHERS

Carraro, A.

University of Padua and SSIS of Veneto, Italy

Factors that influence the professional condition of teachers could be grouped into three areas: personality factors, occupational hazards and specific work environment conditions. When job-related demands and stressor factors become excessive, there can be lots of different, possible reactions. Burnout (BO) has been identified as one type of chronic response to the cumulative, long-term negative impact of work stressors. Based on Maslach's research, some symptoms of the syndrome are commonly accepted: emotional exhaustion, depersonalization and low personal accomplishment. Although teachers' burnout has been the focus of many studies, only a few have dealt with PE teachers.

The target population was a not selected series of 150 Italian PE teachers, (56% female, 44% male; mean age 44.4, SD 5.82; mean years of service 18.03, SD 7.74). We used a specific questionnaire together with the MBI (Maslach Burnout Inventory). The questionnaire got information about personal background: demographic, educational and occupational data, working conditions, personal physical fitness perception, attitudes towards one's own body and BO level perception. Questionnaires were directly delivered to PE teachers in their school and collected after 3-5 days. Descriptive statistics were used to define profiles and BO levels. In addition, analysis of variance was performed entering scores of MBI subscales as dependent variables, and the social statistic information, professional information and body attitude variables as independent variables. A chi-square test was performed on demographic data.

The three main perceived job-related stressor factors were: working in badly administered structures (21%), being under paid (18%) and having unsatisfied relations with colleagues (16%).

The MBI subscales scores revealed a medium level of emotional exhaustion (M 17.70, SD 7.20), a high level in the low personal accomplishment (M 31.03, SD 8.04 and high level in depersonalization (M 6.17, SD 5.41).

In the account of the central role of body and the importance of the lived body in the profession of PE teachers, we studied body-related and personal body fitness perceptions in the sample, comparing these data with the MBI subscales. At the moment they answered, 11% of the teachers practiced regularly physical activity, 20% often, 31.1% sometimes, 6.7% seldom, and 7.3% never practiced. Data analysis showed how teachers regularly practicing, had lower BO levels in all MBI subscales: in the emotional exhaustion scale (F 6.95, df 3, $p < 0.001$), in personal accomplishment (F 29.51, df 3, $p < .001$), and also in depersonalisation (F 40.98, df 3, $p < 0.001$).

Comparing our results to those concerning other curriculum teachers, we found that PE teachers felt less fulfilled in their job, showing lower scorings in low personal accomplishment (31.03 vs. 35.71), and also in emotional exhaustion (17,68 vs. 19,84), they also showed a higher rating in depersonalisation (6.16 vs. 3.80).

COMPARATIVE ANALYSIS OF RECEIVING AND PASSING THE BALL IN THE EUROPEAN FOOTBALL CHAMPIONSHIPS SWEDEN 1992 AND BELGIUM–NETHERLANDS 2000

Mavrek, S., Jerkovic, S., Jerkovic, M.

Karl-Franz-University Graz - Austria, University of Zagreb - Croatia, Croatia

The aim of this research was to compare the effects of successful or unsuccessful receiving and passing the ball in the results of the matches of the European Football Championships 1992 and 2000.

The sample consisted of totally eight matches (final match, semi-final matches, quarter-final matches and one randomly selected match from the group) in each Championship. The group of predictor variables included successful and unsuccessful passing the ball (SPB and UPB), successful and unsuccessful receiving the ball by leg (SRL and URL) and successful and unsuccessful receiving the ball by trunk (SRT and URT). Criterion variables were: the result of match (RM), the number of scored goals (SG) and the number of received goals (RG). Differences between two groups (variables from Championships 1992 and 2000) were examined by discriminant analysis.

Results

Correlation between predictor variables in European Football Championship Sweden 1992 showed high positive correlation (.97) between variables SPB and SRL, high correlation (.64) between variables UPB and SRT and relative high correlation (.50) between variables UPB and URL (at $p<.05$). Distinctive negative correlation between predictor variable URL and criterion variable RM was confirmed by Backward method of regression analysis (URLBeta=-.60).

Multiple regression analysis showed ($R=.751$, $F=1.949$, $p=.17$) that the group of predictor variables in European Football Championship Belgium-Netherlands 2000 has not statistically significant influence on variable RM because $p>.05$. However, distinctive negative correlation between predictor variable UPB and criterion variable RM (UPBBeta=-.60) was confirmed by simple regression analysis between these two variables ($R=-.59$, $F=7.82$, $p=.014$). Variable UPB has statistically significant influence on variable RM because $p=.014$ ($p<.05$).

Discriminant analysis showed that there are differences between two groups of variables because Chi-square is 25.900, $p=.0021$. Group centroids have the following values: G1=1.285 (Euro 2000) and G2=-1.285 (Euro 1992). Therefore, group G1 is better than group G2. Within-groups correlations between discriminating variables and discriminant function showed that variable URL (.768) differs these two Championships the most, while variables SRL (.212), SRT (.262) and SPB (.222) also differ two Championships, but not so much.

Conclusions

Comparing the frequencies of variables of these two Championships, there is a bigger number of SPB, UPB, SRL and URL in 2000. Therefore, tempo of the game in 8 years is increased. If we look the frequencies of variables SPB and SRL in 4 finalists of both Championships, we can notice that France was champion with the highest frequencies while Danemark became champion with the lowest frequencies. That means that these two representations have had two different styles of the game. Overall conclusion is that better result in the match (win or draw) is achieved by reduction of mistakes in receiving and passing the ball.

THE LIMITS OF SCIENCE: A JUSTIFICATION FOR THE ART OF COACHING

Freeman, W.H.

Campbell University, United States

Often we speak of coaching as a "scientific" process, implying that it is so well understood that any well-trained coach would likely produce the same training plan as any other coach. But is coaching today really primarily a science–or is it still in large part an "art", with the coach blending scientific knowledge, practical experience and more than a bit of personal alchemy to produce an effective training plan? This paper discusses two questions: (1) Do we really understand the effects of training on the human body so completely, including the

most effective mechanisms of change; and (2) is coaching success dominantly based on an advanced knowledge of sport science? It is clear that (1) there is still much to learn about the complex interrelationships of training and performance factors as they act upon the biological ecosystem we call the "athlete"–both in our knowledge of mass outcomes and in the variables within any individual that may differ from group data, and (2) the most successful coaches often are not the most highly trained sport scientists. Just as the elite medical researcher rarely performs the most intricate surgery, the advanced sport scientist rarely coaches the talented athletes who come to dominate their sports. As academics and researchers we need to recognize that as the competition of a lifetime approaches, it is that mysterious "art" that often makes the final difference in fitting together the pieces of the next great champion's puzzle.

14:15 - 15:15

Poster presentation (PP)

PP2-01 Physiology 1-9 - "Exhibition Hall"

ACUTE PASSIVE STRETCHING ALTERS MUSCULAR STIFFNESS BUT NOT THE ELECTROMECHANICAL COUPLING IN HUMAN CALF MUSCLES

Cè, E. 1, Alfieri, P. 2, Paracchino, E. 2, Roione, G.C. 2, Veicsteinas, A. 1, Esposito, F. 1

1 Institute of Physical Exercise, Health and Sport; 2 Faculty of Sport Science, University of Milan, Italy

Maximum force and power output are significantly impaired by passive muscle stretching. Structural changes of the stretched muscles and a reduction of neuromuscular activation have been suggested to be responsible for such a decrease in maximum force. Thus, the study was aimed to verify whether stretching-induced changes in muscle activity were related to alterations in the electromechanical coupling and/or in muscle stiffness. To do this, 17 male active subjects (22 ± 1 yrs, body mass 75 ± 2 kg, stature 179 ± 2 cm; mean ± SE) underwent 3 tetanic electrical stimulation (50 Hz) at maximal intensity (maximal M wave +10%) before and after a bout of passive stretching of calf muscles. During contractions, surface EMG and mechanomyogram (MMG) were simultaneously recorded from the belly of the medial gastrocnemius muscle, together with the force (F) signal. Delays between the onset of EMG and MMG (delta t EMG-MMG), EMG and F (delta t EMG-F) and MMG and F (delta t MMG-F), as well as peak F were then calculated. After passive stretching, peak F decreased by 32.6±5 % ($p<0.05$). Delta t EMG-F and delta t MMG-F significantly increased by 16.7±4 % and 13.9±4 %, respectively. No differences were found in delta t EMG-MMG. From these results it appears that acute passive muscle stretching induced a depression in maximum stimulated force, suggesting changes in muscle contraction behaviour. These changes did not affect the electromechanical coupling at the muscle level, as indicated by a similar delta t EMG-MMG after stretching. However, lengthening of the delta t EMG-F and delta t MMG-F may suggest stretching-induced reduction in muscle stiffness.

LONGITUDINAL STUDY 'DOPING FREE SPORT': STEROID PROFILES IN URINE

Schweizer, C., Sottas, P.-E., Saugy, M., Kamber, M.

Laboratoire Suisse d'Analyse du Dopage, Switzerland

Introduction

The measurement and interpretation of an athlete's urinary steroid profile is important in the fight against doping in sport. Changes of this profile may be due to biological variations but also due to the use of doping. The aim of this study was to illustrate that top level performance could be reached without doping and to evaluate the biological variation of the steroid profile over time. In a joint project, the Federal Office of Sports, the Swiss Anti-Doping Commission and the Swiss Laboratory for Doping Analysis performed a longitudinal study with 20 top-level athletes (19-32 years) from five different endurance sports (athletics, triathlon, cycling, cross-country skiing and orienteering).

Study design and methods

During the study, all athletes had to submit to two kinds of urine samples: one at pre-announced dates during medical check-ups within and off season (5 to 8 times) and one at unannounced out of competition doping controls (7 to 12 times). All urines were analysed for prohibited substances according to the doping list of the World Anti-Doping Agency. In addition, the steroid profiles were evaluated as well: among others the concentrations of testosterone (T), epitestosterone (E), androsterone (A), etiocholanolone (Etio) as well as different ratios (T/E, A/T, A/Etio) were measured. An elevated T/E ratio may be an indicator for the use of a prohibited substance. In these cases, some complementary investigations are required to find if the elevated ratio is due to doping.

Results

There was no difference in the steroid profiles between announced and unannounced controls. In men, the inter-individual variation of the T/E ratio was between 14 and 38%: The lower were the concentrations of T and E, the higher the variations. In women, the variations were generally higher (up to 66%) due to the lower steroid concentrations. there was no indication for doping use in any of the samples analysed.

Discussion

To our knowledge this is the first time that such a homogenous group of athletes (top level endurance athletes) was followed up so closely over a period of two competition and two training seasons. The data will serve as a basis to evaluate steroid profiles of other athletes for possible doping use. However, due to inter-individual variations of steroid profiles it is advisable to collect individual reference values from longitudinal studies for top level athletes.

THE EFFECT OF AN 80-MINUTE INTERMITTENT RUNNING PROTOCOL ON HAMSTRINGS STRENGTH: IMPLICATIONS FOR THE INCREASED SUSCEPTIBILITY TO HAMSTRINGS INJURY

Andrews, W., Hori, N., Dawson, B., Newton, R.

Edith Cowan University, Australia

Epidemiological research has shown a possible relationship with fatigue and hamstrings injury (Woods et al., 2005). There has also been evidence of increased susceptibility to hamstrings injury due to reduced hamstrings torque production and an imbalance between the hamstrings and quadriceps muscle groups (Orchard et al., 1997). However there is no research which has investigated the effects of a long-duration running protocol on hamstrings and quadriceps torque relationship. PURPOSE: To examine the effects of an 80-minute intermittent running protocol (IRP) on concentric hamstrings (Hc), concentric quadriceps (Qc) and eccentric hamstrings (He) muscle torque. The conventional (HcQc) and functional (HeQc) hamstrings: quadriceps torque ratios were also examined. METHODS: The dominant and non dominant kicking legs of twenty two semi-professional Australian Rules Football players were examined before (baseline) and immediately following (post) an 80-minute IRP on a Woodway® non-motorised treadmill. Each subject completed maximal Hc, Qc and He muscle contractions on a Biodex isokinetic dynamometer at an angular velocity of 60°.sec-1 at baseline and post the 80-minute IRP. The IRP was divided into 4 x 20-minute quarters consisting of five MS efforts, sixteen fast runs (65% of MS), thirty two jogs (35% of MS) and thirty two walks (20% of MS) per quarter. RESULTS: There was a decrease in He torque in the dominant (pre, 212.64±55.15Nm; post, 190.77±54.28Nm, $p<0.01$) and non dominant (pre, 206.47±62.36Nm; post, 190.18±58.43Nm, $p<0.01$) legs. There was no decrease ($p>0.05$) in Hc and Qc torque in either leg following the IRP. The HeQc ratio decreased in the dominant (pre, 0.89±0.25; post, 0.82±0.25, $p<0.01$) and non dominant (pre, 0.93±0.26; post, 0.87±0.25, $p<0.05$) legs, however there was no decrease ($p>0.05$) in the HcQc ratio for either leg following the IRP. DISCUSSION: Maximal He torque is reduced following an 80-minute IRP on a non-motorised treadmill. There appears to be no detrimental effect on maximal Hc and Qc torque production. There is a reduction in the functional HeQc torque ratio however there is no effect on the conventional HcQc torque ratio. CONCLUSION: The duration of the intermittent running protocol used in this study is similar to many team game sports. The intermittent running protocol was enough to reduce eccentric torque production, which may provide an insight into hamstrings muscle function and increased risk of injury following games of longer duration.

Orchard, J., Marsden, J., Lord, S., & Garlick, D. (1997). Preseason hamstring muscle weakness associated with hamstring muscle injury in Australian footballers. The American Journal of Sports Medicine, 25(1), 81-85.

Woods, C., Hawkins, R. D., Maltby, S., Hulse, M., Thomas, A., & Hodson, A. (2004). The Football Association Medical Research Programme: an audit of injuries in professional football - analysis of hamstring injuries. British Journal of Sports Medicine, 38, 36-41.

THE RELATIONSHIP BETWEEN HEART RATE RECOVERY AND POWER OUTPUT DURING REPEATED BOUTS OF SPRINT EXERCISE IN FEMALES

Papaspyrou, A., Bogdanis, G.C., Evangelidis, P., Theos, A., Maridaki, M.

University of Athens, Greece

Introduction

Heart rate (HR) recovery after high intensity exercise depends on athlete's training level (Darr et al., 1988) and may influence the ability to perform in repeated bouts of high intensity. The purpose of the present study was to examine whether recovery of power output during repeated sprints on a cycle ergometer are related with heart rate recovery parameters in females.

Methods

Seventeen female games players (age: 21.0±0.9 years, mass: 75.1±3.7 kg, lean leg volume- LLV: 7.4 ± 0.3 L) performed 4-5 maximal 6s sprints on a Monark cycle ergometer against different loads, with full recovery. Instantaneous power was obtained by taking into account the changes in kinetic energy of the flywheel and optimal force (Fopt) was calculated (Arsac et al., 1996). On another occasion, participants performed a graded test on the treadmill until exhaustion (11.9±1.3 min), where maximal oxygen uptake (VO2max) was determined. On a third occasion participants performed seven 6 s sprints separated by 24 s of passive recovery, against a resistance equal to 50% of Fopt. Peak (PPO) and mean power output (MPO) were recorded for each sprint and average MPO for the seven sprints per LLV (AMPO/LLV) was calculated. HR was recorded during and for 5 min into recovery and the time constant (HRτ) and amplitude (A) of HR recovery was calculated.

Results

VO2max was 42.1 ± 1.2 ml/kg/min and peak HR at the end of the sprint test was 172 ± 2 b/min. PPO and MPO in the first sprint was 821 ± 26 W and 649 ± 22 W, respectively. PPO and MPO expressed per LLV were 111.8 ± 3.3 W/L and 88.1±2.5W/L. The percent drop in PPO and MPO during the seven sprints was 17.3 ± 1.8 % and 19.2 ± 1.6 %. HRτ was 88 ± 6 s while A was 90 ± 2 b/min. AMPO/LLV was 77.9±1.7 W/L and was positively correlated to HRτ ($r=0.59$, $p<0.01$). The percent drop in PPO and MPO was not correlated with VO2max or with HRτ.

Discussion

The relationship between AMPO/LLV and HRτ it may indicate that HR recovery is related to the anaerobic capacity.The lack of a relationship between drop in power output and VO2max and HRτ would suggest that these parameters do not significantly influence the process of recovery during repeated sprint exercise.

References

Arsac et al. (1996) Eur J Appl Physiol Occup Physiol. 74: 100-106

Darr et al. (1988) Am J Physiol. 254: H340-3.

EFFECTS OF LUNG VOLUMES ON BREATH-HOLD DIVING DEPTH

Ferretti, G.

CMU, Université de Genève, Switzerland, and Université de Brescia, Italy, Switzerland

The speed that a human can attain is the ratio of the metabolic power to the energy cost of the movement (C), so that the distance covered is the ratio of the available metabolic energy (E) to C. In breath-hold diving, this means that the maximal diving depth (d) is directly proportional to the E stored by the diver and inversely proportional to the C of diving. In water, C is the ratio of the drag of water (D) to the mechanical efficiency of diving (h), so that d= h E/D. A reduction of C was pursued either by reducing D or by increasing h. The former was achieved by improving the hydrodynamics of diving, the latter by improving the diving technique. Concerning E, it is the sum

of the energy provided by aerobic (EO2), anaerobic lactic (ELa) and anaerobic alactic (EPC) metabolisms. ELa and EPC can be set invariant, as they are imposed by maximal blood lactate concentration (Lab, say 15 mM) and by muscle phosphocreatine concentration (PC, 20 mM). In turn, EO2 = ELO2 + EBO2 + EtO2, where suffixes L, B and t designate the O2 stores in lungs, blood and tissues, respectively. EBO2 depends on haemoglobin concentration ([Hb]), EtO2 on myoglobin concentration, that are practically invariant. So EO2 = ELO2 + K, where K is the energy provided by other sources than lung O2 stores. Since the energy equivalent of O2 is a constant depending on the respiratory quotient, the last equation implies that EO2, and thus d, are linear functions of lung O2 volume at the dive's start. We thus expect extreme divers to have very large total lung capacity (TLC) values. This is so for Korean diving women, whose TLC is low (< 5 L). The TLC of Enzo Maiorca, who first dived to 100 m under controlled conditions, was 7.8 L, at the uppermost limit of normal population. Bob Croft, however, who set a world record to 73 m in 1968, had a TLC of 9.1 L. TLC values above 9 L in elite breath-hold divers are a common finding nowadays. At least 15 values above 9 L, and a couple above 10 L, can be reckoned in the literature. Several divers also practise oropharyngeal breathing before diving, which increases the TLC by further 1.5 – 2.0 L. This data support the hypothesis put forward above. In a man with a body mass of 70 kg, a muscle mass of 20 kg, a TLC of 7 L, a blood volume of 5 L, a [Hb] of 150 g/L, a Lab of 15 mM and a PC of 20 mM, who dives close to TLC, the E at the dive's start, in O2 equivalents, would be 6.76 L, of which 1.20 L provided by ELO2. In an extreme diver with the same characteristics as that man, except that his TLC is 10 L instead of 7 L, E would be 7.27 L, of which 1.71 L provided by ELO2. This difference may appear small, yet calculation of the energy balance of deep free dives shows that the C of diving is very low, so that the rate of energy expenditure is similar to that of a 50 W exercise on a bike. If this is so, a 0.5 L increase in ELO2 would imply a 43 m increase in depth. Having large lung volumes is indeed an advantage in deep breath-hold diving.

THE INFLUENCE OF A CARBOHYDRATE-ELECTROLYTE SOLUTION ON TREADMILL RUNNING PERFORMANCE

Gant, N., Williams, C., Backhouse, S.H.

Loughborough University, United Kingdom

The ingestion of carbohydrate immediately before and during exercise lasting less than 1 hour may enhance performance. These benefits may occur independently of the status of carbohydrate stores, which are unlikely to become depleted over this relatively short duration. One possibility is that carbohydrate favourably influences the central nervous system and enhances voluntary workrate. This study examines the influence of a carbohydrate-electrolyte solution (CES) on running performance and subjective experiences using a novel treadmill running performance test.

Eight well trained male runners performed a 45 min treadmill running protocol on 5 separate occasions. Participants ingested a volume of fluid equivalent to 7 ml∙kg-1 body mass (BM) 15 min before exercise and a further 2.5 ml∙kg BM-1 every 10 min during exercise. After 3 familiarisation trials during which the reliability of the protocol was assessed, flavoured water was substituted for either a 6% CES or a taste matched placebo (PLA) in a double blind fashion. The treadmill running protocol consisted of 15 min running at a speed equivalent to 70% VO2 max followed by a 30 min performance test. Throughout the performance test an ultrasonic radar modulator altered the speed of the treadmill belt automatically according to changes in participants' actual running velocity. Time remaining was the only indicator of performance available to participants during the test and treadmill belt velocity was recorded continuously.

A suitable period of familiarisation with the experimental protocol is reflected in the lack of statistical bias between the final 2 familiarisation trials. Total distance covered during the performance test in these trials was 7.56 ± 0.94 km and 7.51 ± 0.98 km respectively. The intraclass correlation coefficient between trials was 0.99 and the coefficient of variation was 2.5%. When manipulating the test solution no statistical differences were detected between trials in the total distance covered during the performance test (CES 7.34 ± 0.62 km vs. PLA 7.26 ± 0.53 km). However, the distance covered during the last 5 min of exercise was significantly greater during the CES trial (CES 1.22 ± 0.11 km vs. PLA 1.17 ± 0.12 km; $P<0.05$) and there was a trend toward a greater variability in treadmill speed over this period. Subjective rating of perceived exertion was similar between trials, but felt arousal was significantly higher during the last 10 min of exercise.

The method used to self-select running speed during this treadmill performance protocol results in an acceptable level of agreement in the distance covered between trials. These results suggest that the ingestion of a CES solution providing approximately 1 g∙kg BM∙h-1 of carbohydrate enhances running performance toward the later stages of a 45 min run. This faster and more variable running pace coincides with a higher level of perceived activation which is subjective indicator of the readiness to perform exercise.

IMPACT OF DAILY WHOLE BODY VIBRATION TRAINING (WVT) ON MUSCLE BLOOD FLOW AND METABOLISM DURING 14 DAYS OF BED REST

Liphardt, A.M., Adams, F., Gottschalk, S., Baecker, N., Frings, P., Heer, M., Luft, F.C., Jordan, J., Boschmann, M.

DLR-Institute of Aerospace Medicine, Germany

Prolonged microgravity (µG) causes loss of bone mass and reduction in skeletal muscle mass and performance. Bed rest in 6°-head-down-tilt (HDT) is a well-established model to simulate some of the physiological effects astronauts experience in µG. Similar to µG, immobilization in 6°-HDT bed rest leads to a lack of mechanical loading in the lower extremities. Although the negative effects on the muscular-skeletal system are known, training methods during space flight still need optimization. Daily WVT might prevent these processes. Because muscle performance and metabolism are strongly associated, we studied the effect of WVT on muscle blood flow and metabolism during 14 days of HDT by micro dialysis.

Eight healthy male, non-obese subjects performed 14-days of bed rest in 6°-HDT in the clinical research facility at DLR-Institute of Aerospace Medicine. The study was carried out as a cross-over-design, consisting of two phases, each lasting 23 days. Each subject received WVT in one phase and a control intervention in the other phase. Study phases were divided into three periods: a 4-day adaptation period, a 14-day intervention period in 6°- HDT bed rest and a 5-day recovery period. During the intervention period, all activities including eating, showering and weighing were carried out in the 6°-HDT position. Study phases were identical with respect to environmental conditions, study protocol and diet. The WVT consisted of 5 x 1 minute whole body vibration twice daily on the Galileo 900 vibration plate (20 Hz / 2-4 mm). At the day before entry into HDT (day -1) and day 13 of HDT, a microdialysis probe was inserted into the right quadriceps femoris muscle (vastus lateralis) and perfused with Ringer's solution (+50 mM EtOH) and increasing doses of isoproterenol (ISO, 0, 0.01, 0.1, 1 and 10 µM). Changes in muscle blood flow were monitored by the ethanol dilution technique.

At day -1, ethanol ratio decreased dose-dependently from 0.11±0.01 to 0.06±0.02 whereas dialysate glucose remained unchanged during perfusion with ISO. At the same time, dialysate lactate increased from 1.12±0.08 to 2.66±0.15 mM and dialysate pyruvate from 0.014±0.003 to 0.100±0.008 mM. Dialysate glycerol did not change significantly. At day 13 of HDT, no significant differences for both baseline and ISO induced changes in ethanol ratio and dialysate metabolite concentrations were observed. If subjects received WVT during HDT, baseline ethanol ratio increased to 0.18±0.03 ($p<0.01$, vs. HDT). However, baseline dialysate metabolite concentrations and

relative changes in ethanol ratio and dialysate metabolite concentrations during perfusion with ISO remained unaffected by additional WVT.

After 13 days of HDT, baseline and ISO induced changes in muscle blood flow and metabolism remain almost unchanged. However, additional WVT reduces significantly baseline perfusion. But, this reduced tissue perfusion is not limiting for both resting and ISO stimulated muscle metabolism.

THE SYSTOLIC TIME IS SHORTENED MORE THAN CARDIAC CYCLE ABOVE CATECHOLAMINE THRESHOLD DURING GRADED EXERCISE

Tanaka, H., Matsuda, T., Kumahara, H., Kiyonaga, A., Shindo, M.

Laboratory of Exercise Physiology, Japan

Introduction

The heart sound is a convenient and noninvasive technique for assessing cardiac performance. This may provide the valuable information regarding exercise stress. Obara et al. (2005) reported that the amplitude of the first heart sound (S1) during exercise accelerates above the lactate threshold. The systolic time, which can be determined by the appearance time of S1 and that of the second heart sound, may vary with the change in a volume of venous return, cardiac contractility and total peripheral resistance. Most of the parameters, which influence the systolic time, are affected by the sympathetic nerve activities. The purpose of this study was to investigate whether the systolic time during exercise could be applied for an alternative index of the catecholamine threshold.

Methods

Nine males, aged 25+/-3 years and 23.6+/-3.7 kg/m2 of body mass index, underwent a submaximal graded cycle ergometer test. The work rate started at 15 watts and then increased at 15 watts every 2 minutes until the heart rate reached 85% of its maximum expected for the age. The heart sound was monitored beat-by-beat throughout the exercise session. Blood from the antecubital vein was sampled and the plasma epinephrine was determined every 2 minutes during the graded exercise test. The plasma epinephrine concentrations were plotted against the work rates. The epinephrine threshold (ET) was determined as the initial break point for plasma epinephrine. The systolic time intervals were calculated for 6 consecutive beats. The correlation coefficients and regression line below and above the ET was individually calculated between the systolic time and the cardiac cycle.

Results

The average of ET was 86.6+/-19.6 watts. The systolic time shortened above the ET in all subjects, thus resulting in the existence of a break point of the systolic time against cardiac cycle. The slope of regression line in the systolic time against the cardiac cycle was found to be steeper above the ET in all cases. The value of slope of regression equation above ET was doubled on average (0.19+/-0.04 in below ET vs. 0.42+/-0.05 in above ET, $p<0.001$).

Discussion/Conclusion

These results suggested that the systolic time starts to shorten sharply above the epinephrine threshold, since the augmentative effects of the sympathetic nerve activity may accelerate the cardiac contractility. Based on the above findings, the break point of systolic time could provide us with valuable information regarding exercise stress.

References

Sigeru Obara, Tetsuya Niki & Masayuki Satake (2005) Adv Exerc Sports Physiol 11: 33-39.

ELECTROMYOGRAPHIC ANALYSIS OF BICEPS BRACHII AND VASTUS LATERALIS MUSCLE DURING AN AEROBIC AND AN ANAEROBIC CYCLING TEST IN SPRINTERS AND LONG-DISTANCE RUNNERS

Tavares, P., Parada, J., Anjos, I., Ribeiro, G., Rosado, M.F., Santos, A., Fontes Ribeiro, C.A.

Faculty of Sport Science and Physical Education, Portugal

In day life and sports we move the arms rhythmically during walking or cycling. However, in cycling laboratory tests the arms neuronal activity is usually neglected, since the majority of the studies focus the leg, in special the Vastus lateralis muscle. Is our goal to do a comparative study between the arm (Biceps brachii) and leg (Vastus lateralis) neuroactivity in two cycling maximal tests.

Male volunteers participated in this study: sprint athletes (SA), endurance athletes (EA) and age and sex-matched sedentary controls (SC). All the subjects performed an aerobic maximal graded exercise test in cycle ergometer (Monark 824E), consisting in a constant pedal frequency (60 rpm) starting with 50 W workload and increasing 25 W every 2 minutes until fatigue. The Wingate test (as a maximal anaerobic test) consists in pedalling for 30 seconds at maximal power.

During the tests the surface-EMG parameters (RMS and MPF-mean power frequency) were evaluated (MegaWin® ME3000 device) in the Biceps brachii and Vastus lateralis of each subject. In order to compare individual results the RMS-EMG values were normalized by dividing the obtained values by the crural and bicipital perimeters of each subject. Results were analysed according to power and time.

Different EMG profiles were found depending on the analysed muscle and exercise type. Concerning the Biceps brachii muscle we observed different behaviours in MPF and RMS depending on the exercise performed. Thus, in the aerobic test there was a higher MPF values for SC and the lowest to EA, decreasing in both groups along the test. The SA presented a constant MPF in the first part of the test followed by a sudden fall in the last part. The RMS showed higher values for EA and a progressive increase during the test in all subjects. The SA and SC groups had lower EMG amplitude. In EA the RMS profile was similar but reverse (increasing) to the observed MPF. In all the cases, the EMG parameters indicated fatigue. The anaerobic test (for all groups) showed a constant value of MPF, but significant lower when compared to the aerobic test. The RMS values decreased during the anaerobic test, but presented absolute values about ten times higher than in the aerobic test.

The Vastus lateralis muscle also showed differences depending on the performed test. Thus, in the graded aerobic test the SA presented a decrease in MPF values that were constant for EA and SC. The corresponding RMS values increased during the test, being the SA the group that present the lowest values. A positive correlation with power was found. In the anaerobic test the MPF values decrease for EA and remain constant for the other subjects. However, RMS remains constant for all the studied groups. The differences found concerning EMG parameters may be related with the proportion of fiber types recruited.

This work was supported by a PAFID programme from the Portuguese Sport Institute and by FCT (Fundação para a Ciência e Tecnologia), Portugal.

EFFECTS OF ALTITUDE TRAINING ON VASCULOGENIC/ANGIOGENIC GROWTH FACTORS

de Marées, M., Wahl, P., Knuth, S., Buitrago, S., Suhr, F., Tandi, S., Achtzehn, S., Mester, J.

German Sport University Cologne, Germany

Effects of altitude training on vasculogenic/angiogenic growth factors

Markus de Marées, P. Wahl, S. Knuth, S. Buitrago, F. Suhr, S. Tandi, S. Achtzehn, J. Mester

Institute of Training Science and Sport Informatics, German Sport University Cologne, Germany

Introduction

In competitive sports high altitude training is used to increase EPO concentrations and erythrocytes in order to improve O2-transport capacity in blood. Hypoxia and EPO, however, seem to be a major stimulus for angiogenesis/vasculogenesis as well1. Like EPO, vascular growths factors (VEGF), are also controlled by HIF-1α and may be induced by hypoxia2.

The aim of this study hence was to realise a protocol with a large homogenous group of highly-trained athletes where the control group trains at sea level and the experimental group under natural hypoxic conditions. The effects of hypoxia and sea level training on angiogenic/vasculogenic growth factors were measured.

Methods

Thirty-two highly-trained junior swimmers (18 subjects in experimental group, 14 subjects in control group) participated in the study. The athletes of the altitude group stayed for three weeks in a training camp at an altitude of 2300 m. During the baseline two incremental tests on a cycle ergometer under sea level conditions and under artificial hypoxic conditions with 2 blood samples (before and after, respectively) were carried out. The same protocol was carried out in both groups. In first and second week after the training period the athletes realized two post-investigation tests. Before and after the training phase swimming competitions were carried out.

Results

Significant changes of EPO, VEGF and IGF-1 were measured for the high altitude group although a highly individual component could be proven. As expected, VEGF and EPO both regulated by HIF-1α increased only in high altitude group. The breakdown of IGF-1 in the high altitude group indicated a more exhaustive training compared to sea level. Endostatin showed a significant increase at the first day of hypoxic exposure. During the hypoxic intervention endostatin then returned to nearly base-line levels. Whether that is a general trend for adaptation or can stronger reactions for the mentioned values caused by highly physically activity be displayed (data not shown yet)?

The results in general showed a clear influence of hypoxic conditions also with respect to performance parameters such as anaerobic threshold compared to the control group.

References

1. Heeschen C, Aicher A, Lehmann R, Fichtlscherer S, Vasa M, Urbich C, Mildner-Rihm C, Martin H, Zeiher AM, Dimmeler S. Erythropoietin is a potent physiologic stimulus for endothelial progenitor cell mobilization. Blood 2003; 102: 1340-1346

2. Liu LX, Lu H, Luo Y, Date T, Belanger AJ, Vincent KA, Akita GY, Goldberg M, Cheng SH, Gregory RJ, Jiang C. Stabilization of vascular endothelial growth factor mRNA by hypoxia-inducible factor 1. Biochem Biophys Res Commun 2002; 291: 908-914.

THE INFLUENCE OF RAMP RATE ON THE VO2-WORK RATE RELATIONSHIP IN ROWING

Draper, S., Townsend, M., Potter, C., Samuel, K.

University of Gloucestershire, United Kingdom

The relationship between the rate of oxygen uptake (VO2) and work-rate (W-R) is a concept that is central to exercise physiology. Whilst this relationship was traditionally viewed as linear, recent findings have demonstrated non-linearity in both cycling (Zoladz et al., 1995) and running (Jones et al. 1999). This non-linearity is however often masked by the use of fast incremental protocols that do not allow the slow component of VO2 to fully develop. Hansen et al. (1988) demonstrated in cycling that when a fast ramp rate was used the slope of the VO2 – W-R relationship was unchanged across exercise intensities. However, when a slower ramp rate was used this slope increased at higher W-Rs. Such a response to incremental exercise has never been investigated in rowing exercise. The purpose of the present study was to investigate the influence of ramp-rate on the VO2 – W-R relationship in rowing.

Ten physically active male subjects (mean ± SD); age 21 ± 1 years, height 1.79 ± .04 m and mass 82.2 ± 11.2 kg volunteered to take part in the study. Each preformed two incremental tests to exhaustion on a rowing ergometer (Concept II model C, Nottingham UK). One test was a fast incrementing (25 W·min-1) and the other slow (10 W·min-1); each was performed on separate days and the order of theses tests was counterbalanced. Power and VO2 were measured throughout each test on a stroke-by-stroke and breath-by breath (K42b, Cosmed , Italy) basis respectively. Ventilatory threshold (VT) and peak VO2 (VO2peak) were calculated for each test and data were split both at the half time for each test and at VT to analyse the change in slope.

Neither VO2 at VT nor VO2peak was affected by ramp rate ($P = 0.899$ and 0.718 respectively) but power at VT was significantly lower in the slow ramp test ($P = 0.029$). The slow ramp test demonstrated an increased slope when data were split at VT and any visual VO2 plateau was removed ($P = 0.041$). The fast ramp test showed a decreased slope when data were split by both time ($P = 0.036$) and at VT ($P = 0.026$).

The results supported previous research in cycling as an increased slope was identified above VT in a slow incremental test showing that the VO2 – W-R relationship is not linear in rowing. The mechanisms responsible for the decreased slope above VT in the fast test are unclear and warrant further investigation. For the assessment of rowers, the ramp rate does not affect VO2peak but does alter the W-R at VT.

References

Hansen et al. (1988) Oxygen uptake as related to work rate increment during cycle ergometer exercise. J Appl Physiol. 57: 140-145

Jones et al. (1999) A disproportionate increase in VO2 coincident with lactate threshold during treadmill exercise. Med Sci Sport Ex. 31: 1299-1306

Zoladz et al. (1995) Non-linear relationship between O2 uptake and power output at high intensities of exercise in humans. J Physiol. 488: 211-217.

ANGIOTENSIN I CONVERTING ENZYME GENE POLYMORPHISM AND PHYSICAL TRAINABILITY IN ELDERLY: AN ELECTROCARDIOLOGICAL APPROACH

Tobina, T., Mori, Y., Akagi, Y., Doi, Y., Ishii, K., Chiba, H., Shindo, M., Kiyonaga, A., Tanaka, H.

Fukuoka University, Japan

Introduction

It is established that inter individual differences exists in exercise effects and a specific genetic factor was behind that. The well known genotype influence human physical performance and trainability is angiotensin I converting enzyme (ACE) gene insertion/deletion (I/D) polymorphism. ACE is a key enzyme to produce angiotensin II (Ang II) and it is known that individual with the D allele has higher ACE activity in serum and tissue. The Ang II stimulates cell growth, resulting greater exercise induced left ventricular hypertrophy (LVH) in D allele. Some studies confirmed the phenomenon, but it is unclear whether D allele contributes improvement of cardiac function to exercise training. It is most likely that morphological cardiac changes accompany electrophysiological adaptation. In electrocardiological approach, Schuit et al reported that QT interval corrected by heart rate (QTc), which prolongation is prognostic factor for arrhythmia and sudden death, is decreased by exercise training. Furthermore, some studies suggested that there is association between ACE gene I/D polymorphism and QTc prolongation. In the present study, we investigated the association between ACE gene I/D polymorphism and physical performance and cardiac adaptation in elderly.

Methond

One hundred thirty five elderly (51 men and 84 women) participated in this study. Genomic DNA was obtained from peripheral blood and ACE gene I/D polymorphism were decided by PCR method. All subjects performed incremental exercise test on bench stepping and lactate threshold (LT) was determined for aerobic capacity and training intensity. The participants were instructed to do bench step exercise for 140min/week for 12weeks. A 12-lead resting electrocardiogram (ECG) was recorded. QT interval corrected by Bazzet formula.

Results

The distribution of ACE genotype in I/I, I/D and DD was 44 (32.6%), 73 (54.1%) and 18 (13.3%), respectively. Characteristics and training time were similar among the genotypes. The baseline of aerobic capacity was higher in I/I than that in I/D, and QTc was longer in I/D than that in I/I only the women but not in the men. Training responses were adjusted by age, training time and the baseline. The aerobic capacity was improved in all genotypes. The increase in aerobic capacity in I/D was greater compared with that of I/I in women (0.98±0.79 vs 0.43±0.81 mets: Mean±SD). QTc was not decreased by exercise training in men and women. That is tendency to decrease in QTc only D/D women (426±19 vs 418±15 msec). Furthermore, training response of QTc was significantly different in D/D vs I/I and I/D vs I/I (D/D: -7.8±12.3, I/D: -2.7±17.3 and I/I: 9.8±17.3 msec, respectively)in women. Conclusion: The D allele of ACE gene I/D polymorphism may contribute cardiac function improvement to exercise in women.

Reference

Montgomery HE et al., Nature 393: 221-2, 1998.

Montgomery HE et al., Circulation 96: 741-7, 1997.

Schuit AJ et al., J Electrocardiol 31: 111-6, 1998.

EFFECTS OF PROLONGED BED REST ON THE CARDIOPULMONARY RESPONSE TO POSTURAL CHANGES IN HUMANS

Tam, E. 1+2, Fagoni, N. 3, Azabji-Kenfack, M. 1, Cautero, M. 2, Lador, F. 1, Moia, C. 1, Capelli, C. 2, Ferretti, G. 1+3

1 CMU, Genève, CH, 2 Uni Udine, IT, 3 Uni Brescia, IT, Switzerland

In order to gain a better understanding of the cardio-pulmonary impairment induced by prolonged bed rest, we measured steady-state oxygen uptake (V'O2) and carbon dioxide output (V'CO2), by Grønlund's algorithm on a breath-by-breath basis, cardiac output (Q'), by open circuit acetylene washout, heart rate (HR), by electrocardiography, and mean arterial pressure (MAP), by fingertip plethysmography, on 18 male subjects (33.1 years ± 0.9; 71.1 kg ± 1.1; 1.75 m ± 0.01) before (BB) and after (AB) 90 days of head down tilt bed rest, in the following conditions : upright and supine posture, both at rest and at the 50 W exercise. The stroke volume (SV) was calculated as the ratio of Q' to HR. The total peripheral resistance (TPR) was calculated as the ratio of MAP to Q'. V'O2 was lower ($p<0.01$) supine than upright (0.43 l/min vs 0.52 l/min at rest; 1.06 l/min vs 1.27 l/min at 50W) in BB. In AB, V'O2 was 0.81 l/min at rest and 1.61 l/min at 50W upright, whereas supine it was 0.74 l/min at rest and 1.54 l/min at 50W. All the values in AB were significantly higher than the corresponding values in BB. V'CO2 followed the same patterns as V'O2, so that the gas exchange ratio was the same in all conditions. In BB, Q' was the same supine and upright. In AB, Q' was significantly higher supine than upright at rest (6.11 l/min vs 5.40 l/min). All Q' values observed in AB were significantly higher than the corresponding values in BB (rest: 5.40 vs 4.50 upright; 6.11 vs 5.05 supine. 50 W exercise 8.26 vs 6.99 upright and 9.18 vs 7.38 supine). SV was higher supine than upright (71.2 ml vs 51.2 ml BB, 78.6 vs 55.4 ml AB at rest; 76.9 ml vs 67.2 ml BB, 87.5 ml 70.8 ml AB at 50W). HR was lower supine (70.3 bpm at rest, 95.2 at 50W) than upright (87.8 bpm at rest, 104.7 at 50 W) in BB, and was (77.3 bpm at rest, 103.9 at 50W) and (97.7 bpm at rest, 116.8 at 50 W) in AB. SV was the same in AB as in BB, whereas HR was higher in AB than in BB. MAP was lower supine than upright in AB (94.3 mmHg vs 105.4 mmHg at rest; 101.6 mmHg vs 115.4 mmHg at 50W). In supine posture, MAP was lower in AB than in BB, both at rest and at exercise. TPR was lower supine than upright in AB (17.8 mmHg*min/l vs 21.6 mmHg*min/l at rest; 12.8 mmHg*min/l vs 16 mmHg*min/l at 50W). In supine posture, TPR was lower in AB than in BB, both at rest and at exercise. These results suggest that the cardio-pulmonary system adjusts to reduced blood volume and increased venous compliance essentially by increasing HR, perhaps modulated by increase in sympathetic output tone. The HR increase is larger than the drop in SV, so that Q' is increased in AB. This is coherent with the higher V'O2 levels in AB than in BB at the same power. The V'O2 increase could be mainly due to an impairment of the motor control system after 90 days of bed rest.

SEX DIFFERENCES IN HAMSTRING/QUADRICEPS RATIO AFTER AN ISOKINETIC ENDURANCE TRIAL

De Ste Croix, M., Deighan, M.

University of Gloucestershire, United Kingdom

It is well known that the Hamstring/Quadriceps (H/Q) ratio is important for knee stability, especially at high limb velocities (Gerodimos et al. 2003). Studies have suggested that females fatigue less than males during muscular endurance tasks (Hicks et al. 2001) but there appear to be no studies that have examined sex differences in the H/Q ratio after an isokinetic fatigue task.

Twenty five subjects, consisting of 14 males (age 23.9 ± 4.5 y; mass 78.6 ± 6.9 kg; stature 1.82 ± 0.07 m) and 11 females (age 29.1 ± 6.5 y; mass 62.4 ± 8.2 kg; 1.66 ± 0.05 m), agreed to participate in the study. Gravity corrected isokinetic concentric knee extension and flexion

peak torque for the dominant limb were assessed using a calibrated Cybex 6000. After a standardised warm up subjects performed 3 maximal efforts at 1.04 and 3.14 rad.s-1, followed immediately by a 50 repetition fatigue task at 1.56 rad.s-1. Immediately after the fatigue task the subjects repeated the strength assessment at the 2 velocities. The H/Q ratio was expressed as a percentage. A sex (2) by velocity (2) by test occasion (2) Repeated Measures ANOVA was undertaken to examine sex and velocity specific differences in the H/Q ratio pre and post fatigue. Mean (± SD) values pre and post fatigue task for males were: 54% (± 11) and 62% (± 15) at 1.04 rad.s-1 and 62% (± 11) and 70% (± 13) at 3.14 rad.s-1. Females' values were 46% (± 6) and 51% (± 9) at 1.04 rad.s-1 and 53% (± 8) and 58% (± 11) at 3.14 rad.s-1. There were no interaction effects for all variables examined. However, a significant test occasion effect ($P < 0.05$) was observed with a higher ratio evident after the fatigue task for both velocities. A significant sex effect ($P < 0.05$) was also observed for both velocities with males demonstrating a higher ratio than females. A significantly higher ratio ($P < 0.05$) was evident at 3.14 compared to 1.04 rad.s-1 at both velocities. These data suggest that when the knee muscles are fatigued the H/Q ratio provides increased stability of the knee, irrespective of movement velocity. In all cases this was due to greater levels of fatigue in the quadriceps compared to the hamstrings. Males' greater ratio than females could be attributed to stronger hamstring muscles in relation to their quadriceps. To conclude, as the knee muscles fatigue there is an increase in the H/Q ratio which could reduce any potential injury risk.

Hicks, A.L., J. Kent-Braun, and D.S Ditor. Sex differences in human skeletal muscle fatigue. Exerc. Sport Sci. Rev. 29:109–112, 2001.

Gerodimos, V.; Mandou, V.; Zafeiridis, A.; Ioakimidis, P.; Stavropoulos, N.; Kellis, S. 2003. Isokinetic peak torque and hamstring/quadriceps ratio in young basketball players. J. Sports Med. And Phys. Fitness 43 (4) 444-452.

WINGATE TEST: DETERMINATION OF OPTIMAL LOAD IN OLDER WOMEN

Fernández Peña, E., Ditroilo, M., Benelli, P., Centonze, D., De Lillo, F., Giacomini, F., Grassi, E., Trisolino, G., Stocchi, V.

Istituto di Ricerca sull'Attività Motoria, Università degli Studi di Urbino , Italy

The Wingate Anaerobic Test (WAnT) was introduced in the 1970s and ever since has been widely used for measuring the anaerobic power output for primarily knee extension. Athletes involved in different sports have been assessed with the WAnT (1). Modifications and adaptations of the original protocol, especially the appropriate resistance that would lead to the highest possible peak power output (PPO), have been suggested when particular populations, such as sedentary individuals and children, had to be evaluated. However, to the best of our knowledge, very few studies focused on the WAnT protocol adjustments for elderly, despite the fact that anaerobic power output is related to the ability of successfully perform daily tasks (3). Accordingly, the aim of the present study was twofold: i) identify the best ergometer resistance for older healthy women in a 6 second WAnT for achieving the maximal PPO; ii) present some normative data related to WAnT for older women.

Fourteen healthy women (age 66.14 ± 3.8 years; weight 66.21 ± 7.8 kg) volunteered and gave their written informed consent for participating in the study. They underwent a medical examination and were familiarized with a mechanically braked cycle ergometer (Monark 894E) before inclusion. The pedals were equipped with toe clips and straps. Each participant was requested to perform, in random order, three 6-second WAnTs against a resistance equivalent to 7.5%, 5% and 3.8% of body weight (BW). Since it has been shown that the PPO is typically gained in the first 5 seconds for a normal WAnT (1,2), a 6-second test was chosen. After a 5-minute warming up, they pedaled as fast as possible against the unloaded flywheel, and the resistance was applied when they reached about 100 rpm (measured by an automatic counter).

The PPO (mean±SD) for 3.8% and 5%BW was 3.97±0.65 W/kg and 4.23±0.64 W/kg respectively, which means a 6.64% higher with 5%BW. Results for PPO at 7.5%BW are not presented because most of the subjects weren't able to complete the test with such a high resistance, or performed it at a pedaling rate that was too low (<50 rpm). A paired t-test analysis showed statistical significance between the 3.8 and 5% conditions ($p<0.01$).

Nowadays the original 7.5%BW load is considered too small for testing healthy adults, and 10% and 9%BW loads are recommended respectively for adult athletes and nonathletes (1). Marsh et al. (2) used a 8.5%BW load with healthy and physically active older men in a 30-second WAnT, yielding a PPO of 10.7 W/kg. The results presented showed that older healthy women reached a higher PPO with a resistance of 5%BW when compared to a 3.8% and 7.5% during a 6-second WAT. These findings are in agreement with Slade et al. (3), who found a 3,83 W/kg PPO with a 6,7%BW in a similar population.

1- Inbar, O. et al. (1996). Champaign, IL, Human Kinetics.

2- Marsh, G. D. et al. (1999). Exp Physiol 84(3): 589-97.

3- Slade, J. M. et al. (2002). J Gerontol A Biol Sci Med Sci 57(3): M168-72.

AN INTEGRATIVE APPROACH IN STUDYING HUMAN CARDIOVASCULAR RESPONSE TO ACUTE NORMOBARIC HYPOXIA

Nesterov, S.V.

University of Turku, Finland

Physiological responses to acute hypoxia – deficiency in the amount of oxygen delivered to the body tissues of the organism – are complex and involve a wide range of mechanisms, occurring at all levels in the body to achieve enhanced survival in hypoxic environment: from integrated systems' response to relatively self-sustained peripheral responses on molecular level. The purpose of the work was, encompassing in the one study cerebral circulation, central circulation and the control of circulation by autonomic nervous system, find out the integrative response of the cardiovascular system to severe acute hypoxia.

The study was performed on 45 practically healthy right-handed men aged 18-34 years. The hypoxic exposure consisted of 15 minutes of breathing hypoxic gas mixture (8% oxygen in nitrogen). Impedance plethysmography methods were used: rheoencephalography – to estimate cerebral blood flow, integral rheography – to estimate the stroke volume and cardiac output. Pneumotachography was used to assess the respiratory frequency, pulse oximetry – hemoglobin oxygen saturation. Autonomic nervous system influence on the heart rate was assessed with continuous wavelet transform-based analysis of heart rate variability (HRV). A part of the study was solely dedicated to evaluating the influence of respiratory frequencies (RF) on HRV. (It showed that estimation of HRV without simultaneous estimation of RF conveys a possibility of misinterpretation of results for the decreasing RF nonlinearly increases HRV not mentioning the fact that RF less than 9 per minute automatically transfers a "parasympathetic" peak into a "sympathetic" region.)

Hypoxic exposure led to the predominant reduction of HRV. It was found out that the known hypoxic reaction "sympathetic increase – parasympathetic decrease" is the most frequent but not the only possible: "both increase" (after initial drop) was a reaction, although rare, in persons with high hypoxic tolerance and "both decrease" was a sign of the bad tolerance leading to collaptoid reaction. Stroke volume always decreased under the exposure; however, cardiac output could decrease, increase or stay almost unchanged. No particu-

larly surprising results were obtained for the cerebral blood flow: it increased; however, in the left hemisphere there was a significant ($p < 0.0001$) prevalence of internal carotid artery supply over that coming from the vertebrobasilar system; in the right, this prevalence was not significant ($p = 0.09$).

Although the study showed some individuality of reactions, in general, acute hypoxia can be seen as a strong influence leading to isolation of functional systems and attracting them, through losing their homeokinetic properties, to final stability.

ANTHROPOMETRIC PROFILE OF ELITE SYNCHRONIZED SWIMMERS AGED 13-15Y

Bante, S., Bogdanis, G.C., Papaspyrou, A., Maridaki, M.

University of Athens, Greece, Greece

Introduction

Synchronized swimming is classified into a special category of sports that are collectively termed "artistic sports". In this category of sports not only the technical skills, but also the harmony in movement as well as the physical structure are very important and may influence the judge's evaluation. The purpose of the present study was to determine the anthropometric profile of synchronized swimmers aged 13-15 years, and the relationship of selected anthropometric characteristics to performance scores.

Methods

The sample consisted of 128 synchronized swimmers aged 13-15 years. These swimmers were members of 17 national teams that took part in the 15th Comen Cup 2005. Measurements included body weight, height, selected body lengths, diameters, perimeters and skinfolds, and were performed by an experienced anthropometrist using standard procedures. From these data, the Heath-Carter somatotype was determined and the percentage of body fat and lean body weight were estimated using the equations of Durnin and Rahaman. Synchronized swimmers were then divided into two subgroups, the medalists (3 top teams, n=35) and the non-medalists (n=93) and t-tests were used to compare the two subgroups. The relationship between anthropometric variables and performance scores were determined using Pearson's Correlation Coefficient.

Results

Medalist synchronized swimmers had similar height, body weight, arm length and leg length with the non medallists. However, medalists had a lower percentage of body fat (18.0 ± 0.5 vs. 19.7 ± 0.4 %, $P<0.01$) and a higher lean arm cross sectional area (43.5 ± 0.8 vs. 39.0 ± 0.6 cm2, $P<0.05$) compared to the non medalists. Low but significant correlations were found between performance scores of all swimmers and thigh length ($r=0.39$, $P<0.01$), leg length ($r=0.36$, $P<0.01$), arm length ($r=0.24$, $P<0.01$) and arm lean cross sectional area ($r=0.3$, $P<0.05$). The values for the somatotype components were 3.2 ± 0.1 - 3.2 ± 0.4 - 4.0 ± 0.1 with the ectomorphic component being predominant.

Discussion

The results of this study show that the medalist synchronized swimmers had similar body structure (height, lengths, weight) but different body composition (body fat, lean arm cross sectional area) compared with the non-medalists. However, physical characteristics of young synchronized swimmers do not seem to be related to performance in agreement with previous reports referring to senior synchronized swimmers (Poole et al. 1980, Yamamura et al. 1999).

References

Poole G.W. et al (1980). Can. J. Appl. Sports Science 5: 156-160

Yamamura C. et al (1999). Int. J. Sports Med. 20: 246-251.

SOLEUS TENDON TAP REFLEX ADAPTATIONS TO LOWER LIMB SUSPENSION IN HUMANS

Seynnes, O.R., Pensini, M., de Boer, M., Maganaris, C.N., Narici, M.V.

Manchester Metropolitan University, United Kingdom

Simulated and actual microgravity conditions induce a loss of muscle mass and strength (1) and, as recently reported, a reduction in tendon stiffness (2). Concomitantly, studies looking at the neuromuscular adaptations to unloading have typically reported increases in the Hoffmann (H) reflex in both humans and animals (3,4), reflecting an increase in synaptic efficiency. In accordance with these spinal adaptations, one would expect the tendon tap (T) reflex to increase in microgravity. However, since muscle spindles act in series with the tendon, an increase in tendon compliance following disuse might induce changes in stretch reflex opposite to those observed above.

In the present study, neuromuscular adaptations to 23 days of unilateral lower limb suspension (ULLS) were assessed in the soleus (SOL) and gastrocnemius lateralis (GL) muscles of 6 healthy men (aged 18 to 20 yr). Measurements were performed at baseline, at the end, and after 7 days of recovery from ULLS. Spinal reflex activity (maximal H reflex and T reflex) and maximal muscle compound action potential (M) were recorded on the SOL muscle. In order to differentiate the influences of changes in synaptic efficiency and tendon material properties, the T reflex was recorded at 4 increasing intensities of tendon tap percussion (T1, T2, T3, and T4). The highest intensity was defined as that necessary to evoke a maximal response (T4) in all subjects at baseline, while the lowest intensity corresponded to the liminal level necessary to evoke a T reflex (T1). Consistently with previous literature, maximal voluntary contraction and electromyography activity of the GL decreased by 9% ($p=0.03$) and 26% ($p=0.03$), respectively. These changes were accompanied by a gain in synaptic efficiency represented by an increased H/M ratio (+27%, $p=0.04$) and a similar trend for T4/M (+11%, $p=0.20$). However, the slope of the recruitment curves of T/M versus percussion intensity increased by 49% ($p=0.04$), indicating that at the intensities eliciting T1 and T2, the sensitivity of this response was reduced. Indeed, when the influence of spinal adaptations was by-passed by normalising the T to H, the normalised T reflex was depressed at all intensities of hammer strike. Seven days after resuming normal ambulation, H reflex decreased to its initial value. Instead, the T reflex was depressed in all subjects but one.

Taken together, these results highlight an antagonism between the influence of adaptations at the spinal and tendinous levels upon the T reflex. Most of all, they show for the first time that, during prolonged disuse, the effect of an increased tendon compliance on the T reflex is masked by an acute increase in synaptic efficiency.

1. Edgerton and Roy, In: Handbook of Physiology Environmental Physiology.1996, p. 721–763.

2. Reeves et al., J Appl Physiol 98: 2278-2286, 2005.

3. Duchateau, Med Sci Sports Exerc 27: 1581-9, 1995.

4. Anderson et al., J Exp Biol 202: 2701-7, 1999.

THERE IS NO AN ELECTROMYOGRAPHIC THRESHOLD DURING INCREMENTAL EXERCISE IN ELDERLY SUBJECTS

Ferri, A., Adamo, S., Longaretti, M., Lanfranconi, F., Marzorati, M., Colombini, A., Grassi, B.

University of Milano-Bicocca, Italy

Introduction. During incremental cycling exercise in young (Y) people, the metabolic and ventilatory changes associated with the aerobic-anaerobic transition phase seem to be associated with muscular changes reflected by non-linear increases in surface electromyographic activity (EMG)1. The EMG threshold could be explained by an increased contribution of fast twitch motor units to maintain the required energy supply for contraction. Because of atrophy of type II fibres with age, it was hypothesised that there would not be an EMG threshold in elderly (E). It was further hypothesised that EMG and ventilatory thresholds would occur at the same time in young (Y).

Methods. 12 Y (28.2±3.2yr; mean±SD) and 12 E (78.2±3.8yr) males carried out an incremental exercise to voluntary exhaustion on a cycle ergometer. Pulmonary ventilation (VE), gas exchange (O2 uptake, VO2, and CO2 output, VCO2) and vastus lateralis (VL) EMG were recorded continuously during the test. Root mean square (RMS) and median power frequency (MDF) of the EMG signal were calculated and ventilatory threshold (VT) was determined by conventional methods2. Values obtained at exhaustion were considered "peak" values.

Results. At exhaustion, peak power (107.9±22.9 W) and VO2peak (18.8±4.4 mL kg-1 min-1) in E were about 50% lower ($p<0.001$) than in Y (243.3±42.9 W and 37.0±5.2 mL kg-1 min-1, respectively). The VT occurred at 70.6±8.3% and 62.3±13.2% of the VO2peak, and at 65.5±11.6% and 55.8±17.2% of the maximal power in E and Y, respectively. In Y, RMS values showed a non-linear increase, reflecting a breaking point, at 62.4% of the peak power, whereas in E, a significant positive linear regression ($R2=0.98$) was found. MDF values increased positively in Y from the first point to 90% of the peak power, where MDF started to decrease; in E a positive linear correlation was found throughout the incremental test. When RMS was correlated to VO2, a non-linear increase was found in Y with a break point corresponding to 78.2% of the VO2peak, whereas in E, no break point was found.

Discussion. These results suggest that elderly people show a different pattern of fibre recruitment with respect to young during incremental exercise, probably because of the preferential atrophy of fast-twitch fibres, that occurs with ageing. The presence of an EMG threshold during incremental exercise in Y is consistent with previous research, and may be due to the progressive recruitment of type II fibres. Whereas in E there was a linear relationship between RMS and VO2, in Y increases in RMS exceeded increases in VO2 after 78% of the VO2peak, indicating that RMS is not always a reliable estimate of energy expenditure during an incremental cycling exercise.

References.

1Hug F et al. (2003). Clin Physiol Funct Imaging 23: 208-214

2Beaver W et al. (1986). J Appl Physiol 60: 2020-2027

Acknowledgements

Financial support by EC Contract QLRT-2001-00323 ("Better-Ageing") is acknowledged.

SWIMMING TRAINING, LEFT VENTRICULAR DIMENSIONS AND FUNCTION AND MAXIMAL OXIGEN UPTAKE IN YOUNG BOYS

Madeira, R., Trabulo, M., Alves, F., Gomes Pereira, J.

University Lusófona of Humanities and Technologies; Faculty of Human Kinetics, Technical University of Lisbon; British Hospital, Portugal

The purpose of this study was to determine the effect of swimming training on left ventricular (LV) cardiac morphology and function in young boys and analyse the relationship between LV dimensions/function at rest and maximal oxygen uptake (VO2max) in young swimmers. Antropometric and body composition measures, resting M–mode and Doppler echocardiography and a treadmill protocol for determination of VO2max were performed by twenty four boys separated into two groups: swimmers (SA) and control group (CG).

Two dimensionally guided M mode recordings were obtained parasternally in accordance with the recommendations of the American Society of Echocardiography; measurements of the left ventricular (LV) wall thickness and internal diameter were obtained by positioning the trackball cursor on the screen. VO2max was determined using the modified Balke treadmill protocol. The athletes were encouraged to reach maximal effort. VO2max was defined as peakVO2. All the studies were performed by the same investigator. Echocardiographic data and VO2max was expressed in absolute units and then scaled allometrically for individual differences in anthropometrical data - body mass (BM), height (H), body surface area (BSA), body fat percentage (%BF) and fat free mass (FFM). Mean values for SA were compared with those for CG using *t* tests for unpaired data. Pearson product–moment correlation coefficient was calculated to evaluate the relationships between LV dimensions and functions and VO2max. Results of all statistical testes were considered significant if $p< 0.05$. SA and CG were of similar age but different in their anthropometric and body composition characteristics. The SA group was significantly heavier, had greater BSA, owing to significantly reduced %BF ($p<0.01$) and showed greater FFM, was slightly, but not significantly, taller and had greater BMI, when compared to CG. Fifty percent of SA exhibited end–diastolic LV internal chamber dimension above normal (> 54 mm). Cardiac dimensions in both groups were within normal ranges. Absolute end–diastolic LV internal chamber dimension (LVIDd) and end–systolic LV internal chamber dimension (LVIDs) were significantly greater in SA than CG. The differences between the groups persisted after allometric scaling. CG displayed significantly greater mean values for relative end–diastolic wall thickness ($p < 0.01$) but both groups showed LV eccentric enlargement ($RWTd < 0.44$). LVM was greater in SA than in CG, after scaled by BSA-1.5. Absolute and relative LV systolic functions were significantly greater ($p < 0.01$) in SA, namely LV end–systolic volume, SV and Q as well as LV diastolic function (LV end–diastolic volume). Heart size was highly correlated with VO2max in swimmers and end–diastolic LV internal chamber dimension was the main determinant factor. Swimming training induced a typical "athlete's heart" with dominance of volume and diameter (eccentric LV hypertrophy) and mild changes in LV mass.

RELATIONSHIP BETWEEN DECAY TIME OF HEART RATE AND TIDAL VOLUME AFTER EXERCISE BY OCULOCARDIAC REFLEX

Tajima, T., Tadano, C., Yona, M., Muro, M.

Toho university school of medicine, Japan

Purpose :

Many investigators have reported that heart rate (HR) recovery after exercise is regulated by central command (CC) and arterial baroreceptor reflex. It has been suggested that the decay time of HR response is related to the exciting strength of vagal activity via CC. The HR decrease is a consequence of the oculocardiac reflex (OCR) that produces bradycardia and cardiac arrhythmias such as nodal rhythm throughout a trigeminovagal reflex.

We evaluated the change of the vagal activity after exercise when the eyeballs were pressured immediately after exercise.
Method :
Five healthy males (mean age: 30.8±8.2 yrs) took part in the incremental exercise test using a cycle ergometer. The subjects were in a supine position on the cycle ergometer and after resting for 5 minutes they proceeded with the exercise for 3 minutes. Immediately after exercise HR responses of the recovery were measured for 5 minutes with OCR and without OCR in both eyeball pressure for 10 sec at about 80mmHg. The respiratory responses, inspired (iVt) and expired tidal volumes (eVt), were measured simultaneously by breath- by-breath method. The recovery HR was calculated from R-R interval at corresponding phase of respiration. The time constant of HR recovery (T30) and the decay rate of HR recovery (DR5) was calculated form the decay time of HR response for 30 sec and for 5 sec, respectively. These indexes were defined as an index of parasympathetic activity immediately after exercise.
Results :
The T30 was compared with OCR and without OCR by pressure of the eyeballs (EP). The DR5 after exercise in EP (0.0209 HR/sec) increased more than CON (0.0073 HR/sec). However, T30 in CON (60.25sec) declined faster than in EP (67.21sec). Thereby, the relationship between DR5 in EP and T30 in CON was negative in correlation (r=0.798). However, the relationship between iVT and HR response also showed a negative correlation during EP.
Discussion/Conclusion :
Although HR recovery for 5 seconds was short, the effects of exciting vagal activity by pressuring eyeballs was reinforced. Vagal activity was excited immediately after the exercise stopped, but as time passed, OCR induced a negative feedback and then slowed down the recovery in the time between 5 seconds and approximately 2 minutes.
In conclusion, the slope of the decay time of HR for 5 seconds was affected immediately by OCR. Furthermore we suggest that OCR may repress vagal activity temporarily because it might affect iVT and take a role in respiratory drive.
References :
Pedro Boscan and Julian F. R. Paton: Integration of cornea and cardiorespiratory afferents in the nucleus of the solitary tract of the rat, Am J Physiol Heart Circ Physiol 282: H1278-H1287, 2002.

DRINKING WATER AD LIBITUM DOES NOT PREVENT MASS LOSS. DOES IT PREVENT DEHYDRATION?

Golja, P. 1, Blatnik, J. 1, Mekjavic, I.B. 2
1 Nova Gorica Polytechnic, 2 Jozef Stefan Institute, 39 Jamova St., SI-1000 Ljubljana., Slovenia

Background
Guidelines for maintaining proper hydration recommend fluid intake at a level which matches sweat and urine losses (Casa, 2000; Coyle, 2004). Such guidelines are not easy to follow, as the sensation of thirst during exercise results in a water consumption lower than the concomitant sweat loss (Pitts, 1944), but the voluntary over-consumption of water may lead to hyponatraemia (Noakes, 1985). Also, in competitive long duration sports it is not practical to drink at high rates; the athletes may voluntarily risk dehydration in order to save time. No such conflict is present during non-competitive activities. The aim of the study was to assess whether and to what level dehydration occurs during moderate non-competitive activity in temperate environment with ad libitum water availability.
Methods
Sixteen subjects were weighted and then rested supine for 1 hour in a 24°C environment. Upon rest, venous blood samples were taken in supine position, and urine samples were obtained. The subjects then walked outdoors for 12.5 km at an average walking speed of 5.5 km/h. During the walk, eight subjects drank water ad libitum (NH) and the other eight were restricted from drinking (DH). Following the walk, the subjects were again weighted, rested supine for 1 hour, and blood and urine samples were obtained. The concentration of haemoglobin (Hb; g/L) and sodium in the blood (Na+; mmol/L), the hematocrit (Hct) and urine specific gravity (USG) were determined.
Results
The mean (SD) subjects' age was 24 (4) years and pre-walk body mass 70 (11) kg. The ambient data during the walk were: Ta = 20 (4)°C, Pb = 977 (1) hPa, and RH = 61 (12) %. Body mass decreased for 0.8 (0.4) % in the NH group, and for 2.5 (1.0) % in the DH group. USG increased in both groups ($P<0.01$), but in the NH group remained below the cut-off value for dehydration of 1.020 (Casa, 2000). Despite mass loss, plasma Na+ concentration remained within normal limits (135-145 mmol/L) in both groups. Plasma volume, as calculated from changes in Hb and Hct (Harrison, 1985), increased ($P<0.01$) by 5 (5) % in both groups, probably due to the fluid shifts between extravascular and intravascular fluid compartments.
Conclusions
In subjects exercising in temperate environment, water intake ad libitum was lower than the sweat loss. However, the resulting mass loss was less than 1 %, and was thus lower than the "tolerable" body water loss of 2 % (Coyle, 2004). Despite a reduction in body mass, plasma Na+ concentration remained normal, likely due to the intercompartmental fluid shifts. These results suggest that in temperate environments the sensation of thirst during exercise is sufficient to maintain the hydration within the "tolerable" (optimal) limits.
References
Casa FJ et al. J Athl Training. 35: 212-224; 2000.
Coyle EF. J Sports Sci. 22: 39-55; 2004.
Harrison MH. Physiol Rev. 65(1):149-209; 1985.
Noakes TD et al. Med Sci Sports Exerc. 17(3):370-5; 1985.
Pitts GC et al. Am J Physiol. 142: 253-259; 1944.

SELECTION PROCESS OF YOUNG SOCCER PLAYERS ACCORDING TO THEIR PLAYING POSITION

Gil, S., Gil, J., Irazusta, A., Ruiz, F., Irazusta, J.
Faculty of Physical Activity and Sports Sciences, University of the Basque Country, Spain. , Spain

Introduction
Specific characteristics have been described for the different positional roles in soccer players (1,2). The aim of the present study was to establish the relevance of the characteristics in the selection process of players for each position. Thus, we compared the characteristics between the selected and not selected soccer players within each positional role.
Material and methods

We assessed 241 soccer players from the Getxo Arenas Club, Spain (56 forwards, 79 midfielders, 77 defenders and 19 goalkeepers). Their mean age was 17.31±2.64, the height 175.78±8.56cm and weight 69.2±9.68kg.
The height and weight, skin fatfolds four diameters and perimeters were measured. The body composition and the somatotype were calculated.
The endurance (using the Astrand Test), velocity (30 m flat sprint), agility (30 m + 10 cones) and leg power (squat jump, counter-movement jump and drop jump) were also measured.
A Student-t test was performed to analyze the differences between the selected (S) and the non-selected (NS) players within each playing position. Also, logistic regression was used to study the importance of the variables in the selection process.
Results
• FORWARDS: The selected players ran faster in the agility (S: 4.77±0.27s vs NS: 4.98±0.28) test. They also performed better in the flat sprint test (S: 3.61±0.29s vs NS: 3.76±0.35) and the jump test (S: 42.08±5.15cm vs NS: 40.42±3.38). The logistic regression showed that best predictor to be selected in the group of forwards was the agility test, followed by the drop jump test.
• MIDFIELDERS: Selected players were taller (S:174.86±6.98cm vs NS:170.45±7.67). They also had higher relative maximal oxygen consumption (S:60.09±7.93 ml•kg-1•min-1 vs NS:53.20±12.47) and performed better in the agility test (S:4.77±0.28s vs NS:5.01±0.32). In fact, the latter was the most important variable, followed by the height.
• DEFENDERS: The predictor variables were the amount of fat in the extremities (S:32.89±8.39mm vs NS:39.47±16.14) and, after that, the C.M.J. jump.
• GOALKEEPERS: Although none of the differences among goalkeepers were statistically significant, the selected players tended to perform slightly better in all the tests.
Conclusion
In the selection process the most relevant characteristics are consistent with the different workloads for each positional role. Thus, the selected forwards had the better agility and power. Agility was also the best predictor for the selection of midfielders, together with height and the endurance capacity. In the defender group, having a leaner body and the power of the lower legs were the important features. However, it is possible that a different set of tests would be more appropriately used for goalkeepers.
Bibliography
1. Bansgbo J, Norregaard L, Thorso F (1991). Activity profile of competition soccer. Can. J. Sport Sci. 16(2):110-16.
2. Wisloff U, Helgerud J, Hoof J (1998). Strength and endurance of elite soccer players. Med. Sci. Sport Exerc. 30(3):462-467.

THE INFLUENCE OF EXERCISE EXPERIENCE ON HIPPOCAMPAL STRUCTURE AND PSYCHOLOGICAL WELL-BEING IN HEALTHY YOUNG PEOPLE

Sensui, H., Fujimoto, T., Gondo, Y., Ono, Y., Ogawa, S., Kinomura, S., Tashiro, M., Itoh, M., Takekura, H., Nagatomi, R., Nagamatsu, T.

Meiji Yasuda Life Foundation of Health and Welfare, Japan

Maintaining mental health throughout life is one of the most important public health goals, and it is increasingly clear from psychological research that exercise can be of benefit. The hippocampus is one of the regions that have recently received considerable attention in mood disorders research, and the highly plastic and stress-sensitive hippocampal region is thought to play a central role in depressive illness. The primary mechanisms underlying the relationship between exercise and psychological effects are still poorly understood, however, animal studies demonstrated that exercise-induced hippocampal cell proliferation may be associated with mental health promotion and sustention. To elucidate the effect of exercise on hippocampal structure in human, hippocampal gray volumes were compared between the students who actively been engaged in physical exercise (athlete group) and those who did not exercise for a long time (sedentary group). Method: For the present study, young male university students and graduate students were recruited. All subjects were highly educated, right-handed healthy males, who had never smoked. Regularly exercising subjects were included in the athlete group (n= 22) and those who had scarcely participated in regular exercise were classified in the sedentary group (n= 26). Optimized voxel based morphometry (VBM) was performed to compare hippocampal structures between the two groups after acquisition of T1-weighted MR images. VO2max measurement and psychological survey were also performed. Result: Optimized VBM revealed that the athlete group had greater gray volume in bilateral hippocampal tails than the sedentary group. Likewise, the athlete group had significantly higher psychological well-being (self-efficacy, development of identity and self-acceptance) and VO2max than the sedentary group. There were no differences in age, height and weight between the two groups. Conclusion: This study suggested that exer cise experience influenced hippocampal structure even in healthy young students. Similar to previous research, exercising students had better psychological well-being than those who did not. Since smaller hippocampus could be a risk factor for developing psychiatric disorders, exercise-induced hippocampal soundness might contribute to the psychological benefit of exercise.

METHODOLOGICAL ASPECTS OF ANAEROBIC PERFORMANCE ASSESSMENT

Santos, A.M., Lopez, R., Fontes Ribeiro, C.A.

Faculty of Sport Science and Physical Education, University of Coimbra, Portugal

There are intrinsic problems with determining peak power (PP) from the Wingate test (WAnT), particularly with regard to optimal braking force, which was originally set to optimise mean power. The force velocity test (FVT) may overcome this problem since several sprints are completed against different braking forces. By plotting the highest power achieved for each of these bouts against the respective braking force, the resulting parabola enables optimal peak power (PPopt) to be calculated accurately for each subject. Therefore, the aim of this study was to characterise the anaerobic performance obtained through FVT and WAnT with different loads. We also intended to verify how the peak power (PP) and mean power (MP), obtained by the WAnT, change with increments of 0.010 Kg.Kg-1 of Body Mass (BM) in the applied loads.
Written informed consent to participate was received from 14 student's girls aged 20.3  1.4 years old. Anthropometric measures were: body mass 56.1  8.9 kg , stature 160.9  4.7 cm, sitting height 83.3  1.9 cm; skinfolds sum (triceps, suprailiac, abdominal, anterior mid-thigh and medial calf) 88.9  20.4 mm. All subjects performed the FVT in order to determine their PPopt, , their own optimal load (OL) and their optimal RPM (ORPM). After the FVT, each subject randomly performed six WAnTs with five different loads (0.065, 0.075, 0.085, 0.095 and 0.105 kg.kg-1 of BM, and one more with their OL obtained by the FVT); the rest period between tests was, at least, 48 hours. Post-exercise blood lactate levels were obtained 5 minutes after the WAnT.

PP-values obtained in the WAnT with the five different loads were: 474.6  62.5, 502.1  66.3, 523.1  68.2, 538.1  67.4 and 527.5  81.9 W, whereas the MP-values were: 374.9  42.6, 392.3  48.5, 405.5  47.6, 413.5  50.4 and 407.8  62.5 W. The PP-values in the WAnT with the OL were significantly higher than those obtained with the standard load (536.86 ± 74.62 W vs 502.07 ± 66.31 W). The same occurred with MP-values: 412.10 ± 54.58 W vs 392.25 ± 48.48 W.

The results suggest that the performance of the WAnT with the OL, individually determined with the F-V test, allows the achievement of the maximum values of PP and MP, which is not in accordance with the existent literature. We also verified, by the performance of WAnT with five different loads, that the determination of the PP through the WAnT protocol is sensitive to variations of 0.010 Kg.Kg-1 of BM, either with low or heavy loads. The determination of the MP through the same protocol is also sensitive to variations of 0.010 Kg.Kg-1 of BM when low loads are applied, namely 0.065 Kg.Kg-1 or 0.075 Kg.Kg-1. Thus, data suggest that in order to assess in a more precise way the anaerobic performance in the WAnT, it is necessary to determine previously the OL of each subject, instead of the application of a standard and pre-defined load.

AGE-RELATED CHANGES IN THE CEREBRAL BLOOD FLOW FROM 12 TO 18 YEARS OF AGE IN FEMALES

Sadamoto, T., Sato, K., Ohmori, F., Okajima, M., Iwadate, M., Kagaya, A.

Japan Women's College of Physical Education, Japan

<Purpose> To understand physical capabilities of children and the potential impact that sport activity can have on children, it is important to describe the developmental state of their bodies and various aspects of functions. There are few studies focusing on the development in cerebral blood flow. Especially, it has not yet known how changes occur in the cerebral distribution of cardiac output as a child grows. To challenge this question, we studied age-related changes in the cerebral distribution of cardiac output in healthy females between 12 and 18 years of age. <Methods> A hundred and thirty-one girls took part in the experiments. Duplex ultrasonography (Logiq5 and Vivid7, GE-Yokogawa Medical Systems, Tokyo) was used to assess vessel diameter and mean flow velocity in the left common carotid artery (CCA) and the left middle cerebral artery (MCA) while the subject was quietly sitting. The blood flow in CCA (BFCCA) was calculated as the product of π × (diameter/2)2 × (mean flow velocity) × 60 (ml/min), and used as an index of the cerebral blood flow in this study. Arterial blood pressure was measured non-invasively by photoelectric plethysmography with a Finometer (Finapres Medical Systems BV, Arnhem). Heart rate, stroke volume (SV) and thus cardiac output (CO) were determined from the blood pressure waveform using Modelflow software program implemented in the Finometer. The cerebral distribution of CO (%) was calculated as BFCCA/CO × 100. <Results & Conclusion> The BFCCA began to increase from 14 years and reached the peak at 15 years. The increase in BFCCA was accompanied by both increases in vessel diameter and mean flow velocity in CCA. There was 18-20 % of increase in BFCCA for 3 years from 12 to 15 years. Similarly, the decline in VMCA, which probably reflects the vascular growth in MCA, occurred from 13 to 15 years. After 15 years both BFCCA and VMCA reached the plateau. The increase in CO began between the ages of 12 and 13 years and was nearly complete by 15 years. The increase in CO was due to a significant increase in SV. For 3 years from 12 to 15 years CO increased by 60-65 %. This marked increase in CO, three times larger than the increase in BFCCA, produced a gradual decrease in the cerebral distribution of CO. The highest value of distribution was 11 % observed at 12 years, followed by a gradual decline to 6.5-7.0 % at 14-15 years of age. The cerebral distribution of CO over the age of 15 years was almost identical to that observed in adult females. From these findings, it was suggested that the development in cerebral blood flow is accomplished by the age of 15 years in females.

PULMONARY O2 UPTAKE KINETICS AND MUSCLE DEOXYGENATION IN CHILDREN AT THE ONSET OF MODERATE INTENSITY CYCLING EXERCISE

Welford, D., Barker, A.R., Welsman, J.R., Armstrong, N.

University of Exeter, United Kingdom

The purpose of this study was to examine the relationship between pulmonary oxygen uptake kinetics and muscle deoxygenation measured by near infrared spectroscopy (NIRS). This relationship has previously been examined in adults (Delorey et al. 2003; Grassi et al. 2003) but no such study has been carried out with children.Twelve children (6 boys, 6 girls) visited the laboratory for a determination of peak VO2 and then completed at least 4 step change transitions from unloaded pedalling to a constant work rate corresponding to 80% of their previously determined ventilatory threshold. Each participant's breath by breath responses were interpolated to 1s intervals, time aligned and then averaged. A single exponential that included a time delay was used to analyse the averaged response following phase 1 (15s). Muscle deoxygenation was also measured during the constant work rate tests using a NIRS device (Hamamatsu NIRO 300) that utilizes continuous wave spectroscopy to determine changes in deoxyhaemoglobin (Hb). Data were collected at 1s time intervals and then individual tests were time aligned and averaged and a single exponential that included a time delay was used to analyse the averaged response from the start of the test.

The delay in muscle deoxygenation at the onset of exercise was 5.7 ± 2.9 seconds. There was no significant difference between the time course of adaptation of Hb and O2 , as shown by the time constant for O2 (22.8 ± 4.5 seconds) and the MRT (time delay + time constant) for Hb (23.0 ± 6.6 seconds).

NIRS measures of muscle deoxygenation reflect the balance between local muscle oxygen delivery and muscle oxygen utilisation. The delay in muscle deoxygenation at the onset of exercise was similar to that shown in other studies. In conclusion, the significant relationship between the kinetics of pulmonary O2 and muscle deoxygenation during the initial transition to moderate exercise may reflect an appropriate matching of muscle blood flow and muscle O2 consumption. Further studies are necessary to examine the relationship between pulmonary oxygen uptake kinetics and muscle deoxygenation at different intensities of exercise.

DeLorey, D.S., Kowalchuk, J.M., Paterson, D.H. (2003) Relationship between pulmonary O2 uptake kinetics and muscle deoxygenation during moderate intensity exercise. J Appl Physiol 95:113-120.

Grassi, B., Pogliaghi, S., Rampichini, S., Quaresima, V., Ferrari, M., Marconi, C., Cerretelli, P. (2003) Muscle Oxygenation and pulmonary gas exchange kinetics during cycling on transitions in humans. J Appl Physiol 95: 149-158.

THE INFLUENCE OF BODY TEMPERATURE ON A 10 KILOMETER RUNNING PERFORMANCE

Che Muhamed, A.M., Hamzah, S.

University of Malaya, Malaysia

Introduction: Self-paced and externally regulated exercise performance in the heat has been shown to decline as body core temperature rises to around 400C (Tucker et al., 2004). The underlying mechanism responsible for this has been associated with a reduced central nervous system function, reduced cerebral blood flow (Nybo and Nielsen, 2001), impaired substrate availability or utilization and increased accumulation of blood lactate (Febbraio, 2001). To date this hypothesis has not been directly tested in a real outdoor environment. Accordingly, the aim of the study was to investigate the ability of well trained male middle distance runners to perform under heat stress environment during a 10-kilometer (km) road race.

Method.

Nine well trained male runners volunteered for the study. They were divided into three different groups which were tested on three different environmental conditions, a very hot-dry (VHD;350C, 53%rh, n=3) to hot-humid (HH; 300C, 73%rh, n=3) and warm-humid (WH; 260C, 88%rh, n=3). In each trial, a subject ran a total distance of 10 km, with the speed eliciting an exercise intensity of 70% max was prescribed within the first 5 km. For the following 5 km, subject were instructed to maintain a highest possible self paced speed. Rectal (Tre) and Mean skin temperature ( ) were recorded via VitalSense Telemetric Temperature System (The Mini Mitter Company Inc, Oregon) and recorded at every 1km distance.

Result.

Runners in the VHD group recorded a highest mean (±SD) Tre at the end of the first 5km at 39.9 (±0.1) as compared with 38.9 (±0.3) in the HH and 38.0 (±0.1) in the WH condition. Similarly was higher in the VHD group as compared with the HH and WH group (39.0±0.8 vs. 35.2±0.8 and 32.8±0.3, respectively). In the self paced section of the trial, a largest reduction in running speed during the last 5km as compared to the first 5km was recorded in the VHD group followed with the HH group. Mean speed reduced by 1.3km (±0.6) and 0.3km (±2.3) in the VHD and HH, respectively. Contrary, runners in the WH group who experienced less heat stress during the first 5km run were able to increase their running speed with a mean of 2.3 km (±0.6).

Conclusion.

It was evident that runners in the VHD group with a mean Tre of 39.9 (±0.1) at 5km suffered from a largest drop in running speed within the next 5km. This observation clearly demonstrates the difficulty in maintaining or increasing physical performance as Tre closely reach 400C as described in earlier studies (Tucker et al., 2004; Nybo and Nielsen, 2001).

References

Febbraio, M. A. (2001). Alterations in energy metabolism during exercise and heat stress. Sports Medicine 31: 47-59.

Nybo, L and Nielsen, B. (2001). Hyperthermia and central fatigue during prolonged exercise in humans. Journal of Applied Physiology 91: 1055-1060.

Tucker, R., Rauch, L., Harley, Y and Noakes, T. (2004). Impaired exercise performance in the heat is associated with reduction in skeletal muscle recruitment. Eur. J. Appl Physiol. 448: 422-430.

THE RELATION BETWEEN HIPPOCAMPAL STRUCTURE AND PSYCHOLOGICAL WELL-BEING IN EXERCISING AND NON-EXERCISING STUDENTS

Fujimoto, T., Sensui, H., Takekura, H., Gondo, Y., Ono, Y., Ogawa, S., Kikuchi, J., Kinomura, S.,Tashiro, M., Itoh, M., Nagamatsu, T., Nagatomi, R.

Tohoku University, Japan

Maintaining mental health throughout life is one of the most important public health goals, and it is increasingly clear from psychological research that exercise can be of benefit. The hippocampus is one of the regions that have recently received considerable attention in mood disorders research, and the highly plastic and stress-sensitive hippocampal region is thought to play a central role in depressive illness. The primary mechanisms underlying the relationship between exercise and psychological effects are still poorly understood, however, animal studies demonstrated that exercise-induced hippocampal cell proliferation may be associated with mental health promotion and sustention. To elucidate the relation between hippocampal structure and psychological well-being, correlation analysis between hippocampal gray volumes and psychological well-being were conducted in the students who actively been engaged in physical exercise (athlete group) and those who did not exercise for a long time (sedentary group). Method: For the present study, young male university students and graduate students were recruited. All subjects were highly educated, right-handed healthy males, who did not smoke. Regularly exercising subjects were included in the athlete group (n= 22) and those who had scarcely participated in regular exercise were classified in the sedentary group (n= 26). The correlation analysis between the gray volumes in the regions where the gray volume differences were detected between the two groups using optimized voxel based morphometry (VBM) and psychological states measured by psychological scales measuring development of identity, self-efficacy, self-acceptance and subjective happiness were performed. Result: Optimized VBM revealed that the athlete group had greater gray volume in bilateral hippocampal tails than the sedentary group. There were no significant correlation between psychological states and the gray volume of right and left hippocampal tails in each group. However, there were tendency of positive correlations of self acceptance (R= 0.36, P= 0.064) and subjective happiness (R= 0.34, P= 0.080) with the gray volume of left hippocampal tail in the sedentary group. Conclusion: The gray volume in the left hippocampal tail might be associated with psychological well-being. We are going to increase the number of subjects in future study.

EFFECTS OF FLUID SHIFT ON EMG PARAMETERS

von Walden, F., Elman, T., Pozzo, M., Tesch, P.

Karolinska Institutet, Sweden

Lack of weight bearing (e.g. spaceflight, bed rest) provokes muscle atrophy and compromised muscle force [1]. Acutely exercise-induced changes in muscle fatigue can be assessed through myoelectrical manifestations, i.e. by analyzing electromyographic (EMG) spectral content (mean power frequency, MNF) [2]. Hence, the EMG technique should be a useful tool for monitoring in-flight muscle function including muscle fatigue phenomenon. Unfortunately, there is a cephalic fluid shift occurring in microgravity such that calf girth and volume are reduced. Similarly, the transition from vertical to supine position brings about alterations in bio impedance of the leg [3]. Thus

altered electrical properties of muscle may affect EMG parameters. The aim of this study was to investigate whether cephalic fluid shifts presents a methodological limitation to employing EMG techniques in assessing exercise-induced muscle fatigue.

Ten men performed unilateral, isometric plantar flexions at 20 and 60% of maximum isometric contraction (MVC) for up to two min. Measurements were performed in the supine position, preceded by 1 hr rest in the supine or vertical position. Bi-polar surface EMG was detected from the soleus and gastrocnemius muscles and mean frequency (MNF) and amplitude (ARV) were analyzed. A three-way ANOVA (factors Position, Force and Muscle) on MNF slope disclosed dependence from force ($P < 0.05$) and muscle ($P < 0.05$) but was not different for position. The rate of decrease in MNF (0.035 ± 0.16 and 0.033 ± 0.12 Hz/s for supine and vertical, respectively) at 20% MVC was smaller for SOL than for any of the gastrocnemius heads. There was no difference across muscles at 60% MVC. The initial value of MNF differed across muscles ($P < 0.05$) but not across positions. ARV initial value showed dependence on muscle ($P < 0.05$) and force level ($P < 0.05$) but not on position, with larger values at 60% MVC for all muscles ($P < 0.05$). A three way ANOVA on ARV slope showed significance for muscle ($P < 0.05$), with SOL showing larger ARV increase over time than the other two muscles ($P < 0.05$).

This study investigated the effect of a cephalic fluid shift on EMG parameters. Our results indicate that alterations in body fluid distribution do not affect myoelectrical manifestations of muscle fatigue. This would suggest that fluid shift is not a methodological limitation of EMG techniques as a tool for assessing exercise-induced muscle fatigue in microgravity conditions.

1. Adams, G.R., V.J. Caiozzo, and K.M. Baldwin, Skeletal muscle unweighting: spaceflight and ground-based models. J Appl Physiol, 2003. 95(6): p. 2185-201.

2. Basmaijan, J.V. and C.J. De Luca, Muscles Alive - Their functions revealed by electromyography. 5th edition ed. 1985, Baltimore: Williams & Wilkins.

3. Berg, H.E., B. Tedner, and P.A. Tesch, Changes in lower limb muscle cross-sectional area and tissue fluid volume after transition from standing to supine. Acta Physiol Scand, 1993. 148(4): p. 379-85.

DIMINISHED INCREASES OF URINARY DOPAMIN LEVELS ON SWIMTRAINING - A QUESTION OF WATER IMMERSION?

Krakowski-Roosen, H., Stoia-Djeska, C., Skipka, W.

German Cancer Research Center, Germany

Introduction: Physical activity is associated with muscular work and increases in neuromuscular functioning, as derived from alterations in electromyographic recordings or in plasma concentrations of neurotransmitters. Activity of the motorcortex could be read from electroencephalogram-recordings or functional magnetresonancetomography, but methodical limitations cause the lack of data during sports. Dopamin (D) as the most important neurotransmitter in the motorcortex was found to be increased during and after several kinds of physical exercise and is a good indicator for motorcortical activity.

The aim of the present study was to get some insight view on extensive intervall swimtraining.

Method: Experienced, male (n=14) and female (n=12) swimmers of two different performance levels (PL) passed 90 min of extensive interval training at the same individual level of 75%. Urinary samples were taken immediately before (BL) and after the training session, furthermore 90 and 180 min afterwards. Glomerular filtration rate (GFR) was calculated by creatinine clearance. In a second experiment plasma dopamin was measured in 15 male volunteers before and after a 25 minutes lasting period of thermoneutral immersion (34.3±0.4°C).

Results: Urinary D changed significantly with time ($p=0.044$; MANOVA) with no differences for gender or PL. D level is weakly but highly significant correlated to GFR ($r=0.355$; $p<0.000$) and so data is corrected for GFR: There remain no differences for time, gender or PL at all. Immersion itself lead to a slightly but not significantly decreased plasma level of D.

Discusssion: „Dry" physical exercise has already shown markedly increasing dopamin levels mentioned as a sign for motorcortical activity, 90 minutes of swim training failed to do so. Methodical limitations for the urinary data may be corrected by GFR, but GFR itself seems to be influenced by the activity level (Stoia et al. 2006). As land based exercise differs from exercise in the water particularly through the lack of postural work, the diminished urinary dopamin levels are mentioned to reflect a lower motorcortical activity in the water although a resting control experiment failed to prove this thesis. Further experiments are necessary to clear up the part of antigravitational work and posture on the overall motorcortical activity.

References: Carmen Stoia-Djeska, Werner Skipka, Holger Krakowski-Roosen: Modulated renal function during extensive interval training in swimming. Abstract ECSS Lausanne, 2006.

A COMPARISON OF CONTINUOUS AND DISCONTINUOUS PROTOCOLS FOR THE DETERMINATION OF MAXIMAL OXYGEN UPTAKE

Barber, R., Wood, D., Draper, S., James, D.V.

University of Gloucestershire, United Kingdom

Previous research suggests that the highest oxygen uptake (VO2peak) derived from a traditional discontinuous test (DCT) and continuous test (CT) is similar, although the incidence of a VO2-plateau is higher for a DCT. However, it has been suggested that a VO2-plateau in a traditional DCT could be an artefact of the test protocol (Noakes, 1997). The present study compared VO2peak and the incidence of a VO2-plateau for a DCT with a comparable CT.

In a counterbalanced order, 10 participants completed a DCT, in which speed remained constant whilst gradient increased in 2.5% increments, and a CT in which speed remained constant whilst gradient increased as a continuous linear function of time. Breath-by-breath VO2 data were interpolated to 1 s values and smoothed using 15 s moving averages and 60 s sequential averages.

The highest of the smoothed values for both sampling periods were taken as VO2peak and compared between the CT and DCT. Peak VO2 derived between 1 min 45 s & 2 min 45 s for the DCT was compared with the VO2peak derived for 60 s sequential averages for the CT. Peak VO2 was higher for the CT than for the DCT when VO2 was determined between 1 min 45 s & 2 min 45 s for the DCT (4066 ± 711 vs. 3871 ± 619 ml.min-1; $p= 0.008$), but not for 15 s (4231 ± 710 vs. 4258 ± 654 ml.min-1; $p= 0.717$) or 60 s (4066 ± 711 vs. 4157 ± 634 ml.min-1; $p= 0.242$) averages.

For the identification of a plateau for the CT three approaches were used: a modelling approach; a 95% confidence-interval approach; and an absolute criterion (<150 ml.min-1) approach. A plateau was identified in 100% of participants for the modelling and absolute criterion approach, and in 90% of participants for the confidence-interval approach. For the identification of a plateau for the DCT two approaches were used: a participant sample-specific approach, and an absolute criterion approach. The sample-specific approach identified a plateau in 100%, 100% and 90% of participants for 60 s averages, when VO2 was determined between 1 min 45 s & 2 min

45 s, and 15 s averages respectively. The absolute criterion identified a plateau in 60%, 80%, and 70% of participants for 60 s averages, 15 s averages, and when VO2 was determined between 1 min 45 s and 2 min 45 s respectively.

The findings from the present study suggest that the highest VO2 and a high incidence of a VO2-plateau can be identified in both CTs and DCTs with appropriate protocols, but, due to the substantial practical advantages, a CT should be the test of choice for the routine assessment of VO2max.

Noakes, T.D. (1997). Challenging beliefs: ex Africa semper aliquid novi. Med. Sci. Sports Exerc. 29: 571-590.

RELATIONSHIP BETWEEN EXPIRATORY GAS RESPONSE AND LOAD INTENSITY DURING CONSTANT-LOAD EXERCISE

Kimura, M., Saito, H., Németh, H., Watanabe, T., Ito, S.

Kokushikan University, Japan

INTRODUCTION

The purpose of this study was to examine the relationship between load intensity and expiratory gas parameters during constant-load exercise. According to previous studies, VO2 response reaches steady state during constant-load exercise in the moderate intensity domain. Additionally, VO2-load (W) relationships have already been extensively investigated for moderate intensity constant-load exercise; it is known that this relationship has linear characteristics within this domain. With recent advances in mechanical measurements, it is possible to measure many expiratory gas response parameters. For our study, we measured many parameters and performed 3 analysis methods.

METHODS

Subjects were 5 healthy males and 2 females.

Exercise protocol was set with a bicycle ergometer (REhcor500P, Groningen, The Netherlands). The subjects had to check the monitor and maintain a pedaling rate of 60rpm during exercise. Following a 7-minute warm-up (2W) and a 3-minute increase to reach the constant-load, exercise load (2W, 22W, 42W, 62W, 82W and 102W) was maintained for 20 minutes. Expiratory gas parameter were measured using an expiratory gas analyzer (AE300S, and AT for WINDOWS, Minato Medical Science, Japan) which outputs data on a breath by breath basis. Expiratory gas parameters (VO2, VCO2, HR, VE, RR, R, TVe, ETO2, ETCO2) were measured continuously throughout the exercise period.

Data analysis software (KyPlot 4.0, Kyens Laboratory, Japan) was used to create the calculation average, moving average, and fitting data.

RESULTS

(1) Our results showed that VO2-load relationship was linear during constant-load exercise.

(2) Gender difference was not observed in the VO2-load relationship.

(3) Relationship between exercise load and expiratory gas parameters (VCO2, HR, VE, RR, TVe) had linear characteristics for analysis.

(4) The coefficients of the formula for expiratory gas parameter relationships depend on analysis method.

DISCUSSION

We conclude that load intensity has a strong relationship with expiratory gas response parameters in moderate intensity constant-load exercise. Although these results are consistent with previous studies, linear characteristic formulas vary depending on the analysis method utilized.

PHYSIOLOGICAL, BIOCHEMICAL AND FUNCTIONAL CHANGES INDUCED BY TOP-LEVEL OFF-ROAD COMPETITIVE MOTOCROSS HEATS

Ascensão, A., Azevedo, V., Oliveira, E., Ferreira, R., Marques, F., Magalhães, J.

Faculty of Sport Sciences, University of Porto, Portugal

Physical conditioning of motocross riders has been considered an important component in this specific and complex sport performance. However, to our knowledge few studies regarding the impact of motocross heats on functional and physiology variables of riders have been addressed so far. In this regard, the present study was designed to analyze physiological, biochemical and functional changes induced by top-level off-road competitive motocross heats.

To achieve this purpose, fifteen (15) elite motocross riders (28,3 ± 7,9 yrs; 71,1 ± 7 kg; 169 ± 4cm; 53,5 ± 3,7 ml.kg-1.min-1; 14,9 ± 3,3 % fat) performed one treadmill running test to exhaustion in order to determine maximal heart rate (HRmax), maximal oxygen consumption (VO2max) and ventilatory threshold (Lan vent). Thereafter, three 30 min competitive off-road motocross heats were performed to measure biochemical (blood lactate and urine catecholamine concentrations) and/or functional (forearm power and fatigue tests) alterations induced by race. Exercise intensity through HR monitoring, estimated VO2max, rating of perceived exertion (RPE) and forearm pain were also accomplished.

During the 30 min heats, the riders spent: (i) 26 minutes (87%) of time above 90% of HRmax; (ii) 27 minutes (89%) between 95-100% of VO2max and; (iii) 25-28 minutes with an HR higher than that corresponding to Lan vent. Significant impairments were observed on maximal forearm isometric handgrip force as well as on Wingate variables after the race. Blood lactate concentrations significantly rose from rest vs. 10 min, 20 min and final time of analysis ($p>0.05$). However, significant decreases were observed between 10 min vs. 20 min and final of the race. A significant increase in the urine levels of catecholamines was observed after the race.

In conclusion, the present data suggested that competitive motocross heats are performed at high exercise intensity. Motocross specific effort induces significant functional and physiological alterations that may reflect a decrement on physical performance.

CHANGE OF FORCE DEVELOPMENT BY ANTAGONIST CONDITIONING CONTRACTION AT SEVERAL INTENSITY AND DURATION

Kamimura, T., Takenaka, T.

Kokushikan University, Japan

INTRODUCTION

Muscle force potentiation by preceding contraction of the antagonist muscle has been reported. Effect of antagonist conditioning contraction was thought to be neuromuscular influence by 1b inhibition of golgi tendon organ (GTO) and change of elastic energy. In most prior

studies maximum voluntary antagonist contraction was used as conditioning contraction, and duration of conditioning contraction was fixed but different in each study. In this study, the muscle contraction force and maximum rate of force development (dF/dt) after antagonist conditioning contraction at several intensities and durations were examined.

METHODS

Elbow and shoulder joint were kept at 90 degrees, and isometric elbow extension and flexion were performed. After a warm-up, measurements at maximum extension were done three times each subject. 100% muscle extension was determined by measuring the maximum extension 3 times and calculating the average. Intensity of antagonist conditioning contraction was set at 25, 50, 75, and 100%. Duration of antagonist conditioning contraction was set at 1, 2, 5, and 10 seconds. Simple maximum elbow flexion was measured three times, and the mean value was considered to be 100%. Total 16 patterns (combinations of 4 intensities and 4 durations) were used as antagonist conditioning contractions at random sequence. Electromyography (EMG) signals were measured at biceps brachii and triceps brachii, and root mean square (RMS) amplitudes were calculated. Force, dF/dt, and RMS amplitude of total 16 patterns were evaluated. The statistical analysis was done using two-way ANOVA and correlation analysis of Pearson.

RESULTS

The elbow flexion force was not significantly affected by antagonist conditioning contraction. However, dF/dt increased significantly either with decrease of duration or increase of intensity. As for RMS amplitude of biceps brachii and triceps brachii during elbow flexion no statistically significant difference was obtained.

CONCLUSION

Potentiation of muscle force output was not obtained. However, dF/dt depended on intensity and duration of antagonist conditioning contraction. The role of stored elastic energy and activity of GTO might be important factors in the effects of antagonist conditioning contraction.

INTERMITTENTLY INCREASING THE WORKLOAD TO 50 %MVC DURING REPETITIVE WORK IN COLD: MORE BENEFICIAL IN INDUCING EMG GAPS THAN 30 %MVC?

Oksa, J., Paasovaara, S., Ollila, T.

Fiinish Institute of Occupational Health, Oulu, Finland

In our previous repetitive work study at 4°C we observed that increasing every fourth minute the workload from 10 %MVC to 30 %MVC (breaking the monotonous work cycle) the amount of EMG gaps increased by 44 % and 37 % ($p<0.05$ in relation to work at 10 %MVC level) in the forearm flexors and extensors, respectively (Oksa et al. 2006). The aim of this study was to evaluate if using 50 %MVC intermittent work level would further enhance the occurrence of EMG gaps during repetitive work at 4 °C. Eight healthy and volunteer females performed six 20 minute repetitive work bouts (120 minute exposure) at 4 °C twice and at 21 °C (reference) once. The work consisted of wrist flexion - extension work at 10 %MVC (21 °C and 4 °C), contraction every third second. During the second exposure to 4 °C every fourth minute a double contraction was performed at 50 %MVC level (4 °C/50). During the exposures EMG activity of the wrist flexors and extensors was measured. The amount and duration of EMG gaps were analyzed from the data. The results showed that the amount of EMG gaps in the forearm flexors was 9.9 /min, 10.6 /min and 11.9 /min at 4 °C, 4 °C/50 and 21 °C, respectively. The percentage difference between 4 °C conditions was 7 % and 12 % and 20 % between 21 °C and 4 °C conditions. The amount of EMG gaps in forearm extensors were 10.6 /min, 10.6 /min and 12.6 /min, at 4 °C, 4 °C/50 and 21 °C, respectively. The percentage difference between 21 °C and 4 °C was 19 %. The duration of the gaps varied between 0.2 - 0.4 seconds and there were no differences between conditions. The results indicate that in both 4 °C conditions there are less EMG gaps in relation to 21 °C and that using 50 %MVC instead of 30 %MVC for breaking the monotonous work cycle at 4 °C does not induce more beneficial effects in terms of EMG gap occurrence.

Reference: Oksa J, Sormunen E, Koivukangas U, Rissanen S, Rintamäki H. Changes in neuromuscular function during repetitive work in cold: effect of intermittently increased workload. (submitted manuscript).

CAN OLDER FEMALES BENEFITS FROM SPECIFIC RESPIRATORY MUSCLE TRAINING?

Watsford, M., Murphy, A.

University of Technology, Sydney, Australia

Sarcopenia affects central and peripheral physiological function, compromising activities of daily living and quality of life. Traditional strength training and cardiovascular training have been demonstrated as viable modalities to overcome the deleterious effects of sarcopenia, however, a seemingly endless search for new training modalities suggests that specific respiratory muscle (RM) training may assist physical performance for the older population. Controlled RM training is a proven method of improving RM strength and endurance in healthy and non-healthy humans and RM training may reduce the competition for blood flow between the central and peripheral body segments, thus improving exercise efficiency. Therefore, the current study examined whether the training modalities of walking and threshold RM training could improve physical function in older females.

Fifty-two healthy females (mean age 64.4 yr, range 60-69 yr) were randomly allocated to one of four groups for an eight week training program. The groups were: RM training (RMT), walking training (EX), both RMT and EX (RMTEX) and non-exercising control group (CON). Pre-testing consisted of assessment of pulmonary function, RM strength (maximal inspiratory and expiratory pressure) and RM endurance (RME). Physical assessment included an incremental treadmill test to an RPE of "hard" (TRPE15) which included measures of cardiovascular and respiratory function, along with subjective ratings of perceived exertion (RPE) for breathing and peripheral fatigue.

The RMTEX and RMT groups improved RM strength and RME to a greater extent than the EX and CON groups. Furthermore, the improvements in RM strength and endurance were significantly negatively correlated with pre-test scores for these variables. The RMTEX and EX groups displayed within group improvements in walking performance in the form of reduced submaximal HR, reduced RPE and a greater TRPE15. Further to these expected changes, the RMT group displayed several within-group changes including an improved TRPE15 (12%), decreased submaximal percentage of maximum voluntary ventilation (mean -18%), decreased submaximal HR (mean -5%) and decreased submaximal breathing RPE (mean -6%).

RM training improves RM strength and endurance in older females. Further, RM training may augment the physiological response to exercise in older females. Correlation analysis showed that the mechanisms associated with the improved exercise performance were related to improved RM strength and endurance. It appears that the combination of RM training and submaximal exercise has implications for functional performance and perceived exertion during walking tasks in older adults. Further, the improvements in submaximal exercise function indicate that RM training may aid activities of daily living, as such activities are carried out at low-moderate intensities, however, further specific assessment is required.

THE EFFECT OF PROLONGED FASTING ON FUEL SELECTION DURING SUBMAXIMAL EXERCISE OF DIFFERENT INTENSITIES

Stannard, S., Thompson, M.

Massey University, New Zealand

Introduction

It is well known that fasting increases the contribution of lipid as a substrate to support exercise. Most studies, however, compare only an overnight fast with the acutely fed or postprandial state and have not investigated the interaction between fasting duration and exercise intensity. This study was conducted to compare the effects of a 12-hr (overnight) and 72-hr period of water only fasting on fuel selection and blood-borne metabolic markers during exercise of three different submaximal intensities.

Methods

Six endurance trained men (four cyclists and two runners), VO2max 65.8 ± 10.6 ml.kg-1.min-1, 13.6 ± 3.5% body fat, underwent a three stage (6 min per stage) incremental submaximal exercise test on two separate occasions: A) after a 12 hr overnight water-only fast; and B) after a 72 hr water-only fast. Expired respiratory gases were collected into Douglas bags during the final two minutes of each workload for calculation of respiratory exchange ratio (RER). Venous blood samples were collected from the forearm during the final minute of each workload and were immediately analysed for plasma glucose and lactate concentrations.

Results

VO2 averaged 39, 54 and 69% VO2max in the 12-hour fasted, and 40, 55 and 68% VO2max in the 72-hour fasted state in stages 1, 2, and 3 respectively (no significant difference, p = 0.953). RER values indicate a significant interaction between fasting period and exercise intensity (p = 0.031) such that the large difference in RER at the lower intensities had diminished at the higher workload. Plasma glucose concentration was significantly lower during exercise in the 72-hr fasted state (p = 0.007), whilst plasma lactate concentration was significantly higher (p = 0.001). There was a proportionally greater increase in plasma lactate with increasing exercise intensity (p = 0.001) in the 72-hour fasted state than occurred in the 12-hour fasted state. There was no effect of fasting on the intensity-induced increase in circulating glucose concentration (p = 0.377).

Conclusion

The results of this study show that prolonged fasting alters the relationship between exercise intensity and fuel selection. In particular the data show an increased reliance upon fat metabolism during submaximal exercise after prolonged fasting compared with an overnight fast, but this difference diminishes as exercise intensity increases. The concomitant accelerated production in lactate with increases in exercise intensity during prolonged fasting most likely indicates that the larger motor units being recruited still rely on glycolysis, whereas the smaller oxidative motor units have shifted to preferential lipid oxidation.

EFFECTS OF SWITCHING PEDAL RATE MODEL ON THE NET MECHANICAL EFFICIENCY AND VO2 SLOW COMPONENT DURING CYCLING EXERCISE

Migita, T., Hirakoba, K.

Kurume University, Japan

Introduction Switching pedal rate at the halfway point during constant-metabolic demand cycling exercise (rpm switching model) could induce the alteration of muscle fibers recruitment pattern synchronized with switching from lower pedal rate to higher one and vice versa, which in turn lead to affect the net mechanical efficiency (η) at later phase of exercise, because the η correlates with type of muscle fibers recruited in exercise. Therefore, we examined the effects of rpm switching model on the η and VO2 slow component (VO2SC) and compared with those of previously employed exercise model for maintaining a given pedal rate throughout exercise at the same metabolic demand (control model). Methods Seven healthy male volunteers [mean ± SD: age 24 ± 2 yr, body mass 64.8 ± 7.5 kg] completed four 6 min constant-metabolic demand cycling exercises, which consisted of two trials (60 rpm and 110 rpm) in control model and two trials (60→110 rpm : 60→110swi and 110→60 rpm : 110→60swi) in rpm switching model. Pulmonary gas exchange parameters were measured during all exercise tests. Non-linear regression technique was used to fit the data of VO2 and the amplitude of VO2SC was quantified. Total mechanical power output (Ptot) was calculated as sum of external power output delivered to cycle ergometer plus internal power output estimated as 0.153×frequency^3, where frequency is in Hz (Minetti et al., 2001). Total energy turnover (Etot) was sum of aerobic and anaerobic energy turnovers, which were calculated using VO2 or blood lactate accumulation, respectively. The η was defined as the ratio of Ptot to Etot. Results and Discussion Although Ptot in 4 trials was remained at a constant and same level throughout the exercise tests, the estimated η at early phase (from 2 to 3 min) of 4 trials decreased at later phase (from 5 to 6 min), probably owing to the appearance of VO2SC. The extent of reduction of η between early and later phases was the smallest in 60→110swi (23.6 ± 1.2 % for early phase, 22.2 ± 1.8 % for later phase) and the greatest in 110→60swi (25.3 ± 2.1 % for early phase, 21.0 ± 1.8 % for later phase). However, the amplitudes of the VO2SC were not significantly different among four exercises (350 ~ 479 ml/min). Consequently, the difference of reduced η in two trials of rpm switching model could not be accounted for by the difference of VO2SC. It seems likely that the difference of η between two trials in rpm switching model would be caused by alternation of muscle fibers recruitment patterns depended on muscle developed tension and contraction frequency. References Minetti AE et al. From bipe dalism to bicyclism: evolution in energetics and biomechanics of historic bicycles. Proc R Soc Lond B 2001; 268: 1351-60. Ferguson RA et al. Effect of muscle temperature on rate of oxygen uptake during exercise in humans at different contraction frequencies. J Exp Biol 2002;205: 981-7.

THE VO2 OVERSHOOT IN ENDURANCE-TRAINED ATHLETES: THE INFLUENCE OF MODE OF EXERCISE

Kilding, A.E., Jones, A.M.

Auckland University of Technology, New Zealand

The VO2 overshoot in endurance-trained athletes: the influence of mode of exercise

Kilding A.E1 and Jones, A.M2

1Division of Sport and Recreation, Auckland University of Technology, Auckland, NZ; and 2School of Sport and Health Sciences, University of Exeter, St. Luke's Campus, Exeter, UK

Introduction: For many years, the dynamic response of oxygen uptake (VO2) following the onset of moderate-intensity exercise (i.e. below the gas-exchange threshold, GET) in healthy humans has been suggested to follow an exponential time-course with time to reach a VO2

steady-state being largely dependant on aerobic fitness. However, recent observations by Koppo et al. (2004) and Kilding et al. (2005), in trained cyclists and runners respectively, highlighted that the exponential response of VO2 at phase II appears to be distorted by an apparent transient 'overshoot' in some athletes. To further explore this observation, the purpose of the present study was to determine whether the overshoot of VO2 above the eventual steady state is dependent on mode of exercise in trained athletes. Method: Ten endurance athletes (5 cyclists and 5 runners) participated in the study. Following maximal exercise tests to determine the gas-exchange threshold (GET) and VO2peak for both cycling and treadmill running, each subject performed repeated (n=6) six min square-wave transitions from low-to-moderate (80% mode specific GET) exercise in both modes of exercise. After data interpolation and ensemble averaging, kinetic parameters were estimated using a mono-exponential model with time delay. The magnitude of the VO2 overshoot (if observed) was measured as the peak amplitude of the VO2 above the steady state (mean VO2 during last 30s). Results: During cycling, 100% of the cyclists and 60% of the runners demonstrated an overshoot. During running, 60% of runners and 0% of cyclists demonstrated an overshoot. In both modes, the overshoot occurred between ~50 and ~150 s after exercise onset. The magnitude of the overshoot above the eventual steady-state VO2 was 209 ± 75 ml.min-1 during cycling and 156 ± 63 ml.min-1 during running. Conclusion: In conclusion, the occurrence of a VO2 overshoot following the onset of moderate-intensity exercise is more prevalent during cycling than during running, regardless of the athletes' preferred exercise discipline. These data challenge the notion that the required (steady-state) VO2 is constant following the onset of moderate-intensity exercise, and that VO2 projects towards this steady-state with a mono-exponential time course in Phase II of the response. Further work to determine the origins (metabolic or mechanical) of these observations in both modes of exercise is required.

References

Koppo, K., et al. (2004). Overshoot in VO2 following the onset of moderate-intensity exercise in trained cyclists. EJAP, 93, 366-373.

Kilding, A.E., et al. (2005). Characterisation, asymmetry and reproducibility of pulmonary oxygen uptake kinetics in endurance runners. EJAP, 93: 588-597.

THE EARLY SPECIALIZATION EFFECT OF DIFFERENT SPORTS, SWIMMING VS FOOTBALL, IN PRE-PUBERTAL CHILDREN

Fernandes, R., Pereira, F.D.

Escola Superior de Desporto de Rio Maior, Portugal

Introduction

Regular physical activity has proved to be beneficial for health promotion. Do different sports promote a metabolic specialization in pre-pubertal children? To answer this question we assessed a group of young athletes to test their physical performance (VO2max) and the short-term power output (Wingate Test- WAnT arm and leg evaluations). The WAnT allows a practical assessment for both legs and arms performance (2). Assuming the specificity of the anaerobic capacity for the main requested muscle groups (3), probably, football players would perform better with their legs and the swimmers with their arms.

Methods

A group of young athletes (n=22) with a two-year of training practice was divided in two sub-groups (n=11): swimmers (age: 11,27 y ± 0,47; W: 37,82 kg ± 4,14; BMI: 17,22 kg/m2 ± 1,59) and football players (age: 11,5 y ± 0,52; W: 41,00 kg ± 5,71; BMI: 18,09 kg/m2 ± 1,59). Modified Balke maximal protocol using ergo-spirometry procedures (Cosmed® b2) was selected to determine VO2max and the Ventilatory Anaerobic Threshold (VAT) as estimates for the aerobic capacity. The anaerobic capacity for both arms and legs was quantified using the WAnT, performed in a cycle-ergometer (Monark® 849). Three relative parameters were assessed: Peak Power, Average Power and Power Drop. Heart rate was measured in all the tests with the Polar S610. The two groups were compared and the experimental variables correlated (SPSS, ver.12.0).

Results

The results were similar for both groups on the WAnT and VO2max tests. There were no significant differences observed for the experimental parameters between the groups. No correlations were found when relating the prolonged with the short-term power outputs between running and cycling. Nor differences were found within each group between arms and legs cycling.

Discussion / Conclusions

No correlations were found between the anaerobic capacity (WAnT) for arms and legs within each sport. The results for both tests are in agreement with the literature and slight higher for the VO2max test.

It seems that, during the pre-pubertal development period, different sports have no significant specific metabolic effect on athletes, confirming the hypothesis of "lack of specialization" (4, 5 and 6).

References

(1). Van Praagh, E. (2000). Development of anaerobic function during childhood and adolescence. Pediatric Exercise Science, 12, 150-173.

(2). Inbar, O., Bar-Or, O., & Skinner, J. (1996). The Wingate Anaerobic Test. Champaign: Human Kinetics.

(3). Van Praagh, E. (1998). Pediatric anaerobic performance. Champaign: Human Kinetics.

(4) Bar-Or, O. (1983). Pediatric sports medicine for the practioner. Physiological principles to clinical applications. Springer Verlag. New York.

(5). Rowland, T. (1996). The Development Exercise Physiology. Champaign: Human Kinetics.

(6) The Child and adolescent athlete, Oded Bar-Or editor, The encyclopaedia of sports medicine an IOC medical commission publicationon. Blackwell Science.

EFFECT OF THE USE OF THE FIRE FIGHTING EQUIPMENT ON DIFFERENT FATIGUE FACTORS AND STRENGTH POST MAXIMAL EFFORT

Aguado, R., Ruesta, M., Izquierdo, M., Ibáñez, J., Gorostiaga, E.

Centro de Estudios, Investigación y Medicina del Deporte. , Spain

Six male professional firemen were recruited and gave informed written consent to take part in the study, which was approved by the ethics committee.

Selection criteria included male gender; age between 35-42 yr; high level of habitual aerobic activity, defined as at least two 30-min sessions of continuous aerobic-type per week; high aerobic fitness, defined as maximal oxygen uptake (VO2max) running above 55 ml.Kg.min-1; no current participation in competition at national or international level; and no illness or medications known to impair exercise or alter endocrine function. Subjects were asked not to change their dietary habits or training programs during the study. On

entry of the study, subjects underwent a full medical history and physical examination". The mean (SD) age, height, mass, and VO2max the male subjects were 40.2 years (1.5), 175.8 cm (1.8), 73.2 kg (1.8), and 57.3 ml.Kg.min-1 (1.4), respectively.

Subjects exercised on a treadmill a protocol with 5,4 km.h-1 constant velocity and incremental % inclination grade, based in Balke-Ware protocol (Froelicher, VF 1987) compound for a first discontinuous part with three stages of 3 minutes of exercise at constant workload (30% - 45% - 60% VO2max respectively), and 2 minutes of resting between trials. Second part was defined by an incremental continuous protocol, increasing 2% grade inclination every 1 minute until fatigue. Protocol was completed in two occasions at same time, separated at least one week, one time with fire fighting equipment and one time with sportswear

Previous the protocol, subjects exercised various strength tests: maximal isometric leg extension forces (MIL), height vertical jump (CMJ) and power-load concentric actions with loads 30% of body mass half-squat (HS30). These tests were reply during each resting trial, and after the fatigue, always at the same time after the stop exercise: CMJ after 15 seconds, HS30 after 30 seconds and MIL 60 second only after fatigue. During recovery after fatigue, MIL was repeated after 3, 5, 10, 15 and 30 minutes to determinate the strength recovery.

During the test was analyzed the VO2, RER, blood lactate concentration (bLA), blood ammonia concentration (bAM), blood uric acid concentration (bU), rectal temperature (RT), skin temperature in the head (HT), skin temperature in the leg (LT), heart rate (HR) and rating of perceived exertion (RPE).

Test completed with fire fighting equipment in comparison with the normal sportswear had an average of bLA 26% higher, bAM 28% higher, RT 1% higher, HT 1% higher, LT 11% higher, VO2 27% higher, RER 10% higher, HR 18% higher, rate of loss of mass 237% higher and RPE 131% higher. These result produced an effect in the strength observed in MIL 2% lower, CMJ 31% lower, HS30 13% lower, total time test 16% lower.

Fire fighting equipment reduce the performance during an endurance test and the fatigue produced decrease more the legs strength, possibly due to a higher increase in the central temperature and higher dehydration.

THE EFFECT OF 15-DAY CYCLING TOUR ON ANABOLIC AND CATABOLIC HORMONES IN UNTRAINED WOMEN AND MEN

Wu, C.-L., Chui, Y.C., Chang, C.K., Ku, S.H., Hong, W., Chang, Y.W.

National Taiwan College of Physical Education, Taiwan

Single bout of intensive endurance training has been suggested to affect catabolic and anabolic hormones in trained subjects. This study was aimed to investigate the effect of long haul cycling tour on anabolic and catabolic hormones responses in untrained subjects. Fourteen healthy, young, untrained subjects (7 male and 7 female) aged 18-35 years old were recruited from a cycling group of Cycling Taiwan 1000 km 2005. The tour covered approximately 1100 km in 15 days. Overnight fasting blood samples were collected in the morning on the day 1, day 3, day 7, day 11, and day 15 before daily departure during the tour. Plasma testosterone (T), cortisol (C), insulin-like-growth factor-1 (IGF-1) and growth hormone (GH) were measured to examine the anabolic and catabolic hormones changes during the tour. Testosterone concentrations were significant higher in male subjects than female subjects ($p<0.001$). Testosterone concentrations changes (%) were increased more significantly by the end of the tour in male subjects compared to that of female subjects ($p<0.05$). Cortisol concentrations rose in day 3 and dropped significantly on day 15 in both genders ($p<0.05$). Testosterone-to-cortisol ratio (T/C) were elevated gradually and peaked at the end of the cycling tour in both genders ($p<0.05$). Plasma GH concentrations were decreased sharply in the early stage of the tour in both genders. IGF-1 concentrations were significantly dropped on day 3 compared to day 1 but gradually recovered till the end in both genders. We concluded that anabolic hormones increased steadily during the long haul cycling tour. However, the catabolic hormone was elevated in the beginning but decreased on the following the days.

MODULATED RENAL FUNCTION DURING EXTENSIVE INTERVAL TRAINING IN SWIMMING

Stoia-Djeska, C., Skipka, W., Krakowski-Roosen, H.

University of Medicine and Pharmacy Carol Davila, Bucharest, Romania

Introduction: Strenuous physical activity is combined with a reduction in renal function. The immersion situation is generally leading to an improved diuresis, but knowledge about the counterbalancing effects of swimming with its sympathicotonic stimulation due to work and the hormonal responses on immersion is scarce. The aim of this study was to investigate the influence of swimming exercise on the behavior of urine excretion and the glomerular filtration rate (GFR) in high trained and low trained subjects.

Methods: We investigated 14 men and 12 women of different performance capacity who made an extensive interval training in front crawl lasting about 90 min. The total distance ranged from 3500m to 4200m. Distance, intensity and interval had been fixed individually, respecting the personal performance capacity of subjects; so the subjects had been divided into well trained and low trained swimmers. Before swimming, immediately after it, as well as 1.5 and 3 hours after cessation of training both urinary and blood samples were taken to determine urine flow and GFR by measurement of creatinine clearance. We calculated the training velocity (TV) as an indicator of the intensity of the effort in this exercise. We also calculated the Pearson correlation index (r) between the difference of GFR values in the two moments before and immediately after swimming (ΔGFR = GFR2-GFR1) and TV.

Results: During swimming training we have registered a significant increase in urine excretion from 0.61±0.31 to 1.31±0.43ml/min and this range was kept in the following 3 hours. GFR also increased significantly from 119±54 to 135±55ml/min with further augmentation to 144±57ml/min 1.5 hours after swimming. A significant positive correlation was found between ΔGFR and TV ($r=0.522$, $p=0.006$, ΔGFR=333TV-378) in the entire group; and also in the group of men ($r=0.577$, $p=0.031$).

Discussions and conclusions: Our study emphasized that in swimming training renal function is differentiated from the behavior during exercise on land; we have found that in swimming the renal function is increased and the increasing of GFR during our swimming training - leading to the effect that GFR-related dopamine excretion in our experiments was not increased significantly (Krakowski-Roosen et al 2006) - could be correlated with training velocity. These aspects are more evident for men than for women and they are not related to the performance capacity of the subjects.

References: Krakowski-Roosen H, Stoia-Djeska C, Skipka W: Diminished increases of urinary dopamin levels on swimtraining - a question of water immersion?

THE BLOOD PRESSURE RESPONSE TO EXERCISE IS NOT RELATED TO MINIMUM MICROVASCULAR RESISTANCE IN 9-10 YEAR OLD CHILDREN

Middlebrooke, A., Farr, C., Armstrong, N., Mawson, D., Shore, A.

University of Exeter, United Kingdom

An exaggerated blood pressure response to exercise has been shown to be a strong predictor of future hypertension (1) and cardiovascular mortality (2) in adults and is associated with cardiovascular risk in children (3). In adults, an exaggerated blood pressure response to exercise has been shown to reflect impaired vascular function (4). The aim of this study was to investigate whether the blood pressure response to maximal exercise is associated with minimum microvascular resistance in 9-10 year old children.

100 children, 53 boys and 47 girls (age: 9.9±0.4years, body mass index: 17.3±2.6kg.m2) were recruited. Systolic and diastolic blood pressure were measured using a manual mercury sphygmomanometer and stethoscope at the site of the brachial artery at rest (supine), pre-exercise (seated on ergometer) and immediately after a continuous incremental exercise test to exhaustion on a cycle ergometer. Delta blood pressure was calculated as post-maximal minus pre-exercise blood pressure. Maximum microvascular hyperaemia was assessed by the maximum skin hyperaemic response to local heating (42°C) and minimum microvascular resistance was calculated as resting mean arterial pressure / maximum microvascular hyperaemia.

There was no significant sex difference in maximum microvascular hyperaemia although minimum microvascular resistance approached significance (boys: 39.7±7.4 v girls: 43.6±11.9mmHg.V, p=0.052). There was no significant sex difference in resting systolic blood pressure, systolic or diastolic blood pressure pre-exercise, post-maximal exercise or in delta systolic or diastolic blood pressure. However, resting diastolic blood pressure was significantly higher in girls (boys: 61±6 v girls: 64±6mmHg, p=0.02). Sex specific correlation analysis revealed that neither maximum microvascular hyperaemia nor minimum microvascular resistance was significantly correlated with systolic or diastolic blood pressure at rest, pre-exercise, post-maximal exercise or delta systolic or diastolic blood pressure in boys. In girls, resting systolic blood pressure was significantly correlated with maximum microvascular hyperaemia (r= -0.31, p=0.037) and minimum microvascular resistance (r=0.34, p=0.022). There was no significant correlation between either maximum microvascular hyperaemia or minimum microvascular resistance and resting diastolic blood pressure, systolic or diastolic blood pressure pre-exercise or post-maximal exercise or delta systolic and diastolic blood pressure.

These data collectively demonstrate that in 9-10 year old children the systolic and diastolic blood pressure response to exercise does not reflect minimum microvascular resistance.

(1) Tsumura et al. (2002). Journal of Hypertension, 20(8): 1507-1512

(2) Mundal et al. (1994). Hypertension, 24(1): 56-62

(3) Kavey et al. (1997). American Heart Journal, 133(2): 162-168

(4) Stewart et al. (2004). American Journal of Hypertension, 17(4): 314-320.

WHICH DIFFERENCES ARE TO BE EXPECTED IN LABORATORY RUNNING TESTS BETWEEN SOCCER PLAYERS AND SPRINTERS?

Rakovac, M., Vucetic, V., Soric, M., Heimer, S.

University of Zagreb, Faculty of Kinesiology, Croatia

Training principles and aerobic requirements of sprinters and soccer players - forwards differ substantially. Nonetheless, due to characteristics of the football game, forwards must have a high ability to perform short sprints and are often exposed to demands characteristic for a sprint race. The aim of the study was to determine if there were significant differences in functional capacity parameters between forwards and sprinters.

Sample consisted of 15 Croatian top-level soccer forwards (mean age ± SD 23.67 ± 3.81 years) and 10 sprinters (100m and 200m) (mean age ± SD 20.53 ± 3.01 years). Groups did not significantly differ in weight (forwards 79.57 ± 7.72 kg; sprinters 76.11 ± 4.31 kg) and height (forwards 179.92 ± 6.11 cm; sprinters 184.86 ± 5.12 cm). In spirometry testing no significant differences in forced vital capacity (FVC) and forced expiratory volume in the first second (FEV1) were found between the groups (FVC - forwards 6.53 ± 0.95 L; sprinters 6.16 ± 0.65 L; FEV1 - forwards 5.31 ± 0.56 L; sprinters 5.25 ± 0.55 L). Both groups performed an incremental treadmill test to exhaustion. Following variables were observed: heart rate at ventilatory threshold (VT), speed at VT, maximum speed attained, absolute and relative maximal oxygen uptake (VO2max), absolute and relative oxygen uptake at VT, percentage of VO2max at VT (%VO2VT); maximum heart rate, maximum ventilation, respiratory frequency and tidal volume at maximum speed, ventilatory equivalent for oxygen at maximum.

T-test was used to determine differences in observed variables between the groups.

Statistically significant differences between the groups were found in three variables. Forwards reached a higher maximum speed than sprinters (19.13 ± 1.68 km/h vs 17.15 ± 1.38 km/h, respectively; t = 3.09, p = 0.01), had a higher speed at ventilatory threshold (13.53 ± 1.03 km/h vs 12.40 ± 0.99 km/h, respectively; t = 2.74, p = 0.01) and a lower heart rate at ventilatory threshold than sprinters (170.07 ± 10.15 bpm vs 177.80 ± 6.49 bpm, respectively; t = -2.13, p = 0.04). No statistically significant differences in aerobic capacities were found - VO2max (absolute - forwards 4.52 ± 0.42 L/min; sprinters 4.36 ± 0.27 L/min; relative - forwards 56.92 ± 3.02 ml/kg/min; sprinters 56.22 ± 3.39 ml/kg/min); %VO2VT (forwards 85.69 ± 3.64 %; sprinters 83.77 ± 4.84 %).

Despite the markedly different aerobic demands of respective sports and training principles, athletes showed no statistically significant differences in aerobic capacities. Results confirm findings of previous studies (Ruzic, 2005), which pointed to the needful caution in interpreting functional testing results in athletes of different energetic groups of sports. Namely, even not having preferable aerobic capacities, some athletes develop compensatory mechanisms that enable top-level performance.

Ruzic, L., & Heimer, S. (2005). Proceedings of the 4th International Scientific Conference on Kinesiology, Opatija, 2005 (pp.501-503).

TRACK AND FIELD WORLD RECORDS AND BEST PERFORMANCES IN DECATHLON RECORD HOLDERS

Mauri, C., Serena, E., Cereda, F., Manfredini, G., Peroni-Ranchet, F., Mognoni, P.

Università Statale di Milano, Italy

Track and field world records and best performances in decathlon record holders

A typical application of the logistic equation is a common model of population growth, which states that: 1) the rate of reproduction of a population is proportional to the existing population, all else being equal, 2) the rate of reproduction is proportional to the amount of

available resources,, all else being equal. Thus the second term models the competition for available resources, which tends to limit the population growth (Wikipedia.org). Recently logistic equations were used to predict upper asymptote (UA), maximal rate of growth and corresponding calendar year (Centered Year = CY) of 6 male and 2 female world-record running in races in the range of 0.8 and 42.195 km (1). The analysis started in 1920. The UA or predicted speed of "Peak" World Records of males were by 0.6-3.3% higher. These limits refer to 5 and 10 km races. CYs occurred from the late 1940s to the mid-1960s and were considered reasonable from several points of view. The determination coefficients (R^2) were satisfactorily high (0.947-0.984).We extended the logistic approach to World Records in all Decathlon events to compare them to results obtained in the same events by Decathlon World records holders (DEC). Records of javelin throw were excluded from the analysis because the aerodynamics characteristics of the tool were changed. Furthermore, we tried to differentiate the anthropometry of world record holders (WRH) and DECs.

The R^2s of WRHs were high for all events (range 0.956-0.986) except long jump (=0.852). The CYs were unreliable for 100 m race and high jump (1705 and 1915, respectively). The UA of shot put was slightly less than actual record. On the other hand, the UAs were unlikely high for high jump (+9.4%), pole vaulting (+14.7%), discus throw(+18.8%). In summary there was a clear discrepancy between the good fitting of experimental data by using logistic equations and the meaning of the numerical coefficients.

In DEC the performances in each events were not monotonically increasing and consequentely the R^2 were low (range 0.617-0.894). Furthermore, data of shot put were fitted by a power function being not consistent with any logistic function. The CYs were unreliable for 110 hm, 400 m , long jump and 100 m, being all before 1920. In 2006 the DEC predicted records were less than 10% worst than WRH predicted records for 110 hm (-6.8%) 100 m (-7.5%), 400 m (-9.3%) The larger differences were found for 1500 m (-22.9%), shot put (-32.0%) and discus throw (-40.2%). There was a tendency towards an increasing difference between WRH and DEC in high jump and pole vaulting. The ANOVA of height and body mass showed that DECs were too tall and heavy to compete in 1500 m race. The DEC body mass was significantly lower than in discus throwers or shot putters.

Reference

Nevill AM, White G: Are there limits to running world records ? Med Sci Sports Exerc 37,(10),1785-1788,2005.

RELATION BETWEEN STATURE AND CONTACT OR FLIGHT TIME IN RUNNING

Peroni-Ranchet, F., Cereda, F., Serena, E., Griner, R., Casolo, F., Mognoni, P.

Istituto Padre L. Monti, Saronno (Mi), Italy, Italy

According to a well known study, the variation coefficients (=VC) of stride times (or stride length) were 5.9-6.0% in the range of running speeds between 3.15-4.12 m/s. Such data refer to 21 subjects ranging from 1.69 to 1.83 m. The correlation coefficient between stride time and stature (H) was not significantly different from zero (1). We measured contact time (Tc) and flight time (Tf) during treadmill running at different speeds up to the maximal one maintained for at least 5 s. Rest pauses were inserted between 0.28 m/s incremental steps to avoid fatigue. The 21 subjects' height was 1.77±0.15 (1.52-1.98) m. Maximal attained speed was 7.5±0.7 (6.1-8.9) m/s At 4.17 and 6.11 m/s step lengths (Ls) were 1.450 m±6.9% (= ±VC) and 1.834 m ±8.1%, respectively. Ls was significantly related to H (R^2=0.42-0.37). The forward movement of the centre of gravity (=CG) during contact (Lc) was related to H (R^2=0.56-0.57) while the movement during flight was completely independent (R^2=0.00-0.00). In 90% of the subjects Lc plateaued over 5 m/s and was strictly related to H (R^2=0.79). At the fastest speed the unexplained difference of Ls from linear regression ranked from +0.19 to – 0.20 m. It is unknown if these differences are due to anthropometric characteristics not taken into account like body mass, muscle fibre distribution and length or mass of leg,thigh, shank, foot. Nevertheless, in cycling the dependence of freely chosen cadence on muscle fiber type is an open question (2). The vertical velocity (Vv) at the beginning of Tc can be computed from Tf (Vv=9.81*0.5*Tf). Assuming a half time of Tc as pushing time and a linear increase of vertical velocity up to the take-off, the vertical displacement of the CG and vertical work may be obtained. Assuming a decrease of forward speed in the first half of Tc indipendent of average speed (3), the changes of kinetic energy in forward direction may be obtained. The computed vertical and horizontal powers are a good approximation of values obtained by force-platforms and imaging analysis. A positive relationship between horizontal power and H was found but the p value was only 0.025.

1) Cavanagh and Kram, Med Sci Sports Exer 21:467-479,1989.

2) Hansen and Cow., Acta Physiol Scand 176:185-194, 2002.

3) Cavagna and Cow., J Physiol 262:639-657, 1976.

ESTIMATION OF ANAEROBIC RUNNING CAPACITY FROM A SINGLE RAMP TEST

Sentija, D., Vucetic, V., Milanovic, D.

Faculty of Kinesiology, University of Zagreb, Croatia

Background:

Ramp-pattern treadmill tests with gas exchange measurements are widely used for determination of maximal oxygen uptake (VO2max) and the speed at the first (aerobic) and second (anaerobic, AnT) ventilatory threshold. If the test is performed to volitional exhaustion (all-out), then the maximal running speed (Vmax) achieved in the test should be influenced, in part, by the anaerobic capacity of the subject. We hypotesize that the anaerobic capacity for running could be estimated from the distance run above AnT (AWCd), to the point of exhaustion. Recent studies reported that parameters of the 'critical power' model (CP and AWC, as measures of the anaerobic threshold and anaerobic work capacity) can be estimated from ramp-pattern tests on a cycle ergometer (Morton et al, 1997; Pouilly et al, 2005).

Purpose:

The purpose of this study is to evaluate the validity of AWCd from a single treadmill test as an estimate of anaerobic capacity, by examining the relationship between AWCd and the performance in a field test commonly used to assess anaerobic capacity, the 300 yard sprint test.

Methods:

Fourteen basketball players (24.6+/-3.5y, 193+/-10 cm), members of the national team, performed an incremental running test on a treadmill (with 1km/h increments per minute, at a constant inclination of 1.5%) to volitional exhaustion, in order to determine the ventilatory AnT, VO2max, Vmax and AWCd. On a separate day, they performed a maximal 300 yard sprint, as a criterion measure of the anaerobic capacity. Pearson's correlation coefficient was calculated for the relationship between distance run above the speed that corresponds to the AnT up to Vmax, and the speed in the 300 yard sprint test.

Results:

The ventilatory anaerobic threshold was achieved at the running speed of 13.1+/-1.1 km/h (85+/-4% VO2max), the VO2max was 54.3+/-4.4 ml/kg, and the maximal running speed at exhaustion was 18.0+/-1.7 km/h. The distance run in the ramp test above the ventilatory AnT to exhaustion was 247.3+/-101 meters, while the average speed in the 300 yard sprint test was 17.5+/-0.9 km/h. A moderate, but statistically significant correlation was found between AWCd and the result in the 300 yard sprint (r = 0.55, p<.05).

Conclusion:

The results of this study suggest that the distance run above the ventilatory anaerobic threshold in a ramp-pattern treadmill test is related to performance in the 300 yard sprint, and the ability to perform high-intensity exercise. AWCd thus can provide additional information in incremental treadmill tests, as a measure of anaerobic running capacity.

References:

1. Morton RH, Green S, Bishop D, Jenkins DG (1997). Ramp and constant power trials produce equivalent critical power estimates. Med Sci Sports Exerc 29:833-6.

2. Pouilly JP, Chatagnon M, Thomas V, Busso T (2005). Estimation of the parameters of the relationship between power and time to exhaustion from a single ramp test. Can J Appl Physiol 30(6):735-42.

RELATIONSHIP BETWEEN REFLEX EXCITABILITY IN SOLEUS MUSCLE AND ENDURANCE PERFORMANCE IN NORMAL POPULATION

Piscione, J., Grosset, J.F., Rosant, C., Pérot, C.

Université de Technologie de Compiègne, France

The Hoffmann reflex, which informs about excitability of the motor pool and synaptic efficacy, has been commonly analysed in the case of exercise studies (Zehr, 2002). The H-reflex has been found to be higher in long term endurance-trained athletes than in power-trained athletes (Maffiuletti et al., 2001) and to change after endurance training (Pérot et al., 1991). However, we may wonder if this parameter could allow differentiating no specifically trained individuals having various aerobic endurance performances. In the present study, we investigated relationship between H-reflex in soleus muscle and endurance performance in normal population. Forty five university students, sedentary or having a light recreationally physical activity, took part in the study. Aerobic endurance performance was assessed using an indirect continuous running multistage field test, the Université de Montreal track test (Leger and Boucher, 1980), which allowed the estimation of the maximal oxygen uptake (VO2max). Recruitment curves of both H-reflex and motor response (M-wave) were determined in soleus muscle by electrical stimulations of the tibial nerve in the popliteal fossa (stimulation intensity: 0 to intensity inducing the maximal M wave (Mmax); stimulation frequency: 0.2 Hz). Recruitment curves were normalised in amplitude to Mmax and in intensity to the recruitment threshold of M-wave (Mth). Recruitment threshold, increase slope and maximal value of H-reflex (respectively Hth, Hslope, Hmax) and slope of M-wave (Mslope) were determined. Decrease slope of H-reflex (H-slope) and stimulation value for its extinction (Hext) were also characterised. Relationships between each parameter of the recruitment curves and VO2max were assessed using correlation Z test. No significant correlations were shown between respectively Hth (R = 0.062, p = 0.34), Hslope/Mslope (R = -0.002, p = 0.99), H-slope/Mslope (R = -0.308, p = 0.08) and VO2max. On the other hand, a significant correlation between Hmax and VO2max was found (R = 0.342, p = 0.02). More significant correlations were revealed for both Mslope and Hext with the endurance performance parameter (respectively R = 0.490, p < 0.01 and R = -0.471, p < 0.01). Amplitude of H-reflex has been shown to be mainly due to the activation of slow-twitch motor units. This type of motor unit being more adapted for endurance exercise this can explain the positive relation between Hmax and VO2max. Moreover Mslope and Hext could estimate homogeneity in motor unit content within muscle (Hugon, 1973). Thus these parameters could also emphasize endurance muscle capacity.

Hugon M (1973) J.E. Desmedt, ed., pp. 277-293, Karger, Basel.

Leger L, Boucher R (1980) Can J Appl Sport Sci 5: 77-84

Maffiuletti NA et al. (2001) J Appl Physiol 90: 3-9

Pérot C et al. (1991) Eur J Appl Physiol 63: 368-375

Zehr EP (2002) Eur J Appl Physiol 86: 455-468.

HEART RATE KINETICS IN TENNIS PLAYERS DURING A 2 MIN GROUNDSTROKE RALLY

Cereda, F., Serena, E., Griner, R., Mondoni, M., Mognoni, P.

Università Cattolica di Milano, Italy

The tennis players have a different physiological profile according to their defensive or offensive type play. Defensive players prefer to hit the balls from the baseline and the mean time of each rally was reported to be 8.2±5.1 s (±SD), i.e. significantly longer than that of offensive players (1). Even in defensive players the effective playing time was less than one third of the total time of a match and the heart rate (HR) changes during actual playing were moderate. We designed a simple and low cost specific test to evaluate the cardiovascular stress in "false" rallies in which couples of players of similar technical level were asked to hit shots as hard as possible parallel to the sidelines for 2 min.

Players were asked to play the balls to the center of the court. HR was continously recorded over 5-s intervals with the aid of a Polar Sport Tester (Polar, Finland). In case of wrong shots a new ball was immediately put on the court. The peak ball velocity of 5 or more shots was measured by means of a radar Stalker ATS SystemTM (Minneapolis, MN, US). A 5 min pause of seated rest was interposed between rallies. The entire experimental session lasted about 50 min. Only forehand (FH) or backhand (BH) strokes were carried out in each of the six rallies. After a week from field measurements the relationship between HR and mechanical power were measured during an incremental walk on treadmill with increasing speed and constant slope (12%). Four players of each gender were studied and all of them took part to official amateur tournements of low or medium level. The mean maximal HRs of males and females were 189.3±8.1 and 193.0±4.3 b/min. No difference in HR kinetics were noted in FH and BH and data were pooled. HR increased in exponential way, the half times being 28.8±10.3 and 31.1±6.3 s, for males and females respectively. The corresponding half times during recovery were 88.5±26.8 and 99.8±32.2 s. The HR kinetics at onset and offset were significantly different (p<0.001) in both genders. The mean HRs in the last 20 s of each rally were 163.5±14.4 and 173.8±3.1 b/min in males and females (p=0.07). At the same HRs the mechanical powers during uphill walking were 195.3±10.0 and 112.7±16.1 W (p<0.001). The strokes per 2 minutes were 82.8±2.6 and 66.2±3.6 (p<0.001) and the corresponding peak ball speeds 106.7±5.3 and 84.3±5.5 km/h. In one subject the ball speed was significantly higher during FH and in two subjects during BH (two hands BH). In summary the cardiovascular stress was similar in both sexes in a 2 min tennis drill while the performance was significantly different.

Reference.
1 – Smekal G, von Duvillard SP, Rihacek C, Pokan R, Hofmann P, Baron R, Tschan H, Bachl N: A physiological profile of tennis match play. Med Sci Sports Exerc 33:(6),2001,999-1005.

RELATIONSHIP AMONG AVERAGE ANAEROBIC POWER, FATIGUE INDEX AND AVERAGE SERVICE SPEED IN ADOLESCENT TENNIS PLAYERS: AN EXPLORATORY ANALYSIS

Beisiegel, M., Conte, M., Leitão, M.T., Bergamo, V.R.
Escola Superior de Educação Física de Jundiaí, Brazil

In field tennis there is a predominance of aerobic resistance during a match; on the other hand, service speed and precision are also important for the definition of a set. Therefore, the purpose of this study was to verify the correlation of Average Anaerobic Power, Fatigue Index and Average Service Speed of teenage tennis players. Eight boys (average age 13.87 + 1.95 years) from Jundiai, São Paulo, Brazil were evaluated. The test for determining Average Anaerobic Power (PAM) and Fatigue Index (IF) was adapted from the Rast Test and from the Anaerobic Endurance Tests (Tennis Specific Agility Test - International Tennis Federation). Average Service Speed (VMS) was determined through a radar gun, and consisted of six series of two services that were served between each anaerobic sprint. The main results show a positive correlation r = 0.8839 ($p<0.01$) between PAM and VS, but no significant differences were observed between IF and VS (r = 0.6422), and between PAM and IF (r = 0.6640). The data obtained suggest that in the evaluated group the players with best PAM showed higher service speed, however those who showed a lower fatigue index not necessarily presented higher average service speed or maximum anaerobic power. Finally, the interaction among the metabolisms for the production of anaerobic energy can be observed in the correlation between PAM (glycolytic system) and VMS (ATP-CP system), which is an important aspect for the performance in field tennis.

THE EFFECT OF EXERCISE DURATION ON CALF VOLUME DURING UPPER BODY EXERCISE

Bottoms, L., Carson, R.J., Price, M.J.
Coventry University, United Kingdom

During upper body exercise calf volume decreases with the rate of decrease being slower at 10 minutes when compared to 5 minutes of exercise1. Furthermore, a decrease in calf temperature has been observed during prolonged upper body exercise suggesting that the lower body plays an important thermoregulatory role2. Therefore, the purpose of this study was to examine the effect of exercise duration on changes in calf volume and skin temperature during upper body exercise and recovery.

Eight healthy male subjects (not upper body trained) volunteered for the study, which had received ethical approval. Subjects undertook a seated incremental exercise test to exhaustion on an arm crank ergometer to determine peak power output (Wpeak). Three further trials were conducted in a randomised cross-over design consisting of arm exercise at 60% Wpeak (70 rev.min-1) for either 15, 30 or 45 minutes duration followed by 30 minutes of passive recovery. Aural and skin temperatures (calf, thigh, chest, upper arm, back, and toe) were recorded, as well as heat flow of the upper arm, chest, thigh and calf. Calf volume and blood flow were measured using venous occlusion plethysmography at rest, immediately after exercise, and every 5 minutes during recovery. Expired air analysis was undertaken using an online breath-by-breath gas analysis system. Blood lactate was measured from earlobe capillary samples pre and post exercise. Heart rate (HR) was continually monitored. Data were analysed by separate two factor repeated measures analysis of variance (time x trial) between trials for the first 15 minutes of exercise, between end of exercise values and passive recovery values.

Oxygen consumption (VO2) and HR were similar during the first 15 minutes of exercise, however HR continued to increase during the 30 and 45 minute trials ($P<0.05$). There were no differences in end-exercise VO2 or blood lactate values between trials ($P>0.05$). Calf volume decreased by -1.6±0.6, -2.2±1.0 and -2.2±0.9% during the 15, 30 and 45 minute trials, respectively ($P<0.05$), reaching a plateau by 15 minutes of exercise in all trials. Heat flow from the upper arm increased during exercise with duration and decreased immediately post exercise. Upper arm skin temperature increased during exercise in all trials ($P<0.05$) reaching a plateau at 15 minutes with no differences between trials ($P>0.05$). Although calf skin temperature remained constant during exercise in each trial values decreased during recovery ($P<0.05$) with greater deceases observed during the 30 and 45 minute trials compared to 15 minutes. Calf heat flow remained constant during exercise but decreased during passive recovery in all trials ($P<0.05$). The results of this study suggest a redistribution of blood from the relatively inactive lower body during arm exercise up to 15 minutes after which point calf volume does not significantly decrease further.

1. Hopman et al., 1993: Journal of Applied Physiology, 75(5), 2079-2083
2. Price and Campbell, 1997: European Journal of Applied Physiology, 76, 552-560.

HOW DO INSPIRATORY AND EXPIRATORY MUSCLES FATIGUE DURING HEAVY BREATHING?

Verges, S., Renggli, A.S., Notter, D.A., Spengler, C.M.
Institute for Human Movement Sciences, ETH Zurich, and Institute of Physiology and Center of Integrative Human Physiology, University of Zurich, Switzerland

Respiratory muscles are fatigued after intensive hyperpnoea or whole-body exercise (Mador et al. 1996, Johnson et al. 1993). The time course of fatigue development of the different respiratory muscle is, however, unknown. We therefore studied fourteen healthy, young men performing intermittent normocapnic hyperpnoea (HYP), i.e. 8 min HYP (~70% of maximal voluntary ventilation), 6 min pause, etc., until task failure. Twitch transdiaphragmatic (Pdi,tw) and gastric (Pga,tw) pressures were measured during cervical and thoracic magnetic stimulation after full potentiation to assess diaphragm and abdominal muscle fatigue before HYP, after each HYP-interval, at task failure, as well as after 30 and 60 min of recovery. Ventilation, oesophageal (Pes) and gastric pressures (measured by balloon catheters) were recorded continuously during HYP. Inspiratory and expiratory pressure-time products (PTP, an index of respiratory muscle work) were calculated breath by breath. Breathlessness, respiratory effort and blood lactate concentration were assessed before HYP, at the end of each HYP-interval and at task failure. Subjects breathed for 25.3±4.7 min. After 8 min of HYP, Pdi,tw and Pga,tw decreased significantly (-18±12% and -20±7%); after 16 min, Pdi,tw decreased further (-28±7%) while Pga,tw remained unchanged (-21±8%, significantly different vs. Pdi,tw). Both Pdi,tw and Pga,tw did not further decrease until task failure and were still significantly reduced after 60 min of recovery (-9±9% and -9±7%). PTPes,insp / PTPdi,insp (a surrogate for extra-diaphragmatic inspiratory muscle work) increased significantly during the first 16 min of HYP (+11±21%). Similarly, PTPes,exp / PTPga,exp (a surrogate for rib cage expiratory muscle work) increased significantly during the first 8 min (+10±16%). No further change in PTP was observed until task failure. Breathlessness (+1.6±1.8 points), respiratory

effort (+5.9±2.2 points) and blood lactate concentration (+1.1±0.4 mmol·l-1) increased significantly during the first 16 min of HYP with no further increase thereafter. We conclude that, during hyperpnoea, contractile fatigue of the diaphragm and abdominal muscles develops long before task failure and is likely compensated by increased recruitment of rib cage inspiratory and expiratory muscles to maintain target ventilation.

Supported by the Swiss National Science Foundation (31.61941.00), S. Vergès by a fellowship of AGIRàdom, Grenoble, France.

Johnson BD, Babcock MA, Suman OE and Dempsey JA. Exercise-induced diaphragmatic fatigue in healthy humans. J Physiol (Lond); 1993; 460:385-405.

Mador JM, Rodis A and Diaz J. Diaphragmatic fatigue following voluntary hyperpnea. Am J Respir Crit Care Med; 1996; 154:63-67.

EFFECT OF (-)-HYDROXYCITRATE CO-INGESTED WITH CAFFEINE ON FAT AVAILABILITY DURING EXERCISE IN HUMANS

Kuno-Mizumura, M., Haruyama, T., Miyashita, M.

Ochanomizu University, Japan

Previous study reported that (-)-Hydroxycitrate (HCA) ingestion can reduce malonyl-CoA concentrations and consequently increase fatty acid oxidation in vivo. However, no studies investigated the effects of HCA and co-ingestion of other supplements, such as caffeine, while co-ingestion might have greater effect on glycogen-sparing than HCA alone at rest or during exercise. The purpose of this study was to investigate the acute effects of co-ingestion of HCA and caffeine on fat availability during low intensity exercise in healthy university students. We examined the effect of HCA co-ingested with caffeine for nine healthy Japanese university students (6 females, 3 males) who performed a random order of four experimental trials consisting of 120 min of steady-state walking on a treadmill at 50 % of maximal oxygen consumption. Fifteen minutes before exercise subjects ingested either 100mg caffeine (CAF), 1200mg HCA (HCA), 1200mg HCA ＋ 100mg caffeine (HCA+CAF), placebo which contained no HCA and CAF, but the same amounts of calories (CON). Oxygen consumption (VO2), respiratory quotient (RQ), and heart rate were measured both at rest and during exercise by K4b2 (Cosmed, Italy). During exercise, blood lactate concentration and RPE were also measured every ten minutes. The ingestion of 1200mg HCA was equal to 21.8±3.5mg/kg and that of 100mg caffeine was equal to 1.8±0.3mg/kg. At rest, there was no significant difference in measured parameters among four experimental trials. VO2 at 30 min, 60 min, 90min, and 120 min was significantly higher in HCA＋CAF than either HCA or CAF. RQ at 30min, 60min, 90min, and 120min was significantly lower in HCA＋CAF than the rest three trials. Significant higher VO2 and lower RQ during exercise with HCA＋CAF would suggested HCA co-ingested with caffeine would induce higher sympathetic nerve activity during exercise. From the results of this study, it is concluded that HCA co-ingested with caffeine has an additive effect on substrate utilization than that by the ingestion of HCA or caffeine alone.

TIME COURSE OF IMPROVEMENT IN ENDURANCE PERFORMANCE DURING ALTITUDE ACCLIMATIZATION

Schuler, B., Thomsen, J.J., Gassmann, M., Lundby, C.

University of Århus, Århus, Denmark

This study tested the hypothesis that maximal O2 consumption (VO2max) and performance increases upon acclimatization to moderate altitude. Therefore, rest capillary blood parameters and exercise performance of eight elite bike racers was evaluated on five different occasions: (1) At sea level, (2) after 1 day of exposure to 2340m altitude and again at the same altitude after (3) 7, (4) 14, and (5) 21 days of altitude exposure. Training intensity and volume was controlled two weeks prior to the experiments, and did not change throughout the study. All training was performed at sea level. Daily iron supplementation (100 mg) was stated two weeks prior to altitude exposure.

Compared to sea level, arterial oxygen content decreased at 1 day at 2340m but increased over time at altitude. VO2max and time to exhaustion decreased on day 1 as compared to sea level, but increased gradually over the next weeks, but always remained lower than the sea level values. The highest improvement was observed between 7 days and 14 days during the altitude acclimatization. We conclude that endurance athletes competing at altitude around 2340m should arrive to this altitude at least 14 days prior to the competition.

VENTILATORY PARAMETERS IN LONG DISTANCE AND SPRINT RUNNERS DURING INCREMENTAL EXERCISE

Soric, M., Vucetic, V., Rakovac, M., Sentija, D.

Faculty of Kinesiology, University of Zagreb, Croatia

It has been shown that ventilatory parameters during incremental exercise differ between athletes and sedentary individuals (1), and even between elite amateur and professional athletes (2). Therefore, the goal of this study was to examine if those differences exist in athletes with different metabolic demands.

A group of 10 male sprinters (S), representing anaerobic, and 10 male long distance runners (LD), representing aerobic athletes, participated in the study. Groups differed significantly regarding age (mean + SD): years 27,4 ± 7,4 vs. 20,5 ± 3,0 years , height: 177,6 ± 6,6 cm vs. 184,9 ± 4,8 cm and weight: 67,6 ± 6,4 kg vs. 76,6 ± 4,3 kg, for LD and S respectively. Before exercise all subjects performed spirometry in the up-right position. Groups were not statistically different regarding forced vital capacity (FVC): 6,1 ± 0,8 L and 6,2 ± 0,6 L, LD and S, respectively. Both groups then completed an all effort minute incremental step protocol test on treadmill. Ventilatory parameters were observed at maximum exercise intensity (MaxPO) and at anaerobic ventilatory treshold (AnT). As expected, groups differed regarding both VO2max (4,8 ± 0,5 vs. 4,4 ± 0,3 l/min,) and AnT (4,0 ± 0,4 vs. 3,7 ± 0,3 ml/min,), for LD and S, respectively.

No significant differences were observed for minute ventilation, tidal volume or breathing frequency at MaxPO or at AnT. Ventilatory equivalents for O2 (VE/VO2) and CO2 (VE/VCO2), as well as end tidal pressures (PetO2 and PetCO2), also were not significantly different at AnT. However, those parameters did differ between groups at MaxPO. Long distance runners exhibited lower VE/VO2 - 33,0 ± 2,4 and VE/VCO2 - 28,6 ± 3,1 than sprinters - 36,2 ± 3,5 and 32,1 ± 3,9, respectively. Regarding end tidal pressures at MaxPO, long distance runners exhibited lower PetO2 (109,8 ± 2,7 vs. 112,8 ± 3,3 mmHg) and higher PetCO2 (40,2 ± 4,5 vs. 36,1 ± 4,1 mmHg), than sprinters.

In conclusion, we observed no differences in ventilatory parameters between long distance runners and sprinters during exercise below anaerobic threshold. After this point, also called respiratory compensation point, LD exhibited lower ventilation for given O2 uptake and CO2 output. This relative hypoventilation in LD is probably due to lower acidemia. Although we did not measure arterial gases, lactate levels at the end of exercise were, indeed, significantly lower in long distance runners (10,1 ± 2,4 mmol/L) than in sprinters (15,0 ± 2,9 mmol/L).

1. Folinsbee LJ. et al. (1983) Exercise respiratory pattern in elite cyclists and sedentary subjects. Med Sci Sports Exerc; 15:503-509

2. Lucıa A. et al. (1999) Breathing pattern in highly competitive cyclists during incremental exercise. Eur J Appl Physiol Occup Physiol; 79:512–21.

SERUM ANGIOTENSIN CONVERTING ENZYME ACTIVITY AND PLASMA NITRIC OXIDE LEVEL DURING ACUTE EXERCISE IN FOOTBALL PLAYERS

Nakas-Icindic, E., Hadzimuratovic, A., Hadzovic-Dzuvo, A., Huskic, J., Avdagic, N.

Medical Faculty, Bosnia and Herzegovina

Angiotensin converting enzyme (ACE), as a part of renin-angiotensin system, is involved in production of potent vasoconstrictor angiotensin II. Physical activity stimulates the renin angiotensine system. Nitric oxide (NO) is unstable gas radical released from endothelial and other cells in basal conditions and in response to various physiological and pharmacological stimuli. ACE and NO are involved directly or indirectly in cardiovascular response to acute or chronic physical activity. Results of animal experiments showed that NO negatively modulated renin angiotensine system, while angiotensin II positively stimulated synthesis and releasing of NO (1). There was no secure evidence on this relation in humans. The aim of our study was to estimate the correlations among serum ACE activity and NO level during acute exercise in professional athletes.

Eight healthy, young, male volunteers, professional football players carried out dynamic exercise 12 minutes lasting, in upright, sitting position on bicycle ergometer under the protocol of continuous work load (3 W/kg) and cycling rate 60 RPM. Blood samples were collected in the period of rest, during exercise and in the recovery period. The serum ACE activity was determined by spectrophotometric method (2). The plasma NO level has been determined by means of nitrate and nitrite production measurement, using classical colorimetric Griess reaction (3). Results are showed as mean +/- SEM. The t-test for small dependent samples was used for evaluation of differences inside the group. The correlation level between the variables was determined by Pearson s coefficient of correlation.

No statistically significant changes in serum ACE activities were found either during exercise or in the recovery period compared with basal values. Miura et al. (2) also found no changes in serum ACE activity after acute exercise lasting 30 minutes. During exercise, the plasma NO level statistically decreased compared to NO level in the period of rest. The findings of present study indicate that acute exercise may decrease the plasma NO level during exercise. The plasma NO level starts to increase immediately after the end of exercise. At the end of recovery period it was not significantly different from the basal values, although Franco et al. (3) found the significant increase in plasma NO level after 10 minutes of acute exercise. We did not found any correlation among serum angiotensin converting enzyme activity and plasma nitric oxide level during acute exercise in football players.

References

1. Fernandez-Alfonso MS, Gonzales C 81999; 17(10): 1355-61

2. Filipović N, Borčić N, Igić R (1983). Clin Chim Acta., 128:177-80

3. Grees LC, Wagner DA, Glogovski J, et al. Anal Biochem 1982; 126:131-8

4.Franco L, Doria D, Mattucci F, Med Principles Pract 2001; 10:106-109.

PHYSIOLOGICAL DETERMINANT OF YO-YO INTERMITTENT RECOVERY TEST IN YOUNG BASKETBALL PLAYERS

Castagna, C. 1+2, Impellizzeri, F.M. 3, Rampinini, E. 3, Marini, M. 1, D'Ottavio, S. 2, Manzi, V. 2

1 Scuola Regionale dello Sport delle Marche, CONI, Ancona, Italy, 2 School of Sport and Exercise Sciences, Tor Vergata University, Rome, Italy, 3 HPL Sport Service MAPEI, Castellanza, Italy, Italy

Yo-yo intermittent recovery (Yo-yo) test has recently been proposed to test team-sport players' endurance. To our knowledge no study has carried out in order to test relevance of Yo-yo to basketball. Therefore the first aim of this study was to examine the relationship between the Yo-yo test and laboratory aerobic-fitness parameters, in well-trained basketball players (population validity). Secondly to assess the degree of association between Yo-yo performance and game-related physical-performance (McInnes, Carlson et al. 1995) to examine test specificity. Twenty-two basketball-players (Stamura Basket, body mass 72.4 ± 11.4 kg, height 181.7 ± 6.9 cm, and age 16.8 ± 2 yrs) were tested for Yo-yo, VO2max, ventilatory threshold (VT), running economy (RE, VO2 at 8 km h-1) and speed attained at VO2max (MAS) on a motorized-treadmill. Gas analysis was performed using a portable gas analyzer (K4b2, COSMED, Rome, Italy). Game-related physical performance was assessed before and after an experimental basketball game (Hoffman, Nusse et al. 2003). Players VO2max, MAS, VT and Yo-yo performance values were 60.4±5.1 ml kg-1 min-1, 40.2±4.7 ml kg-1 min-1 and 1678±397m respectively. Yo-yo performance resulted significantly correlated with VO2max ($r=0.77$, $p<0.001$) and MAS ($r=0.71$, $p<0.001$). During the first and the second half of the experimental-game, players attained 86.2±5.3 and 86.7±4.3% of the individual HRmax, respectively ($p=0.42$). Average experimental-games blood lactate concentration was 3.72±1.39 mmol l-1. Yo-yo was related to pre-post Line-drill (LD) decrements ($r= -0.51$, $p=0.04$). These findings support the likelihood of basic physiological association between Yo-yo performance and the individual level of aerobic-fitness in basketball players. Although observations were made using an experimental-game, the intensity attained by players during competition is in line to what reported for professional basketball players during highly competitive games (McInnes, Carlson et al. 1995). This supporting the validity of the research design devised for this investigation. Being LD considered as a basketball-specific test, the existence of a significant although moderate association between Yo-yo performance and LD post-game decrements promote the relevance of Yo-yo to basketball. Given that, Yo-yo may be regarded as an interesting basketball-specific field-test for specific-endurance. However in order to fully validate Yo-yo test, it should be compared with selected game-activities through sound match and time-motion analysis.

Hoffman, J. R., V. Nusse, et al. (2003).

EXERCISE INDUCES BDNF INCREASE IN HUMANS

Rojas Vega, S., Strüder, H.K., Vera-Wahrmann, B., Vafa, R., Im, J.Y., Hollmann, W.

German Sport University Cologne, Germany

Introduction: Brain derived neurotrophic factor (BDNF) and cortisol (COR) have impact on neurogenesis in the brain and directly change its basic structure and morphology. BDNF was shown to promote and improve neuronal plasticity, while chronically elevated COR levels inhibit it. Earlier studies have reported increased serum BDNF after exercise (1) and a recent study confirms this finding in humans (2). The aim of the present study was to investigate the effect of short-term aerobic exercise and ramp incremental cycle ergometry to exhaustion on the acute response of the serum concentrations of brain derived neurotrophic factor (BDNF) and cortisol (COR).

Methods: Eight healthy male volunteers participated in the study. Venous and capillary blood samples were drawn and alterations of lactate, arterial blood gases as well as serum BDNF and cortisol (COR) concentration were measured before (-50), after a 10 min warm-up period (0) after the end of a ramp test (E) and at 3, 6, 10 and 15 min during the recovery.

Results: Capillary blood lactate (LA) concentration and blood gases as well as serum BDNF and COR concentrations did not change during the warm-up period. LA was increased ($p<0.05$) at the end of the ramp test and during the recovery period while bicarbonate concentration, carbon dioxide pressure, pH and base excess were decreased ($p<0.05$) during this period. Serum BDNF was increased at the point of exhaustion ($p<0.05$) while no significant differences were found between values at rest and during recovery period. At 10 and 15 min post incremental exercise COR concentrations increased ($p<0.05$) compared to COR concentrations at rest.

Discussion: The novel finding of this study is that moderate aerobic exercise over 10 min does not affect blood BDNF concentration whereas a following ramp incremental exercise to exhaustion of similar duration increases blood BDNF concentration, pointing to exercise-intensity dependent transient neurotrophic factor induction in humans. The present study also shows that the acute response to high intensity exercise differs between BDNF and COR. Augmented BDNF secretion under exercise does not occur along with changes in blood gases while COR increases concomitant with alterations of blood gases. The augmented exercise-induced BDNF production could result in an increased entry of the neurotrophin into the CNS as demonstrated in vitro. This could allow an influence of the trophin on the central receptors promoting and improving brain neuroplasticity.

References:

1 Eriksson PS, Perfilieva E, Björn –Eriksson Th, Alborn AM, Nordborg C, Peterson DA, Gage FH. Neurogenesis in the adult human hippocampus. Nat Med 4: 1313-1317, 1998

2 Gold SM, Schulz K-H., Hartmann S., Mladek M., Lang U.E., Hellweg R., Reer R., Braumann K-L., Heesen C. Basal serum levels and reactivity of nerve growth factor and brain derived neurothropic factor to standardized acute exercise in multiple sclerosis and controls. J. Neuroimmunol.138: 99-105, 2003.

THE EFFECT OF OFFICIAL HANDBALL COMPETITION ON SALIVARY IMMUNOGLOBULIN A AND TOTAL PROTEIN IN ELITE FEMAIL HANDBALL PLAYER

Yazdanparast Chaharmahali, B., Azarbaijani, M.A., Talebi, Z.

Islamic Azad University, Varamin branch, Iran

There is growing evidencethat physical exercise and psychological stress can influence cellular and humoral immuno function. Salivary immunoglobulinA (sIgA) by plasma cells in the submucosa is one characteristic humoral factor of the local immune system of the upper respiratory tract, where sIgA is acting as the first line defiance against bacteria and viruses. Many investigators in last 2 decades have performed some serial studies both sport and non sport situation. But there are many so much conflicts in previous studies,Therefore present study was designed to investigate the effect of a real stress situation on salivary IgA and total protein concentraction following handball competition. 7 healthy female elite handball player members of HOMA club participated as a subjects in this study.All were informed about protocol and gave written consent. 5ml unstimulared whole saliva sample were collected 15 min before and 5mint after four league games. Before saliva sampling, subjects were rinse out their mouths with water to remove any substances that may affected sIgA,and total proteins, all samples were kept frozen at -20 degree centigrade until use.sIgA and total protein concentration were measured in duplicate by Neflometry and Bradford method respectively.Means and standard deviations were calculated for all comparison were used to determine significant differences.The level of significance was set at $p<0.05$.The findings of the research are as follow: Concentrations of sIgA significantly decreased after fourth game incomparesion base line(before first game). Cncentrations of total protein went through parallel changes during competition. In summary, these results show that in elite female handball players competition stress elevates sIgA and total protein concentrations, indicating that spesific humoral immune function are decrease by acute physiological and psychological competition stress.

RECOMBINANT HUMAN ERYTHROPOIETIN TREATMENT (R-HUEPO) INCREASES MAXIMAL OXYGEN UPTAKE IN MILD AND MODERATE ACUTE HYPOXIA

Robach, P., Juhl Thomsen, J., Mollard, P., Calbet, J.A., Boushel, R., Lundby, C.

Ecole Nationale de Ski et d'Alpinisme, 74401 Chamonix, France; and The Copenhagen Muscle Research Centre, Rigshospitalet, 2200 Copenhagen N, Denmark, France

Background: In a normoxic condition, prolonged treatment with recombinant human erythropoietin (r-HuEPO) enhances maximal oxygen uptake (VO2max). However, if the incremental exercise is performed in acute hypoxia (above 4,000m) there is no effect of r-HuEPO on VO2max. Thus, there should be an altitude threshold - between 0 and 4,000m – at which the VO2max enhancing effect of r-HuEPO evanishes. The effect of mild/moderate hypoxia on maximal aerobic performance after r-HuEPO has not been investigated, even though several competitive aerobic sports take place in a mild hypoxic environment. Therefore, the aim of this study was 1) to verify that the advantage conferred by r-HuEPO on VO2max at sea level persists during mild and/or moderate hypoxia, and 2) to locate the altitude threshold beyond which r-HuEPO would be inefficient.

Methods: Seven male subjects (VO2max = 52 ± 6 ml.min-1.kg-1) were investigated before and after having received 5000 IU of r-HuEPO every second day for 14 days, and then 5000 IU weekly for the following 14 days. Oral administration of 100 mg iron was initiated 14 days before r-HuEPO treatment started. Red blood cell volume was measured by carbon monoxide rebreathing. Each subject performed five VO2max tests, randomly and in a single-blind manner, one in normoxia and the four others in acute hypoxia corresponding to simulated altitudes of 1,500m, 2,500m, 3,500m and 4,500m. At VO2max, cardiac output was obtained by thoracic bioimpedance, arterial O2 content from capillary blood and lactate from venous blood. Systemic O2 delivery and extraction at VO2max were calculated.

Results: r-HuEPO increased red blood cell volume by 11% ($P<0.05$). The treatment improved VO2max by 5.8% at 0m ($P<0.05$), 8.4% at 1,500m ($P<0.05$), 14.0% at 2,500m ($P<0.05$), 14.7% at 3,500m ($P<0.01$) and 1.4% at 4,500m ($P=0.6$). The r-HuEPO-induced increase in VO2max tended to be higher at 2,500m than at 0m ($P=0.1$) and was higher at 3,500m than at 0m ($P<0.05$). The increase in systemic O2 delivery at VO2max after r-HuEPO (from 14 to 18%) was significant at all the altitudes, except at 4,500m (10%, $P>0.05$). The higher O2 delivery was due to an augmented arterial O2 content and a small increase in cardiac output at VO2max. Systemic O2 extraction at VO2max was reduced with r-HuEPO at 0m and at 4,500m, but not at the intermediate altitudes. Venous lactate at maximal exercise remained unchanged.

Conclusion: The beneficial effect of r-HuEPO on VO2max - observed at sea level - persists at moderate altitudes and VO2max remains elevated at altitudes up to 3,500m after r-HuEPO treatment. The altitude threshold for which the effect of r-HuEPO becomes marginal would be comprised between 3,500 and 4,500m.

With Grants from Anti Doping Danmark and Kulturministeriet.

EFFECT OF ECCENTRIC EXERCISE ON MUSCULAR DNA DAMAGE IN RAT

Tadano, C., Yona, M., Tajima, T., Seki, H., Muro, M.

Toho university school of medicine, Japan

Introduction

Vigorous exercise induces an increase of oxidative DNA damage evoked by endogenously generated reactive oxygen species (ROS). The DNA damage is frequently observed with muscle damage indicated by circulatory creatine kinase (CK) response. However, direct evidence of the DNA damage is not so clear in skeletal muscle. In this study, we examined the relationship between muscular oxidative DNA damage and exercise induced muscle fiber damage.

Methods

Male wistar rats (10-14 wk) were used in this experiment. The animals were divided into sedentary controls and downhill (-17 degree incline, DH) exercise rats. The DH rats performed an intermittent protocol at 25 m/min for a total of 90 min (5-min bouts separated by 2-min rest, 18 bouts) on a treadmill. Hindlimb muscle samples, including red portion of medial gastrocnemius (GMR), white portion of medial gastrocnemius (GMW) and soleus (SOL) were collected under anesthesia at specific points of recovery and were quickly frozen in liquid nitrogen. Blood samples were concomitantly collected. All samples were stored at -80 degree until analysis. DNA was extracted from the muscle specimens and treated with enzymes to isolate a nucleoside. The 8-hydroxy-2'-deoxyguanosine (8-OHdG) and 2'-deoxyguanosine (dG) were determined with HPLC as an index of the muscular oxidative DNA damage (8-OHdG/dG). Lipid hydroperoxide (LH) content of the muscles was determined. Muscular glutathione contents, and glutathione peroxidase (GPX), glutathione reductase (GR), superoxide dismutase (SOD) activities were also determined. Plasma CK activity was determined as a common indicator of muscle damage.

Results

Plasma CK showed a 2-3 times increase in immediately post-, 24 h post-, and 48 h post-DH exercise. Muscular 8-OHdG/dG level showed a 2-5 times increase from that in the control after DH exercise in GMR, GMW, SOL at those points. The 8-OHdG/dG responses were different from each other. However, it seemed that any responses followed the CK response at the same time points. LH content slightly increased in these muscles. The levels of glutathione, GPX, GR, SOD were different between muscles and portions (SOL>GMR>GMW). These antioxidants correlated with LH. However, 8-OHdG/dG level was not correlated with LH or any antioxidants.

Discussion and Conclusion

Eccentric exercise induced muscular oxidative DNA damage, suggests an involvement of muscle damage to the muscular DNA damage in an intense exercise. Although there were many differences in the antioxidant capacity between muscle types and portions, an acute increase in muscular DNA damage appeared to be independent on the antioxidant capacity in this experiment. The data suggests a weak response of antioxidant system to an acute ROS generation in skeletal muscle in exercise.

Reference

Tsai K et al. (2001) Free Radic. Biol. Med. 31: 1465-1472.

Radak Z et al. (1999) Free Radic. Biol. Med. 26: 1059-1063.

THE RELATIONSHIP BETWEEN STATIC AND DYNAMIC LUNG VOLUMES AND BREATH HOLDING TIME IN PREPUBESCENT SWIMMERS

Evangelidis, P., Theos, A., Bogdanis, G.C., Maridaki, M.

University of Athens, Greece

Introduction

In many sports, athletes perform strenuous exercise while holding their breath or breathing in a controlled way (Bjurstrom et al., 1987). Larger lung volumes may enhance performance under these conditions, providing a greater gas exchange reservoir. The purpose of this study was to examine whether static and dynamic lung volumes are related with breath holding time in experienced prepubescent swimmers.

Methods

Seventeen prepubescent children (11 boys and 6 girls; age: 10.6±0.2 years, height: 145±2 cm, mass: 39.4±1.9 kg) were tested in this study. All subjects were swimmers with at least four years of training experience. Forced Vital Capacity (FVC) and Forced Expiratory Volume in 1 sec (FEV1) were measured in a seated position with a Vitalograph spirometer. Two days later participants performed a breath-holding test in the laboratory. Breath holding was performed in a seated position without prior hyperventilation. After a 5-min rest period subjects repeated the procedure and the best time for each subject was recorded. Predicted values for FVC and FEV1 were calculated using Dickman's equations (Dickman et al., 1973).

Results

The measured FVC and FEV1 were 2.67±0.13 and 2.38±0.10 lt respectively. These values were 121±6 % and 124±5 % of the age-matched predicted values. Breath holding time (59±6.4 sec) was significantly correlated to FVC ($r=0.78$, $p<0.001$) and FEV1 ($r=0.80$, $p<0.001$).

Discussion

This study showed that prepubescent swimmers had higher FVC and FEV1 compared with age- matched predicted values for reference children (Dickman et al., 1973). Therefore swimming training at an early age may lead to increased static and dynamic lung volumes. Furthermore, the ability of breath holding may be influenced by lung volumes as indicated by the relationship between breath holding time and FVC and FEV1 values.

References

Bjurstrom L.R. and Schoene B.R. Control of ventilation in elite synchronized swimmers. J. Appl. Physiol. 63(3): 1019-1024, 1987

Dickman M.L., Schmidt C.D., Gardner R.M. Spirometric standards for normal children and adolescents (ages 5 years through 18 years). Am. Rev. Respir. Dis. 108: 933-939, 1973.

PERFORMANCE AND METABOLISM IN REPEATED SHORT-SPRINT EXERCISE: EFFECT OF RECOVERY INTENSITY

Spencer, M., Dawson, B., Goodman, C., Dascombe, B., Bishop, D.

The Univeristy of Western Australia, Australia

We have recently reported that active (~32% of VO2max), compared to passive recovery impairs repeated, short-duration, sprint ability(1). This impairment was associated with a lower [PCr] and a significantly higher [MLa-] when an active recovery was performed between sprints(1). While it has not been previously investigated, it is possible that there may be an intensity affect of active recovery on metabolism and subsequent performance due to differences in the oxygen cost of the exercise and therefore, the resynthesis of PCr, which has been associated with sprint performance(2). Alternatively, as muscle activation is required for the initiation of glycolysis(3), active recovery, regardless of intensity, may result in greater [MLa-] and impaired performance. Therefore, the purpose of this study was to investigate the effect of a low-intensity (LI) versus a moderate-intensity (MI) active recovery (with passive recovery as the control) on sprint performance and metabolism, during a repeated-sprint test that mimics the sprint and recovery durations commonly seen in team sports. These intensities were chosen as the majority of active recovery undertaken during repeated-sprint bouts is reported to be of a 'jogging' or a 'walking' intensity(4). Methods. Nine moderately-trained males performed three repeated-sprint cycle tests (6 x 4-s sprints, every 25 s) in a randomized, counter-balanced order. Recovery after each of the sprints for the MI and LI trials respectively were 60 W (~35% VO2max) and 20 W (~20% VO2max). Needle biopsy samples were taken from the vastus lateralis pre-test and immediately post-test during the MI and LI trials to determine [ATP], [PCr] and [MLa-]. Results. Compared to the passive trial, significant reductions in peak power outputs were recorded in both the MI trial (4 of the 6 sprints; $P < 0.05$) and in the LI trial (2 of the 6 sprints; $P < 0.05$), with no differences between the two active trials. There were no significant differences for total work between the passive, MI and LI recovery trials (255.6 ± 41.5, 245.6 ± 30.5 and 245.2 ± 29.5 J•kg-1, respectively). Furthermore, no significant differences were evident in delta change for [ATP] (3.9 ± 3.5 v 3.4 ± 2.3), [PCr] (39.9 ± 17.6 v 37.8 ± 15.6) and [MLa-] (41.9 ± 24.5 v 46.2 ± 19.8) between the MI and LI active recovery trials, respectively. Conclusions. In summary, peak power indices during the repeated-sprint test were inferior in the MI and LI active recovery trials, in comparison to passive recovery. The similar changes in performance and metabolites between the two active recovery trials suggests that muscle activation is an important factor in recovery during repeated-sprints and that any low-to-moderate level of activation may affect recovery during repeated, short-sprint bouts.

1. Spencer et al (2006) Med Sci Sports Exerc, In Press

2. Bogdanis et al (1995) J Physiol 482(2):467-480

3. Crowther et al (2002) Am J Physiol 282:E67-E73

4. Spencer et al (2004) J Sports Sci 22: 843-850.

CALF-TOE SKIN TEMPERATURE DIFFERENCE DURING COLD EXPOSURE

Kocjan, N., Mekjavic, I.B.

Jozef Stefan Institute, Slovenia

Calf-Toe skin temperature difference during cold exposure

Nina Kocjan1, Igor B. Mekjavić1

1 Department of Automation, Biocybernetics and Robotics, Jozef Stefan Institute, Jamova 39, 1000 Ljubljana, Slovenia

Freezing and non-freezing cold injuries occur primarily in the toes. The cause of such an injury is a cold induced decrease in tissue perfusion. The present study investigated protection from cold injury offered by two different types of hiking boots, by monitoring toe perfusion, as reflected in the calf and toe skin temperature gradient (Tsk-diff), during a 3 hour cold exposure. A total of 10 subjects participated in the study. They were divided into two groups, each wearing a different type of hiking boot. The mean (SD) age, height and weight of the subjects wearing boot A were 33 (6), 177.3 (9.2), 77.2 (6.4), respectively. The mean (SD) age, height and weight of the subjects wearing boot B were 26 (2), 183.5 (8.1), 78.5 (14.0), respectively. Subjects were requested to stand still in a snow covered area for 3 hours. Mean skin temperature (Tsk) was calculated from arm, chest, thigh, calf and back body sites. Calf and toe temperatures (Ttoe) were used to calculate the Tsk-diff. The Tsk-diff response was characterized by its amplitude (A), time delay (TD) and time constant (τ). During the trials, core temperature (Tc) was monitored with a gastrointestinal radio pill. In addition, the environmental data (ambient temperature, Ta; wind speed, vw; solar radiation, R) were continuously monitored. For boot A, the change in Tsk was -3.4 (1.8) and for boot B -2.5 (1.5) °C, the difference was not significant. There was no significant difference in the amplitude of the Tsk-diff response between the two boots, but there was a significant difference in TD ($p<0.05$) and τ ($p<0.05$) between the two boots. Ttoe was significantly higher in boot A than in boot B ($p<0.05$). There were no significant changes in Tc during the cold exposures. Ta, vw and R were 0.8 (0.7) °C, 116 (30) W/m2 and 0.0 (0.1) m/s during boot A trials, and -2.0 (2.8) °C, 15 (11) W/m2 and 18.8 (8.5) m/s during boot B trials, respectively.

Due to the cold-induced vasoconstriction, as reflected by lower Ttoe and higher Tsk-diff, boot A posed a greater risk for cold injury. Despite colder ambient conditions, the greater TD and higher Ttoe observed in boot B trials, suggests better cold protection offered by this boot. We conclude that lower extremity Tsk-diff and Ttoe during cold exposure reflects the cold protection offered by footwear.

1. Sessler, D.I., C.I. Olofsson, and E.H. Rubinstein, The thermoregulatory threshold in humans during nitrous oxide-fentanyl anesthesia. Anesthesiology, 1988. 69(3): p. 357-64.

2. Sessler, D.I., et al., The thermoregulatory threshold in humans during halothane anesthesia. Anesthesiology, 1988. 68(6): p. 836-42.

3. House, J.R. and M.J. Tipton, Using skin temperature gradients or skin heat flux measurements to determine thresholds of vasoconstriction and vasodilatation. Eur J Appl Physiol, 2002. 88(1-2): p. 141-5.

LONG-TERM STRENGTH TRAINING AND SKELETAL MUSCLE DNA-TELOMERE LENGTH

Kadi, F., Ponsot, E., Welin, L., Mackey, A., Kjær, M., Oskarsson, E., Piehl-Aulin, K.

Department of Health Sciences, Sweden

Introduction

Long-term strength training lead to a significant remodelling of several morphological parameters in skeletal muscles together with the activation, proliferation and differentiation of satellite cells in order to sustain muscle fibre hypertrophy and to repair micro-injuries caused by the mechanical stress (Kadi et al. 2005). Considering the important role played by satellite cells in the adaptation of skeletal muscle to exercise and knowing that satellite cells are responsible for the regenerative capacity of skeletal muscle, it is of outmost importance to improve our knowledge on the effects of regular strength training on the regenerative capacity of skeletal muscle. This can be achieved

by the analysis of muscle DNA telomere length, which is an indicator of a cell's potential for further cell division. The aim of this project is to compare muscle DNA telomere length in a population of athletes with a long strength training history compared to a healthy active population

Methods

Five young male athletes (mean age 27 years) regularly involved in strength training were included in the study. They have practised strength training for a period of more than 5 years. They trained 3 to 4 times a week and 5 to 10 hours/week. This group has been compared to an age-matched group of healthy active individuals not involved in regular strength training. Muscle biopsies were taken from vastus lateralis muscle. Total DNA extraction is achieved by incubation in proteinase K digestion buffer. The genomic DNA is then digested with a restriction enzyme to generate a smear of DNA fragments containing telomeres with different lengths of the TTAGGG repeat sequence. Mean and minimum telomere length is determined by southern blot analysis. The telomeres are detected by hybridization to a 32P-labelled (TTAGGG)4 probe, followed by exposure to x-ray film.

Results and conclusion

The signal obtained provides a distribution profile of telomeric lengths of all myonuclei and satellite cells present in the tissue. Average telomere length indicates the most frequent DNA telomeric lengths of the tissue whereas the minimal telomere length indicates the shortest DNA telomeric lengths found in the tissue. We found no significant differences between the long-term strength trained individuals and the control group both with respect to the mean telomere length (11.8 ± 1.4 kbp in athletes vs 10.6 ± 0.5 kbp in controls) and the minimal telomere length (5.2 ± 0.8 kbp in athletes and 4.6 ± 0.3 kbp in controls) .

Although strength training is known to alter satellite cell behaviour, the telomere length in long-term strength trained athletes are altered compared to healthy active individuals. The high mechanical stress put on skeletal muscle during long-term strength training is not associated with a decrease in the regenerative capacity of muscle fibres.

References

Kadi F et al. (2005) The behaviour of satellite cells in response to exercise: what have we learned from human studies? Pflugers Arch 451:319-327.

CHANGES IN FLUCTUATION PATTERN OF CARDIOVASCULAR SIGNALS DURING SYMPATHETIC ACTIVATION

Kiviniemi, A.M., Huikuri, H.V., Hautala, A.J., Tiinanen, S., Seppänen, T., Mäkikallio, T.H., Tulppo, M.P.

Merikoski Rehabilitation and Research Centre, Finland

Cardiovascular signals as R-R intervals and blood pressure fluctuates at the frequency of ~0.1 Hz known as a low frequency oscillation pattern (LF). The altered LF oscillation of R-R intervals to higher frequencies (>0.1 Hz) is a strong predictor of mortality among cardiac patients (1). However, the physiological background of altered fluctuation pattern of cardiovascular signals is not well known. PURPOSE: To test the hypothesis that LF oscillation pattern of R-R intervals and blood pressure shift to higher frequencies during increased sympathetic outflow. METHODS: R-R intervals, beat-to-beat systolic blood pressure and muscle sympathetic nervous activity (MSNA) from the peroneus nerve were measured for 11 healthy males (age 34±6 years) during 5-min supine rest followed by 5-min isometric handgrip at the intensity of 20% of maximal voluntary contraction. The prevalent LF oscillation was determined by the frequency (Hz) at peak power within LF band (0.04-0.15 Hz) from R-R interval and systolic blood pressure power spectra. The MSNA burst frequency (bursts/min) was analyzed by standard methods. RESULTS: The mean R-R interval decreased (from 1129±197 to 939±108 ms, $p<0.001$) and MSNA increased (from 22±5 to 30±8 burst/min, $p=0.002$) during isometric handgrip as an evidences of increased sympathetic outflow. The prevalent LF oscillation shifted to higher frequencies in both R-R interval (from 0.081±0.014 to 0.097±0.011 Hz, $p<0.001$) and systolic blood pressure (from 0.070±0.017 to 0.094±0.013 Hz, $p=0.002$) during isometric handgrip. CONCLUSION: LF oscillation pattern of R-R interval and blood pressure is shifted to the higher frequencies during sympathetic activation caused by isometric handgrip. The frequency of spontaneous cardiovascular signals fluctuations may provide unique noninvasive information of sympathetic autonomic regulation.

1. Wichterle D. et al. Prevalent low-frequency oscillation of heart rate: novel predictor of mortality after myocardial infarction. Circulation 110(10): 1183-90, 2004.

THE EFFECT OF THE NECK MUSCLE RESPONSES TO SUDDEN FALL OF THE HEAD DURING VOLUNTARY- AND TVR-CONTRACTIONS IN MASSETER MUSCLE

Muro, M., Tadano, C., Kamibayashi, K., Seki, H., Shimoshikiryo, S., Oka, K., Yona, M., Naito, Y.

Toho University School of Medicine , Japan

Introduction

It has been demonstrated that stretch reflex in neck muscles play an important role in controlling head righting such as rapid head fall. In rapid head fall, the onset of EMG in sternocleidomastoid (SCM) occur earliest response by a vestibulo-collic reflex. However, it has been reported that the vestibula contribution gives an advantage over stretch reflexes alone and also assists in voluntary enhancement of reflex responses. These advantages could be caused by the activation of the masseter muscle because SCM is synergistic muscle in masticatiory function. The present study was undertaken to clarify the pattern of the reflex responses of the neck muscles to abrupt free fall of head during contractions in masseter muscle.

Methods

Eight healthy subjects participated in this experiment. Subjects were lying supine and well supported on a platform. The head extended beyond the edge of the platform in longitudinal alignment with the body and was supported by a head-platform at the occipital position. The head- platform was released a few times and could be performed manually by a hook. The release at random intervals dropped the head, which then fell freely until it hit a cushioned surface 20 cm from occipital position to the sufficient extended neck. Each drop was performed without the biting force and with the biting force (1kg, 3kg) in voluntary contractions and tonic vibration reflex (TVR) at mandibular tip. Head-acceleration and neck-displacement was measured by using an accelerometer and a goniometer mounted on the mandibular tip and rear neck position, respectively. Muscle activity (EMG) was recorded in the both SCM, masseter, and digastricus muscles. EMG responses of 5 trials were rectified and averaged. EMG latencies were measured from onset of head acceleration and neck displacement.

Results

In biting force of voluntary and TVR's contractions, EMG latency in SCM was about 19.3 ± 7.0 ms but short latency response (stretch reflex) was shorter than without biting force, and short latency in TVR was longer than with volunatary biting force. The EMG amplitudes in-

creased with biting force in both voluntary and TVR's contractions. However, EMG latency and short latency response in digastricus muscle showed the same changes as bite force in SCM. The mean latency between biting force in voluntary and TVR's contractions was 18.2 ± 5.6 ms and 23.4 ± 7.7 ms, respectively.

Discussion and Conclusion

The EMG onset latencies and amplitudes changed with contraction of masseter muscle in free head fall. The results of the synergistic study suggested that the neck muscle reflex was facilitated by readiness to execute head fall task and that the vestibula contribution by contraction in masseter could be an advantage in assisting voluntary enhancement of reflex responses.

References

Ito Y.et al.: J Physiol. 489 (3):911-6, 1995.

THE EFFECT OF TRAINING ON THE RESPONSE OF PLASMA VASCULAR ENDOTHELIAL GROWTH FACTOR TO EXERCISE IN PATIENTS WITH PERIPHERAL ARTERIAL DISEASE

Wood, R.E. 1, Stewart, I.B. 1, Sanderson, B. 2, Askew, C.D. 2+3, Walker, P.J. 2, Green, S. 4

1 Queensland Univeristy of Technology, 2 University of Queensland, 3 University of the Sunshine Coast, 4 University of New England, Australia

Introduction. Peripheral arterial disease (PAD) is a manifestation of atherosclerosis resulting in stenosis of one or more major arteries that supply blood to the lower extremity. During exercise, some patients with PAD experience intermittent claudication (IC), which is pain associated with inadequate blood flow. Exercise training can delay the onset of IC, and improve maximum walking time (MWT) and peak oxygen consumption (VO2peak). This has been shown to occur in the absence of an improvement in blood flow, indicating other factors at the level of the muscle may be involved. Angiogenesis, or expansion of the capillary network with exercise training is well-documented and serves to optimise oxygen transport from the blood to active skeletal muscle fibres. Vascular endothelial growth factor (VEGF), an endothelium-specific mitogen, appears to be necessary for this process. Purposes. The aims of this study were to examine the plasma VEGF response to acute exercise (Part A), and to establish whether exercise training altered this response (Part B) in patients with IC. Methods & Results. Plasma VEGF was determined using high-sensitivity ELISA on blood collected from patients (Part A, n=18) before and after an incremental maximum walking test (+20 and +60 minutes post-exercise). VEGF was present in the plasma of patients but was unchanged in response to acute exercise (rest: 41.39 (28.03-53.22), +20 minutes: 41.94 (29.34-53.94), +60 minutes: 37.22 (28.52-52.79) pg.mL-1, p=0.674, data are median and interquartile range). For Part B, patients were randomly assigned to a treatment group (TMT, n=7) or to a control group (CON, n=6). Three times per week, for six weeks, the TMT group completed intermittent high intensity (80-100% VO2peak) treadmill training. Each session comprised ten, two-minute bouts of exercise with two minutes of rest between each bout. All patients completed an incremental maximum walking test before and after the intervention, with blood samples drawn as for Part A. Training had no effect on plasma VEGF at rest (Week 0: 39.27 (20.57-45.27), Week 6: 27.68 (16.67-47.08) pg.mL-1, p=0.949). The response to acute exercise was also unchanged (p=0.199) despite a significant increase in MWT in the TMT group (15:15+/-8:53 to 20:06+/-8:20 minutes, p=0.009). Conclusions. The major findings of this study were that in patients with IC: 1) acute exercise had no effect on plasma VEGF, and 2) plasma VEGF at rest, and in response to acute exercise, was unaltered by training despite an approximate 45% increase in MWT.

COMPARATIVE PHYSIOLOGICAL ANALYSIS BETWEEN INTERVAL AND INTERMITTENT PROTOCOLS IN TREADMILL

Argemi, R., Ortega Gallo, P., Liotta, G.

Club Atletico Boca Juniors., Argentina

Objectives: The purpose of this study was to compare interval and intermittent protocols in treadmill of 4 youth soccer players from the Athletic Club Boca Juniors.

Methods: On different days with 2 weeks interval between tests. Four 17 year old soccer players perform, in random order, two different incremental tests with velocity increase every 3 minutes.

Both test begun with 8 km/h of velocity and increased 2 Km/h each 3 minute step.

In the Interval protocol (IDO) the player runs 90 seconds followed by 90 seconds of pause.

In the Intermittent protocol (ITE) they run 15 seconds followed by 15 seconds of pause.

We measured Oxygen uptake (VO2) (Sensormedics), Heart Rate (HR) (Polar Xtrainer), Respiratory Quotient (RQ) and blood lactate (Accusport).

Results: The average maximal velocity was 18.5 km/h and 22.25 km/h. in IDO and ITE (p=< 0.001). The average oxygen uptake in the 3 minute step had a correlation of 0.90 between protocols. The correlation of HR, lactate and Respiratory Volume was 0.99, 0.48 and 0.97. The average RQ for both tests was 1 and 0.91 to IDO and ITE. (p =<0,005).

Conclusion: During maximal intermittent exercise we had similar VO2 peak and HR, with less RQ and lactate than with the interval protocol and the final velocity reached was greater.

For the same VO2 and HR was less lactate and RQ, and more velocity during intermittent protocol; the exercise lipid substrate was 35 % of the total substrate, vs. great percentage of carbohydrate in the interval exercise.

PRE-MATCH MAXIMAL AEROBIC POWER IS SIGNIFICANTLY RELATED TO MATCH-PLAY WORK INTENSITY IN THE 2ND HALF OF PROFESSIONAL AND RECREATIONAL SOCCER MATCHES

Mann, M., Clark, N., Edwards, A.M.

Universal College of Learning, New Zealand

Introduction: The ability to attain a high maximal aerobic power has consistently been linked to success in soccer; primarily through the association between high distances covered during match-play and the sustained high-intensity effort over a 90-min game. The aim of this study was to compare continuous markers of match-play work efforts with baseline cardiopulmonary fitness to establish whether, or at what stage, this might become a significant factor to performance in both professional and recreational match settings. Methodology: Seven professional male soccer players and 8 recreationally active male players agreed to undertake baseline measurement of cardiopulmonary fitness on a motorized treadmill to volitional fatigue. Gaseous exchange was measured breath-by-breath at the mouth. Match-play heart rates were collected from both a professional soccer match and a recreational game. Heart rates were collected at 5-s

intervals using a Polar Heart Rate Team system and were batched into the mean of 5 min intervals for the purposes of statistical comparisons with baseline fitness variables. Results: The baseline measurements of maximal aerobic power were not related to match-play heart rates in the 1st half of either professional or recreational level match play. 1st half heart rates were significantly higher than those attained in the 2nd half of both matches (Rec: 159.2 ±3.9 bּmin-1 and 153.2 ± 3.3 bּmin-1, P<0.05; Pro: 164.4 ±4.1 bּmin-1 and 159.1 ±2.9 bּmin-1). In both matches, baseline cardiopulmonary fitness become a significant in the latter stages of match-play. In Rec, there were significant associations between maximal aerobic power and the average heart rate of 80-85 min (R2 = 0.46; P<0.05) and also with the average heart rate of 90-95 min (R2 = 0.50; P<0.05). In Pro, baseline fitness correlated with average match-play heart rate at 90-95 min (R2 = 0.55; P<0.05) and with the 2nd half average (R2 = 0.69; P<0.01) but were not significantly related with other match-play heart rates. Conclusion: The significant associations between baseline maximal aerobic power and 2nd half heart rates of both professional and recreational soccer match-play suggest that cardiopulmonary fitness is only of significant importance during the latter stages of a game when fatigue is most prevalent on performance. This observation supports earlier work demonstrating significant reductions in 2nd half distances covered, with the difference particularly large in players of low level fitness. The contribution of skill, team tactics, match conditions and importance make the identification of limiting factors difficult to quantify; however, maximal aerobic power appears to exert a significant influence on performance.

HOW DO REPEATED ACUPUNCTURE-SHIATSU TREATMENTS INFLUENCE MUSCULAR STRENGTH?

Tirelli, S., Perotta, B., Trachelio, C., Casolo, F., Rodano, R., Preatoni, E.

Università Cattolica del Sacro Cuore, Milano, Italy

Introduction

Modern sport science looks at the athlete's performance as the outcome of many physiological, psychological and energetic factors taken as a whole [1,2,3]. Some authors suggest that Chinese and Japanese medicine can be successfully applied to sport [3,4,6,7]. Quantitative clues on the effect of shiatsu treatments have been found [7], but, the attempts to scientifically prove the benefits of Shiatsu are still few. This work tries to assess the effectiveness of digital pressure stimulation on acupuncture points by evaluating its influence on muscular strength after repeated treatments. Isometric tests were used.

Methods

12 healthy female basketball players (29.5±2.2 y; 64.7±10.7 Kg; 173.2±3.7cm) were randomly divided in two homogeneous groups (A and B). A double blind approach with cross-over was used: A underwent shiatsu treatments [5,7] while B was subjected to sham-interventions. Each athlete was submitted to 5 consecutive weeks of treatments, one treatment every week. After a 2-weeks wash out, the groups were crossed over and the same procedure was repeated: this time A underwent sham-interventions, while B received shiatsu treatments. Each subject's isometric strength level was measured (knee flex-extension), before the first shiatsu/sham treatment and after the last one, with an isokinetic machine (REV9000,Technogym). Peak moments and integrals of moments versus time were estimated. All the subjects were familiar with the testing protocol to avoid learning effects. A non parametrical within-groups test (Wilcoxon) was used.

Results

The Wilcoxon-test results always showed, in case of real treatments, a high significative increase (p<0,01) of both peak knee flex-extension moment and moment-time area. In contrast, sham-intervention variables kept stationary or showed a slight decrease, significative just for extension with knee angle at 40° and 45°.

Discussion/Conclusion

The reported results suggested a positive effect of repeated shiatsu treatments on isometric muscular strength, both in its maximal expression (peak moment) and in moment-time area. This conclusion is supported by control group trends and confirms what previously found about single treatments outcomes. Therefore further investigations are encouraged: other aspects of muscular strength or other factors influencing sport performance should be studied.

References

[1] Muzio M (2004). Sport: flow e prestazione eccellente, Franco Angeli ,Milano, Italy

[2] Garratt T (1999). Sporting Excellence, Crown House Publishing, Carmarthen, UK

[3] Requena Y (1982). Agopuntura e psicologia, IPSA, Paris, France

[4] Perini (2002). Agopuntura e T.C. nello sport, Ambrosiana, Milano, Italy

[5] Maciocia G (1997). I fondamenti della medicina tradizionale cinese, CEA, Milano, Italy

[6] Tirelli S (2005).Tecniche Complementari Sportive, Libreria dello Sport, Milano, Italy

[7] Tirelli S et al. (2005). Do Acupuncture-Shiatsu Treatments Influence Muscular Strength?, 10th Congress of ECSS, Belgrade, Serbia.

CAN CENTRAL LIMITATION EXPLAIN DEPRECIATED ENDURANCE PERFORMANCE IN HYPOXIA ?

Millet, G.Y., Aubert, D., Favier, F., Benoit, H.

University Jean Monnet Saint-Etienne, France

Endurance performance is worsened in acute hypoxia (HYP) without any effect on muscle contractile properties. By opposition to the role of oxygen delivery, the central governor model suggests that this depreciated performance in HYP is due to motor unit recruitment modulation, i.e. to central limitation. To test this hypothesis, 11 healthy men performed four intermittent isometric all-out tests (Tlim) on separate days. The four conditions were two environmental conditions (HYP : FIO2 = 11% vs. normoxia, NORM), each of them being performed with (W) and without (WO) the application of a pressure cuff (blown up at 250 mmHg) at the top of the thigh to prevent knee extensors (KE) oxygenation. In particular, we hypothesized that central limitation would be evidenced if the number of repetitions is lower in HYP-W than in NORM-W condition. The Tlim consisted in repetitions of 10 s isometric knee extension at 50% of maximal voluntary contraction followed by a 10 s rest until exhaustion. Single maximal electrical stimulations were delivered to the femoral nerve with a constant current stimulator at the 5th second of each 10 s rest. KE evoked force (peak twitch, Pt) and EMG (M-wave) were measured. EMG of rectus femoris, vastus lateralis, vastus medialis and biceps femoris were also continuously recorded during Tlim. The root mean square (RMS, expressed in % RMS during MVC) and median frequency (MF) values were calculated during each contraction over a 2 s period at the beginning of the 10 s contraction. These analyses were done for the three knee extensors explored here and their values were averaged (RMS KE, MF KE).

The oxygen saturation was reduced during HYP (84.7 ± 3.8% vs 97.3 ± 0.8%, P < 0.001). The number of repetition was 21.5 ± 8.7, 15.6 ± 4.5, 10.0 ± 3.2 and 8.5 ± 2.8 for NORM-WO, HYP-WO, NORM-W and HYP-W, respectively. For this variable, the difference between NORM-W and HYP-W was significant (P < 0.05). During Tlim, RMS KE increased significantly between the first and the last repetition for the four

conditions and the value reached at the end depended on the number of repetitions. The M-wave amplitude did not change significantly in any condition. On the contrary, MF KE and Pt decreased significantly but their values were not significantly different among the four conditions at the last repetition. Pt values changed from 15.1 ± 3.4 to 7.4 ± 3.6 kg for NORM-WO, from 16.1 ± 3.7 to 6.6 ± 3.0 kg for NORM-W, from 15.9 ± 3.8 to 7.6 ± 3.0 kg for HYP-WO and from 16.6 ± 2.8 to 7.4 ± 3.0 kg for HYP-W.
These results show that the exercise was ended at a given "peripheral state" but it is not known whether this is due to peripheral muscular limits or to central limitation due to neural afferences. However, the smaller number of repetitions in HYP-W than in NORM-W suggest that a direct central limitation due to hypoxia occurs. Because statistical significance was hardly reached for this fundamental variable, additional subjects will be incorporated to the study in the near future.

EFFECT OF PRIOR INCREMENTAL CYCLING ON VO2 KINETICS DURING MODERATE AND HEAVY INTENSITY CYCLING EXERCISE

Stasiulis, A., Dubininkaite, L.

Lithuanian Academy of Physical Education, Lithuania

The purpose of the present study was to examine the changes in VO2 kinetics during constant work rate (CWR) cycling with moderate and heavy intensity after incremental cycling exercise.
Methods
Fourteen healthy, physically active male subjects (age 21.1 (2.0) yr, height 181.8 (7.8) cm, and weight 78.9 (9.3) kg, VO2max 52.2 (5.0) ml kg-1 min-1, gas exchange threshold (GET) 53.0 (6.1)% of VO2max) volunteered to participate in this study. Subjects visited the laboratory on two occasions over a 1-wk period. During the first visit an incremental exercise (IE) test (work rate from 70 W was increased by 21 W every min, 70 rpm) until limit of tolerance was performed on a mechanically braked cycle ergometer (Monark 834E) in order to determine the maximal oxygen uptake (VO2max), GET and the intensity of CWR exercise. After the IE the subjects were divided into two groups: low intensity (LI) and high intensity (HI). In the second examination each subject performed two CWR exercises (6 min cycling preceded by 3 min of unloaded cycling) interspaced with IE. The time intervals of passive rest between CWR exercise, IE and repeated CWR exercise were 10 min. The intensity of CWR exercise in the LI and HI groups was set at approximately 45% of VO2max and 70% of VO2max, respectively. Pulmonary gas exchange was measured breath-by-breath throughout all tests. The VO2 response during low intensity CWR was fitted the mono-exponential function and that during high intensity CWR exercise was fitted the bi-exponential function. First 20 s were always removed from the analysis. The slow component of VO2 was calculated as the difference between the end exercise VO2 and the 3rd min VO2.
Results
The intensity of CWR exercise in LI and HI groups averaged 115.1 (17.2) and 215.7 (43.5) W or 48.8 (3.06) and 69.4 (8.58)% of VO2max, respectively. The mean blood lactate concentration just before the start of repetitive CWR exercise was 6.01 (1.1) and 6.04 (1.6) mmol l-1 in LI and HI groups, respectively, indicating the presence of a residual metabolic acidosis. The absolute VO2 values were significantly higher at rest, during unloaded cycling, at third and sixth min of repetitive CWR exercise in both groups. Prior IE had no effect on the amplitude and time constant of the VO2 response in LI group. Similarly, the phase II VO2 kinetics did not change during repetitive CWR exercise in HI group. The time constant of VO2 kinetics in phase III was significantly decreased, both the amplitude of phase III response and the VO2 slow component showed a tendency of decrease in this group.
Conclusions
Prior incremental cycling exercise had no effect on the fast component of VO2 kinetics neither during moderate nor during heavy intensity cycling exercise, whereas the slow component of the VO2 kinetics during heavy intensity exercise was reduced under these conditions. The absolute VO2 was higher both during low and high intensity CWR exercises performed in the presence of metabolic acidosis.

CARDIAC EFFECTS OF PHYSICAL ACTIVITY IN ADULT SUBJECTS

Pavlik, G., Kneffel, Z., Horváth, P., Németh, H., Sidó, Z., Frenkl, R.

Semmelweis University, Facuty of P.E. and Sport Sciences, Hungary

Both in the endurance performance and in the primer prevention it is a very important question how do characteristic features of the athlete's heart develop if regular physical training is started not in the childhood but in the adult age.
Echocardiographically measured data (2D-guided M-mode and Doppler-recordings) of subjects who have began regular physical training in their adult age (later than 18 yr., group A) were compared with data of athletes started their sports activity in their younger age (group Y) and with non-athletic healthy subjects (N) (altogether 1050 individuals).
Characteristics of the left ventricular hypertrophy (wall thickness/BSA½, muscle mass /BSA3/2) and training-bradycardia developed something less in the A than in the Y group. The effect of regular physical training to diminish age-related impairment of diastolic function manifested stronger in the Y group, although the difference between the two athletic groups decreased in the oldest age.
In females differences between the A and Y groups were higher in all parameters than in the males.
Our results indicate that regular physical training started in the young age develop more markedly the characteristics of the athlete's heart, but to begin regular physical activity in the adult age is also useful.

PERIPHERAL SYMPATHETIC OUTFLOW CORRELATES WITH THE RESPONSE TO ENDURANCE TRAINING

Hautala, A.J., Kiviniemi, A.M., Mäkikallio, T.H., Tiinanen, S., Seppänen, T., Huikuri, H.V., Tulppo, M.P.

Merikoski Rehabilitation and Research Center, Oulu, Finland

Individual responses to endurance training vary from almost none to 40% increase in endurance performance in healthy subjects, but the reasons for differences in training response are not well known. We recently showed that cardiovascular autonomic function, in terms of cardiac vagal activity, is an important determinant of the response to endurance training in sedentary subjects (1). In the present study, we assessed whether variability in peripheral sympathetic outflow has a role in the training response. METHODS: The study population included 14 male club level runners (age 33+/-5 years and VO2max 56+/-2 ml/kg/min). The baseline measurements were performed after two weeks of wash out (non-running) period. The training period was 4 weeks, including 6 sessions a week at an intensity of 70-80% of the maximum heart rate for 40 min/session. Muscle sympathetic nervous activity (MSNA; microneurography) from the peroneal nerve was assessed at 5 min supine rest before the training period. Time to exhaustion (TE) was measured at maximal treadmill test

before, after 2 weeks and after 4 weeks of training. RESULTS: After the first 2 weeks of training, TE increased by 4+/-5% (from 940+/-109 to 975+/-85 seconds, P=0.005). During the last 2 weeks of training, TE increased further by 6+/-3% (from 975+/-85 to 1030+/-96 seconds, P<0.0001). Baseline MSNA (bursts/min and area under the curve) did not associate with the change in TE after the first two weeks of training (P=ns for both), but had a strong negative correlation with the change in TE (r= -0.67, P=0.008 and r= -0.61, P=0.020, respectively) during the last 2 weeks of training. CONCLUSION: Baseline muscle sympathetic nervous activity correlates with the response to endurance training among the healthy males. A low peripheral sympathetic activity at baseline condition is associated with a better improvement in running performance after a short-term intensive training period.

(1) Hautala AJ, Makikallio TH, Kiviniemi A, Laukkanen RT, Nissila S, Huikuri HV, Tulppo MP (2003) Cardiovascular autonomic function correlates with the response to aerobic training in healthy sedentary subjects. Am J Physiol Heart Circ Physiol; 285: H1747-H1752.

EFFECT OF REPETITIVE EXERCISE ON NITRIC OXIDE EMANATING FROM HUMAN SKIN

Itoh, H., Ohkuwa, T., Yamazaki, Y., Goto, N., Washiya, T., Takakusagi, A., Matsue, S., Shimada, K., Takahashi, H., Tsuda, T.

Nagoya Institute of Technology, Japan

Introduction

Nitric oxide (NO) is the most important endothelium-derived relaxing factor, which plays a pivotal role in modulating smooth muscle tone in the human conductance and resistance vessels (Moncada & Higgs 2006). Jungersten et al. (Jungersten et al. 1997) have suggested that NO is increased with increased cyclic wall stress associated with increased pulsatile blood flow during acute exercise. Recently, some volatile gases emanating from human skin have been detected (Nose et al. 2005). NO is also a gas, however, no one has confirmed the changes in NO concentration from human skin. Therefore, we examined whether NO gas would change or not after exercise.

Methods

Ten healthy male students (21.6 ± 1.8 years; mean ± SD) volunteered as the subjects, and none of them were smokers. The subjects performed the repetitive wrist flexion-extension exercise at 25% maximal voluntary contraction at a pace of a time per second until voluntary exhaustion. The skin-gas samples were obtained by covering the non-dominant hand for 3min with a polyfluorovinyl bag (Tedlar bag; GLScience, Tokyo, Japan) in which pure nitrogen gas was introduced, and collected in a sampling bag at rest and after exercise (2-5, 7-10, 12-15, 17-20, 22-25 min). The concentration of NO in the skin-gas was measured by a chemiluminescence analyzer (Hamamatsu Photonics, Hamamatsu, Japan).

Results

The mean (± SD) time to exhaustion of the repetitive wrist flexion-extension exercise for the subjects was 160.0 ± 51.6 sec. The skin-gas NO concentrations significantly increased after the exercise compared to the resting values, and significantly higher levels were remained throughout the recovery period ($p<0.01$). The mean peak NO concentrations of each subject were about 1.8-fold from the resting values (44.8 ± 19.9 to 79.8 ± 42.7, $p<0.05$).

Discussion/Conclusion

It has been well known that forearm exercise increases local blood flow (Green, 2005), and that an increase in blood flow stimulates vascular endothelial cells and advances the production of NO (Jungersten et al. 1997). The changes in the skin-gas NO concentrations observed in this study have suggest that the repetitive wrist flexion-extension stimulate endothelial NO production by increases in shear stress during the exercise. Furthermore, sympathetic nervous activity, circulating hormones, exercised muscle-derived metabolites may also affect the production of NO during and after the repetitive exercise. We conclude that the repetitive low intensity exercise increases NO concentrations emanating from human skin.

References

Moncada & Higgs (2006) Br J Pharmacol. 147(Suppl 1): S193-201.

Jungersten et al. (1997) J Appl Physiol. 82(3): 760-4.

Nose et al. (2005) Anal Sci. 21(12): 1471-4.

Green et al. (2005) J Physiol. 562(Pt 2): 617-28.

Acknowledgements

The authors wish to thank Masumi Tachino, Akifumi Kamiya, and Yoshihito Suzuki at Hamamatsu Photonics K.K. for providing us with the chemiluminescence analyzer.

EFFECTS OF A 12-WEEK EXERCISE PROGRAMME ON HEART RATE VARIABILITY IN PATIENTS WITH INTERMITTENT CLAUDICATION

Leicht, A., Crowther, R., Spinks, W., Sangla, K., Quigley, F., Golledge, J.

James Cook University, Australia

Several studies have demonstrated significant improvements in exercise performance following regular aerobic exercise in peripheral vascular disease patients with intermittent claudication (IC). However, mechanisms for these improvements have not been well established. In healthy and heart disease populations, regular exercise has been reported to increase the neural control of heart rate (i.e. heart rate variability, HRV) thereby reducing the risk of further cardiac events. To our knowledge no such studies of HRV and regular exercise with IC patients have been conducted. Therefore, the current study examined the effects of a 12-week supervised exercise programme on resting HRV in IC patients. Seventeen IC patients were randomly allocated to either regular exercise of 3 days per week, 20-40 minutes per day (EX, n=9) or no regular, supervised exercise (NEX, n=8) while another 7 age-matched healthy adults served as controls (CON). Time and frequency domain measures of HRV and cardiorespiratory measures were determined during rest in the supine (15 mins) and standing (5 mins) position. Following orthostatic challenge (i.e. standing), patients undertook a graded exercise treadmill test to determine pain free walking time (PFWT), maximal walking time (MWT) and peak cardiorespiratory measures including VO2peak. Variables were obtained prior to and following the 12-week period and analysed via repeated measures ANOVA. Compared with CON, EX patients exhibited significantly greater resting HR (75.7 vs 60.8 bpm, $P<0.05$) and significantly lower resting HRV (i.e. various time and frequency domain measures). Orthostatic challenge significantly increased HR and most respiratory measures, while reducing HRV similarly for all groups prior to and following the 12-week period. HRV was not significantly modified over the 12-weeks for any group. There were no significant changes in peak cardiorespiratory measures over the 12-week period for any group although CON exhibited significantly greater VO2peak compared with EX and NEX (37.6 vs 21.3 and 21.1 ml.kg-1.min-1, $P<0.001$). Despite these similar peak exercise measures, MWT was increased over time for all groups, although to a greater extent for EX compared with NEX and CON

(130% vs 46% vs 12%, P=0.11), while PFWT was increased similarly for EX and NEX (132% vs 60%, P=0.20). These preliminary results indicate that regular, supervised exercise training increases walking performance while maintaining peak cardiorespiratory measures and resting HRV. Peripheral factors rather than central neural adaptations appear to contribute to the increased walking performance of IC patients following regular supervised exercise.

EFFECTS OF FOOT IMMERSION IN COLD WATER ON HEART RATE, BLOOD PRESSURE AND CARDIAC AUTONOMIC NERVOUS SYSTEM MODULATION

Nishimura, M., Shigeno, M., Kato, T., Onodera, S.

Tottori University, Japan

The purpose of this study was to make clear the effects of foot immersion in cold water on heart rate, blood pressure, rectal temperature, mean skin temperature and cardiac autonomic nervous system modulation in male. Seven males served as subjects. Descriptive data (means ± SE) are as follows: age 22.0 ± 1.2 yeas, height 171.8 ± 6.4 cm, body weight 63.4 ± 6.0kg and body fat 12.6 ± 3.2 %. All subjects gave informed consent before participating. All subjects wore only swimming trunks during the experiment. Subjects rested on chair for 20 minutes. The final 5 minutes of rest (BASE; baseline period) followed by foot immersion and recovery for 15 and 5 minutes, respectively. The subjects performed foot immersion at 5, 10 and 15 degrees Celsius at random, during different days, but always at the same time. Experiments were performed from 1 p.m. to 5 p.m. All subjects were instructed to breath gently in time with a metronome signal set at 15 breaths/min (0.25Hz). Heart rate was derived by calculating the number of R waves of ECG. Blood pressure and rectal temperature (Tre) were measured every minute. Skin temperatures were obtained from three sites by using dermotherm every minute. The magnitude of changes in rectal temperature (ΔTre) during the immersion and recovery period was calculated as immersion or recovery minus BASE. Analysis of heart rate variability (HRV) was performed off-line on a personal computer. Cardiac autonomic nervous system modulation was estimated with the power spectrum analysis of heart rate variability (HRV) by using the Fast Fourier Transformation (FFT). The areas of the two frequency components of HRV were measured by integrating low frequency (LF; 0.04- 0.15 Hz) and high frequency (HF; 0.15-0.40Hz). HF was used as an indicator of cardiac vagal modulation and was showed logarithmically (LogHF). Heart rate during WT5 and WT10 increased significantly during foot immersion compared with BASE value ($p<0.05$). Systolic blood pressure during WT5 and WT10 increased significantly during foot immersion compared with BASE value ($p<0.05$). Mean skin temperatures and rectal temperature in all conditions didn't change compared with BASE value. LogHF during in all conditions didn't change compared with BASE value.

It is concluded that foot immersion into the cold water range from 5 to 10 degrees Celsius for 15 minutes dose not affect Cardiac autonomic nervous system modulation, rectal temperature and mean skin temperature, although it cools the immersion part.

1) Hisataka SAKAKIBARA, Jin LUO, San-Kuan ZHU, Mamoru HIRATA and Mitsuru ABE: Autonomic Nervous Activity during Hand Immersion in Cold Water in Patients with Vibration-Induced White Finger, Industrial Health, 40(3), 254-259, 2002.

AEROBIC FITNESS PROFILE OF FUTSAL PLAYERS OF DIFFERENT COMPETITIVE LEVEL: A PILOT DESCRIPTIVE-STUDY

Barbero-Álvarez, J.C., D'Ottavio, S., Castagna, C.

Granada University and Tor Vergata University , Spain

Futsal or 5-a-side indoor soccer is a popular team sport played all over the world. However despite its popularity only limited scientific literature is available regarding the physiological demands of the game and players' fitness (Barbero et al., 2004a; Barbero Alvarez et al., 2004b). The first aim of this descriptive research-design was to examine the aerobic-fitness (Pate and Kriska 1984) level of players of different competitive levels in order to study whether aerobic fitness is a discriminative variable in Futsal success. Secondly to establish normative data of aerobic fitness to be used to guide futsal coaches and fitness trainers, in designing specific training interventions. Participants were 24 male futsal players randomly chosen from three teams of different competitive levels: A Spanish professional top ranked second division team (PST n=11, 22.8±1.5 years, weight 75.2±6.2 kg, height 178±7.4 cm), a youth Spanish team (YST n=7, 17.1±1.1 years, weight 65.9±8.9 kg, height 171±7.3 cm) and a semi-professional Italian top ranked Third division team IT (n=6, age 24.5±2.2 years, weight 69.6±6.8 kg, height 175±4.9 cm). Maximal oxygen uptake (VO2max), Ventilatory Threshold (VT) and Running Economy (RE, VO2 at 8 km h-1) were assessed using a progressive protocol (1 km h-1 min-1speed increment until exhaustion) on a level motorized-treadmill. Gas analysis were performed using a portable gas analyzer (K4b2, COSMED, Rome, Italy). Between groups comparisons were performed using the Kruskal-Wallis test with post-hoc multiple comparisons. PST, YST and IT VO2max was 62.9± 5.34, 68.6 ±6.2 and 55.0±7.1 ml kg-1min-1 respectively (YST vs IT, $p<0.05$). RE was 34.1± 2.7, 38 ±3.1 and 32.4± 2.7 for PST, YST and IT respectively (YST vs IT, $p<0.05$). PST, YST and IT attained VT at 70.5± 2.7, 67.9 ±5.2 and 71.3± 5.2% of VO2max respectively. Results show that well-trained professional futsal players possess a VO2max well above 60 ml kg-1 min-1. Specifically adults players (PST plus IT) in order to successfully play competitive futsal seems to require a VO2max around 60 ml kg-1min-1 (59.33±7 ml kg-1min-1) whatever the level is. Percentage of VO2max at VT seems not to be related to competitive level in Futsal. In light of this study results futsal coaches and fitness trainers once promoted a VO2max level around 60 ml kg-1 min-1 should implement training programs oriented to other components of futsal performance.

References

Barbero JC, Soto VM and Granda J. Análisis de la frecuencia cardíaca durante la competición en jugadores profesionales de fútbol sala. Apunts de educación física. 2004; 77: 71-78.

Barbero Alvarez J, Soto Hermoso V, Granda Vera J. Effort profiling during indoor soccer competition. Jounal of Sports Sciences. 2004; 22: 500-501

Pate RR, Kriska A. Physiological basis of the sex difference in cardiorespiratory endurance. Sports Med. 1984; 1(2): 87-98.

PERFORMANCE ON REPEATED MAXIMAL SHORT SPRINT CYCLING: PASSIVE VS ACTIVE RECOVERY

Matsushigue, K., Hoinaski, L.F., Schneck, H.C.

Pontifical Catholic University of Parana, Curitiba, Brazil

The purpose of this study was to verify the effect of active recovery on peak and mean power during an intermittent exercise of short effort periods.

Fifteen male subjects gave their informed consent prior to participation in the study. Subjects were physically active but not exercising on a regular basis or a similar sports activity. Each subject performed two intermittent exercises (IT) on two occasions and all subjects were

tested the second time at least 48 hours after the prior test. The format of the IT involved ten all-out 10-s cycling sprints interspersed with 30 seconds of active (A-IT) or passive recovery (P-IT). The sequence of the tests was randomly determined. The sprint bouts were carried out on a friction-braked cycle ergometer, loaded at 0.075 kp per kg of body mass and separated by 30-s of active recovery at a workrate of 1 kp and at a frequency of 60 rpm (A-IT) or by 30-s of rest on the cycle bench (P-IT). Flywheel rotations were recorded each second by an eletronic revolution counter in order to obtain peak (PP) and mean power output (MP) of each of the ten bouts. For each subject a linear regression was fitted over the ten PP points and the fatigue index (FI) was determined by calculating the difference between the preditcted values of the 10th PP and the first PP. The angular coefficient (AC) was adopted as decrease rate of the peak power output (AC-PP) and of the mean power (AC-MP) . A two-way Anova for repeated measures was used to compare bouts and recoveries and Student t-tests were used to compare passive and active recovery. Where significant differences were found, Tukey post hoc tests were employed to determine which means were different. Statistical significance was accepted at the 0.05 level. All results are presented as means (standard deviation).

There were no significant differences between passive and active recovery (P-IT vs A-IT) in peak power (675.8 (87,2) vs 692.3 (92.9) W), mean power (544.9 (79.9) vs 494.4 (140.1) W), FI (236.7 (64.7) vs 225.2 (94.6) W), or AC-PP (-26.3 (7.2) vs -25.0 (10.5) Watts per bout). The AC-MP in passive recovery (-25.7 (6.8) W per bout) was signicantly higher (p=0.02) than in active recovery (-25.0 (10.5) W per bout). However, this characteristcs could be due to a not perfect fit over the points, since there always was a significantly lower mean power output during the second sprint in A-IT. The coefficient of determination (R2) was 0.8 (0.1) to linear regression on peak power of P-IT and A-IT and on mean power of P-IT and 0.6 (0.2) on mean power of A-IT. There were no significant differences in peak or mean power among the 6th to 10th bouts in P-IT and A-IT tests.

During intermittent exercises of short bouts of high-intensity effort periods the active recovery seems thus not to benefit the performance.

ANTROPOMETRIC AND FUNCTIONAL CARACTERISTICS OF BASKETBALL PLAYERS DURING DISTINCT PHASES OF TRAINING

Djuric, I.

School of Medicine Belgrade, Serbia and Montenegro

The aim of this study was to determine antropometric (body weight ,body mass index) and functional caracteristics (VO2max,HRmax) of Serbian proffesional club basketball playersduring 3 distinct phases of their training.17 male basketball players (age 23+/-5)were tested.Players who wer enot available for all evalations sessions wre exluded.Phase 1 took place at the end of season, phase 2 tested fitness and aerobic capacity before preseason practice began, and phase 3 occured after preseason practice.Firstly morfological indices of participants wre determinated.Standing height was measured ti the nearest 1.0 cm using a stadiometar. Body weight was measured to the nearest 0.1 kg using digital scale. Basketball players performed an incremental ramp protocol on treadmill. OO2max anh HRmax wre measured directly. The highest mean estimated body weight (93.77+/-10.86 kg)and body mass index(24.87+/-4.86 m2/kg0wre measuredat the end of preseason practices,and the lowest values for body weight (92.75+/-10.94 kg)were found at the end of the season. Statistical differences were found in body weight between phase 1 and phase 2 ($p<0.05$). The mean estimated VO2max were the lowest (49.30+/-2.78 ml/kg/min) at the begining of preseason practice and the hightest at the end of preseason practice (54.45+/-6.23 mil/kg/min). Comparing the results in phase 1 and phase 2 it is found statistical differences between them ($p<0.05$). It is hoped that these informations will be very helpful for both doctors and trainers in tracing basketball players' health state and physical condition.

EFFECTS OF PREVIOUS AEROBIC EXERCISE PERFORMED AT DIFFERENT PEDAL CADENCES ON MUSCULAR STRENGTH

Greco, C.C., Ruas, V.D., Figueira, T.R., Denadai, B.S.

Human Performance Laboratory, Brazil

Some studies had demonstrated that previous aerobic exercise can compromise subsequent strength (Leveritt and Abernethy, 1999; Sporer and Wenger, 2003), but the mechanisms which can explain this influence are not well identified. In cycling, pedal cadence can influence metabolic (Ahlquist et al., 1992) and neuromuscular (Farina et al., 2004) responses, which can be an important factor on the subsequent strength performance. The objective of this study was to verify the effects of the aerobic exercise performed at different pedal cadences on the muscular strength. Seven active males (21.86 + 3.18 yr., 74.86 + 9.42 kg, 179.28 + 4.92 cm, 13.30 + 2,85 % of body fat), performed in different days and in a random order, the conditions control (C), experimental at 50 rev.min-1 (R50) and experimental at 100 rev.min-1 (R100). At C condition it was performed 3 series of maximal repetitions in the leg-press 45 degrees, with workload corresponding to 10 maximal repetitions. In the conditions R50 and R100 theses series were performed after an aerobic exercise of 30 min duration at the intensity corresponding to the anaerobic threshold (AnT) (3.5 mM of blood lactate) with pedal cadences of 50 and 100 rev.min-1. During constant workload exercise, heart rate (160.21 + 6.77 and 162.21 + 11.26 bpm) and blood lactate (4.02 + 1.12 and 4.34 + 0.88 mM) were not significant different at conditions R50 and R100, respectively. There was a significant reduction in the number of repetitions performed at R100 (23.42 + 5.56) in relation to C conditions (29.85 + 0.37). At R50 (29.14 + 2.26) the number of repetitions performed was similar to C condition. Thus, the effects of aerobic exercise performed in cycling at similar physiological conditions (heart rate and blood lactate) on subsequent strength, can be dependent on the pedal cadence, probably in function of different muscular contractions velocities.

References

1. Ahlquist LE, Bassett DR Jr, Sufit R, Nagle, FJ, Thomas DP. The effect of pedaling frequency on glycogen depletion rates in type I and type II quadriceps muscle fibers during submaximal cycling exercise. Eur J Appl Physiol Occup Physiol 65:360-364, 1992

2. Farina D, Macaluso A, Ferguson RA, De Vito G. Effect of power, pedal rate, and force on average muscle fiber conduction velocity during cycling. J Appl Physiol 97: 2035-2041, 2004

3. Leveritt M, Abernethy PJ. Acute effects of high-intensity endurance exercise on subsequent resistance activity. J Strength Cond Res 13:47-51, 1999

4. Sporer BC, Wenger HA. Effects of aerobic exercise on strength performance following various periods of recovery. J Strength Cond Res 17:638-644, 2003.

LUNG FUNCTION IN TUNISIAN CHILDREN: RELATIONSHIP WITH PUBERTAL STATUS

Trabelsi, Y., Tabka, Z., Gharbi, N., Richalet, J.P., Guenard, H., Zbidi, A., Buvry, A.

Sousse Faculty of Medicine, Tunisia

Puberty is one of the most important steps in life, involving dramatic morphological and physiological changes. In Tunisian children, nothing is known about growth of ventilatory function and pubertal stage.

The purpose of this study was to identify the relationship between lung function and pubertal stage in Tunisian children using anthropometric parameters.

Pulmonary function parameters were measured with a Minato portable spirometer in 684 healthy Tunisian children (351 males and 333 females) from 8 to 16 years old. Pubertal status was assessed for males and females according to the Tanner Method.

A large variation was found in the distribution of children's age and height by pubertal stages in both sexes. Height increased with age and pubertal stage in males and females. Our results also show a significant increase in parameters of lung function (FVC, FEV1, PEF, MEF 50 and MMEF 25-75) with pubertal stage in Tunisian children. Females enter and achieve each stage of puberty earlier than boys.

Parameters of pulmonary function for healthy Tunisian school children increased proportionally with age, height and pubertal stage. The present study confirms that, in females, lung growth is of short duration and occurs earlier than males in the pubertal process.

These data are of importance to follow the children suffered from chronic pulmonary diseases during the puberty.

Poster presentation (PP)

PP2-02 Training and Testing 1-7 - "Exhibition Hall"

DISCRIMINATIVE BASKETBALL GAME-STATISTICS BETWEEN WINING AND LOSING TEAMS FROM THE EUROBASKET 2005' (BELGRADE)

Sampaio, J., Lorenzo, A., Gómez, M., Ibáñez, S., Refoyo, I.

University of Trás-os-Montes e Alto Douro, Portugal

The aim of this work was to identify the discriminative power of basketball game-related statistics between the winning and the losing teams from the 2005 Eurobasket championship. Also, we contrasted the relationships between game-related statistics in winning teams and in losing teams. Data was gathered for all 31 games from the Male Senior European Championship held in Belgrade (2005). All game-related statistics were normalized to 100 ball possessions and they were later analysed with a descriptive discriminant function. The relations between the game-related statistics were investigated through Pearson product-moment correlation coefficient. From the discriminant function results we have identified two powerful game-related statistics: missed 3 point shoots and assists. The remaining game-related statistics were not very relevant in order to discriminate between winning and losing teams. We have identified common correlations between game-related statistics in wining and losing teams (missed 2 point field goals and offensive rebounds; made 3 point field goals and assists; Defensive rebounds and steals) and also specific correlations to winning (made 3 point field goals and missed free throws; made free throws and fouls) or to losing teams (made 3 point field goals and turnovers).

RESISTANCE TRAINING EFFECTS ON PARAMETERS OF AEROBIC AND ANAEROBIC CAPACITY

Marsic, T., Sentija, D., Dizdar, D.

Faculty of Kinesiology, University of Zagreb, Croatia

Background:

Resistance training has several potential benefits on health and performance. Recent research has shown contradictory results on the inluence of strength & power training on parameters of aerobic capacity. The purpose of this study was to examine the effects of a 12 week resistance training program on parameters of anaerobic and aerobic endurance.

Methods:

Eleven male PE students (24±1.5 y, 75.8±6.4 kg) underwent a resistance (Olympic weight lifting) training program for 12 weeks, 3 times per week. Basic and specific exercises were used to develop weight lifting technique and maximal strength and power. Training intensity and volume were determined according to the individual capacity of the subjects. During the training period, they were not engaged in any other formal exercise or training. Pre- and posttraining the subjects performed an incremental running test on a treadmill (with 1km/h increments per minute, at a constant inclination of 1.5%) to volitional exhaustion, in order to determine the running speed at the ventilatory anaerobic threshold (AnT), maximal oxygen uptake (VO2max), maximal running speed (Vmax) and the distance run above AnT to the point of exhaustion (AWCd), as a measure of anaerobic capacity. Student's paired t-test was used to compare the results obtained before and after the training period.

Results:

After the training period a small, but significant increase in VO2max was found (56.4±5.3 vs. 54.9±5.4 ml/kg, $p<.05$), that was related to a small, but also significant increase in body mass (76.6±6.4 vs. 75.8±6.4 kg). The subjects achieved a lower AnT (11.9±1.7 km/h vs. 12.3±2.0 km/h), and a higher Vmax (17.1±1.8 km/h vs. 16.7±1.7 km/h) after training, but the differences did not reach statistcal significance; however, the distance run (AWCd) above the anaerobic threshold up to maximal running speed at exhaustion, was significantly greater after strength and power training (285±98 m vs. 212±104 m, $p<.01$).

Conclusion:

The results of this study indicate that resistance training can lead to a small, but significant improvement in VO2max in young men not engaged in any form of athletic training. However, caution is needed in interpretation of this results, as the increase in VO2max was very small and within the range of measurement error. The significant increase in AWCd after resistance training, confirms that changes in anaerobic capacity can be effectively monitored with a standard ramp-pattern test.

References:

1. Jung AP (2003). The impact of resistance training on distance running performance. Sports Med; 33(7):539-552.

2. Bishop D, et al (1999). The effects of strength training on endurance performance and muscle characteristics. Med Sci Sports Exerc; 31:886-891.
3. Vincent KR, et al (2002). Improved cardiorespiratory endurance following 6 months of resistance exercise in elderly men and women. Arch Intern Med; 162(6):673-8.

MASKEL TRAINING IN AEROBIC GROUP

Wolinska, K., Cybulska, A.
The University of Physical Education and Sport in Gdańsk, Poland

Locomotive speed belongs to one of the most important group of motoric abilities, which has significant meaning in the structure of footballers movement actions.
106 players had been researched in all age categories.
Tests of the locomotive speed of the footballers were executed on light-athletics runway with the tartan surface. 5 m, 10 m, 15m, 20 m, 30 m, 40 m lengths were measured to straight run from stopped position and running start from 2 meters and lengths 5 m, 10 m, 15 m, 20 m, 25 m to swinging run. Time of the run in each probe was electronically measured with the precision to 0,01 s, with Italian Globus photocells set usage (Ergo-tester).
Researched players were in age section 9,72±0,22 years (youngster beginners) and 24,7±4,49 years (seniors). Results from the run tests reflect views of the pertained authors, that after puberty period strength and speed development in sport groups is the biggest. Based on this we can assume, that in 16-17 year of life footballers achieve level of locomotive speed preparation close to maximal.

POSTURAL SWAY RESPONSE TO DIFFERENT FORMS OF RESISTANCE EXERCISE

Zemková, E., Hamar, D., Pelikánová, J., Schickhofer, P.
Faculty of Physical Education and Sport, Comenius University, Slovakia, Slovakia

It has been documented that running, cycling, walking, as well as repeated heel rising and sustaining stance on tiptoe adversely affect balance. However, there is no information on the effect of exercises performed with upper extremities on postural stability. In addition, the fatigue has been proposed as a principal factor responsible for post-exercise impairment of balance without paying any attention to the hyperventilation. The aim of the study was to compare the parameters of balance and ventilation after resistance exercises involving activation of different muscle groups. A group of 22 physical education students (age 21.2 ± 2.1 years, height 178.2 ± 4.4 cm, weight 73.6 ± 9.4 kg) performed 20 squats, calf rises, biceps curls, and presses behind neck with an additional load of 50% 1RM. Thirty seconds prior to and two minutes after exercises a velocity of the centre of pressure was registered at 100 Hz by means of stabilography system FiTRO Sway check based on dynamometric platform. While exercising and standing on stabilographic platform, parameters of ventilation were continuously monitored using breath-by-breath system MMC Horizon. Results showed significantly ($p < 0.05$) higher increase in velocity of the centre of pressure after squats (16.4 ± 1.4 mm/s) and no significant increase after calf rises (15.2 ± 1.3 mm/s) than after biceps curls (14.0 ± 1.1 mm/s) and presses behind neck (13.6 ± 0.8 mm/s). Also ventilation was significantly ($p < 0.05$) higher after squats (59.1 ± 6.6 l/min) and calf rises (48.2 ± 5.8 l/min) than after biceps curls (40.0 ± 4.6 l/min) and presses behind neck (38.9 ± 3.8 l/min). In both parameters a significant ($p < 0.01$) increase to pre-exercise level has been found (8.6 ± 0.2 mm/s and 12.3 ± 0.1 l/min, respectively). In phase of recovery, there was a close correlation between sway velocity and ventilation after squats ($r = 0.939$), calf rises ($r = 0.919$), biceps curls ($r = 0.896$), and presses behind neck ($r = 0.889$). More profound impairment of postural stability in an early phase of recovery after resistance exercises performed with lower than upper extremities is very probably due to more pronounced ventilation. This assumption may be corroborated by finding that sway velocity after squats and calf rises remained temporarily elevated and only after about 25 and 10 seconds a gradual decrease back to the resting level set in. It may be a consequence of delayed activation of ventilation in an early phase of recovery after such exercises. On the other hand, its values after biceps curls and presses behind neck being reached a maximum at the end of exercise and started to decline immediately in recovery phase. It may be concluded that rather than fatigue a more marked ventilation is responsible for more profound impairment of balance after resistance exercises performed with lower (squats and calf rises) than upper extremities (biceps curls and presses behind neck).

SWIM VOLUME, RESTING HEART RATE, 50 METRE SWIM TIME, AFFECT AND FELT AROUSAL IN COMPETITIVE YOUNG SWIMMERS

Stoedefalke, K., Parfitt, G., Richardson, M.J.
University of Exeter, United Kingdom

The purpose of this pilot study was to explore the effect of swim volume on resting heart rate, 50 metre swim time, affect using the feelings scale and felt arousal in competitive young swimmers over a four week period. Young competitive swimmers can spend up to 17 hours training per week in the pool. Attrition rates are high, with the highest percentage of children who drop out of swimming doing so between the ages of 12-14 years. To date, there are few studies that have examined swim training in competitive young swimmers. Twelve competitive swimmers (10-15yrs) participated in the four week study. Swim volumes and best 50 meter swim times were collected for four weeks. In addition, the swimmers wore heart rate monitors while sleeping three times per week over the four week period to measure resting heart rate. Swimmers also reported their affect (-5 = very bad to +5 = very good) before, during and after swim practice on three separate occasions during data collection weeks. The same protocol was used for determining felt arousal (scaled 1 to 6). Finally, the swimmers were interviewed in an attempt to identify the perceived impact of the training regime on motivation and feelings towards swimming. Analysis failed to show any clear relationship between the swim volume and other variables. Analysis of variance across time indicated that all variables remained stable. However, the coefficients of variability (cf %) for individual results varied greatly for the psychological variables. The affect cf % ranged from 16.4% to 235% and the cf % for felt arousal ranged from 10.9% to 154.6%. Conversely, the physiological variables had a much smaller cf % with resting HR ranging from 1.52%-8.9%, swim volume ranging from 2.10%-43.9% and 50 meter swim time ranging from 1.6%-6.79%. The qualitative data supported the high individual variability in psychological response, with individuals expressing various impacts on motivation. These have the potential to influence long-term involvement in the sport and would support the systematic exploration of these variables in swimmers between the ages of 10-15 using a longitudinal design.

THE EFFECT OF 2-MONTH OF PROPRIOCEPTIVE STIMULATION ON STRENGTH ABILITIES IN ELDERLY WOMEN

Schickhofer, P., Hamar, D., Zemková, E., Gazovic, O., Böhmerová, L.

Faculty of Physical Education and Sport, Comenius University, Slovakia, Slovakia

The aim of the study was to examine the long term effects of whole body mechanical proprioceptive stimuli on strength parameters of lower extremities in elderly women. Altogether twenty women randomly divided into experimental and control group respectively (n =10, mean age 61.8 ± 8.1 years, height 164.0 ± 4.7 cm, weight 77.4 ± 12.6 kg and n =10, mean age 60.1 ± 4.9 years, height 164.2 ± 5.5 cm, weight 70.5 ± 11.7 kg) volunteered to participate in the study. During initial 4 weeks experimental group was exposed to proprioceptive stimuli (generated vertical counter shocks by special platform with the frequency of 10 Hz, eliciting force peaks of 2 g within 3 ms) in standing position (6 sets of 45 seconds, separated by 2 minutes of rest, 3 times a week). Following 4 weeks standing alone was replaced by semi-squats with an additional load of 20 % of body weight (6 sets of 10 reps, separated by 2 minutes of rest, 3 times a week). Force in initial 300 ms (F300) and maximal force (Fmax) produced during maximal isometric contraction in semi-squat position were evaluated prior to, after 4 weeks and after 8 weeks of the training using strain gauge force plate. The best one out of the 2 attempts were taken in account. Results showed a significant improvement ($p < 0.05$) of F300 and Fmax in experimental group (from 249.7 ± 136.5 N to 385.0 ± 136.2 N in F300 and from 731.1 ± 447.3 N to 848.5 ± 399.8 N in Fmax, respectively). No further improvements were registered in the following 4 weeks. In control group there were no significant changes of parameters measured. Positive change may be ascribed to the improvement of neuroregulatory functions, namely increased rate of motoneuron firing and better synchronisation of motor units activation. It may be concluded that already 4 weeks of systematical application of mechanical proprioceptive stimuli in nonfit elderly women applied to lower extremities brings about the major part of improvement of both, maximal strength as well as the rate of the force development in elderly women. The continuation of the same regiment despite of slightly increased intensity does not further enhance the parameters of strength.

ASSESSMENT OF ANTHROPOMETRIC, BIOMOTOR AND BIOENERGIC CHARACTERISTICS OF NATIONAL IRANIAN FEMALE TAEKWONDO ATHLETES AND ITS RELATIONSHIP WITH THEIR COMPETETIVE PERFORMANCE

Jafari, A., Moradi, M., Salehi, S.

Islamic Azad University Research and Science Branch, Iran

The awareness of anthropometrical and physiological characteristics of athletes of each sport is very important and has close relationship with their successful performance. Success in taekwondo needs some factors such as: speed, agility, flexibility, anaerobic power and capacity.

The aim of this study is assessment of anthropometric and biomotor and bioenergic characteristics of Iranian female taekwondo athletes and its relationship with their competetive performance

This research was attended by 25 national female taekwondo athletes (age 21±1/78, weight 57/76 ±8/63, height 166/6±6/86).

Anthropometric characteristics composed of height (m), weight (kg), body fat (percentage), BMI (kg/m2), thigh length (m). Biomotor characteristics composed of agility (Illinois test), speed (20 m Run test), flexibility (set and reach test), balance (Strok test) and reaction time (reaction time test). Bienergic characteristics composed of aerobic power (20m shuttle run test) and anaerobic power (sarjent jump and bosco test).for Evaluationof competetive performance we used of video system.

Descriptive statistical and analysis pearson correlation were used for analyzing data. The result showed that there was a significant relationship between percent body fat, BMI, speed, anaerobic power, agility and reaction time and national female taekwondo athlete's competetive performance

Based on result, these factors have an important role in female taekwondo athlete's competetive performance and must be considered by athletes and coaches in conditioning programs. It also recommended considering these factors in talent identification.

SERVICE AND RECEPTION TECHNIQUES AND TACTICS IN WORLD CLASS BEACH VOLLEYBALL

Koch, C., Karacsonyi, D., Staber, G., Tilp, M.

Karl-Franzens-University Graz, Austria

The quality of the reception of the opponents serve is the basis for a good setting and consequently for a successful attack in volleyball and beach volleyball. Investigations with focus on reception and setting in indoor volleyball underline the importance of this skill (Papadimitriou et al., 2004). Our aim was to analyse service and reception with regard to technique, quality and tactics in world class beach volleyball. A method formerly used for game analysis of U18 and U21 beach volleyball (Tilp et al., 2005) was applied to analyse the playing habits of senior World Class players.

By defining 105 categories it was possible to classify all service and reception actions. The analysed videos were taken at the FIVB Grand Slam in Klagenfurt 2005. 28 matches (15 ♀, 13 ♂) were included in the investigation. Data gathering was performed with the digital game analysis system STATSHOT (see Tilp et al., 2005). The data were processed with basic statistics tools included in the program and MS.EXCEL®. Like in similar systems (e.g. FOCUS X2 from ELITE sports analysis) the assessed actions and the associated video scenes were stored in a database. This allows observing all video scenes of interest after the categorization.

Our results show that male world class players used jump serve more often then female players. While men played jump serves with a percentage of 48 (♀ 20%) women preferred to the same amount float serves without jumping. Female athletes used even more jump float serves than jump serves. In both sexes the jump serve was the most successful technique in terms of direct points (♀ 9%, ♂ 5%) but also the one with the highest error rate (♀, ♂ ~17%). Male and female reception tactic consisted of playing the ball to a central zone between the two players near the net. Players at this level applied predominantly the frontal reception technique (♂ 44%, of which 67% were perfect). The high quality of some service types forced the reception player to use the lateral reception technique (♂ 37%), of which 57% were executed perfectly. Especially men are able to cover a large area with just one step (~80%).

The results bare room for improvement especially for female players in the usage of the effective jump service. A reduction of mistakes and a more frequent use could improve the service performance. In conclusion the results demonstrate that the reception quality is on a high level. It is necessary to serve in an excellent way to put pressure on the opponent. A future aim of our research is to develop a database to place the findings at the disposal for Austrian players and trainers.

Papadimitriou, K., Pashali, E., Sermaki, I., Mellas, S., & Papas, M. (2004).The effect of the opponents' serves on the offensive actions of Greek setters in volleyball games. In: International Journal of Performance Analysis in Sport, Vol. 4/1, 23-33.

Tilp, M., Koch, C., Stifter, S., & Ruppert, G. (2005). Digital game analysis of U18 and U21 world class beachvolleyball. Proceedings of 5th Symposium of Computer Science in Sports, Hvar 2005, 25.

COMPARING SOME OF THE MENTAL SKILLS BETWEEN SUCCESS AND NON-SUCCESS NATIONAL IRANIAN FEMALE TAEKWONDO ATHLETES IN INTERNATIONAL COMPETITION OF ISLAMIC COUNTRY IN 1384

Jafari, A., Moradi, M., Salehi, S.

Islamic Azad University Research and Science Branch, Iran

In sport world, competition among athletes is very near and sensitive. In the past, superiority in a special sport in countries was almost simple, but now, some of the athletes in throughout world do serve exercises with regular and yearly planning in a special sport, so that, in high comparative level of skills is often equal. Therefore, athletes need a thing higher than pressed exercises and continue struggles and that is mental skill; because without using mental skill, reach to peak in sport performance is not possible. The purpose of this research comprises some of mental skill between success and non-success national Iranian female taekwondo athletes in international competition of Islamic country in 1384 and 1382. They were 20 players (11 success and 9 non-success athletes). For comprising subjects mental skills was used Winter's mental skills assessment questionnaire that is special for athletes. In addition used a questionnaire including questions about age, record of activation in taekwondo sport and acquired position in 5 years ago. Results were analyzed with t-test. Results are indicator of significant difference in motivation between two groups that was lower in non-success and higher in success athletes. In addition to, we found significant difference in concentration and imaging among tow group that is indicator of being in success athletes and lower in non-success athletes. Results of this research are indicator of concentration and imaging importance at taekwondo player's success that is necessary for coaches and athletes in this sport to attend it.

SPECIAL STRENGTH AND ENDURANCE CHANGES OF ELITE TAEKWONDO ATHLETES DURING THE PREPARATION FOR A WORLD CHAMPIONSHIP

Ribera-Nebot, D., Garcia-Navarro, F.J.

Barcelona University, Spain

The impact of special strength and endurance training was studied in three elite taekwondo athletes, aged 23-26-27, who were preparing for the 7th Open World Taekwondo Championship. During the final preparatory period (16 weeks before competition), special strength and endurance training was performed 4-1 days/week for 14 weeks. The following special strength and endurance tests were performed at the beginning of the final preparatory period and after 12 weeks: a) test of special strength for short movements: 6 sets of 15 seconds (15 seconds rest in between) performing specific short movements with a 5, 10 and 15 kg disc –the number of performed actions is evaluated; b) test of special strength for kicks: 6 sets of 15 seconds (15 seconds rest in between) performing specific kicks with a 5, 10 and 15 kg disc –the number of performed actions is evaluated; and c) test of special endurance: 6 sets of 1 min 30 seconds (30 seconds rest in between) performing specific short movements and kicks –the number of performed actions and recovery heart rate is evaluated. The three athletes demonstrated a significant increase in the number of actions performed in all the special strength and endurance tests, although it was not found significant changes in the recovery heart. The present data suggest that special strength and endurance training added to the technical-tactical training can produce an important improvement of special strength and endurance capacities in elite taekwondo athletes. It should finally be pointed out that these significant increments of special strength and endurance capacities become a relevant component of the technical-tactical performance in many sports.

References:

1. Seirul·lo Vargas, F. (1994). El concepto de planificación en los deportes de equipo. Documento del INEFC-Barcelona.

2. Seirul-lo Vargas, F. (1987). La Técnica y su Entrenamiento. Apunts Medicina de l'Esport, 24, 189-199.

3. Seirul·lo Vargas, F. (1986). "Entrenamiento Coadyuvante". Apunts de Medicina Esportiva, 23, 38-41.

MANIPULATING HIGH-INTENSITY INTERVAL TRAINING: EFFECTS ON VO2MAX, THE LACTATE THRESHOLD AND 3000M RUNNING PERFORMANCE IN MODERATELY TRAINED MALES

Esfarjani, F., Laursen, P.

esfahan university, Iran

The aim of this study was to compare the effects of two high-intensity interval training (HIT) programmes on maximal oxygen uptake (vo2max), the lactate threshold (LT) and 3000m running performance in moderately trained male runners.vo2max , the running speed associated with vo2max (vVo2max), the time for which can be maintained (Tmax), the running speed at LT (vLT), and 3000m running time (3000mTT) were determined before and following three different training programmes performed for 10 weeks. Following the pretest, 17 moderately trained male runners (=51.6 ± 2.7 ml.kg-1.min-1) were divided into training groups based on their 3000m running times (Group 1, G1, N=6, 8x60% of Tmax at , 1:1 work:recovery ratio; Group 2, G2, N=6, 12x30s at 130% , 4.5 min recovery; control group, GCON, N=5, 60 min at 75%). G1 and G2 performed two HIT sessions and two 60 min recovery run sessions (75%) each week. Control subjects performed four 60 min recovery run sessions (75%) each week. In G1, significant improvements ($p<0.05$) following HIT were found in (+9.1%), (+6.4%), Tmax (+35%), vLT (+11.7%) and 3000mTT (-7.3%). In G2, significant improvements ($p<0.05$) following HIT were found in (+6.2%), (+7.8%), Tmax (+32%) and 3000mTT (-3.4%), but not in vLT (+4.7%; $p=0.07$) . No significant changes in these variables were found in GCON. The present study has shown that 3000m running performance,vo2max ,vVo2max and Tmax can be significantly enhanced using different HIT programmes in moderately trained runners.

ARTISTIC GYMNASTIC FLOOR EXERCISE: COMPARISON BETWEEN EXECUTION ON TRAINING AND ON COMPETITION EQUIPMENT

Minganti, C., Piacentini, M.F.

University Institute of Motor Sciences (IUSM) Rome, Italy

Introduction: Artistic Gymnastic floor exercise is performed on a padded carpet 12 x 12 meter which is necessary for the athletes' take-offs and landings. FIG approved International sprung floor area is manufactured from plywood base panels containing a springing system (fastfoam and/or springs). In Italy many clubs don't have space and/or economical resource to have a regular floor exercise equipment, so training is performed on a track (2x12 m) with a springing system less effective than FIG approved floor area.

Due to these considerations, the purpose of the present study was to analyze Heart Rate (HR) response and blood lactate (BL) concentration during floor routine performed on the two different apparatus.

Methods

Six female gymnasts that were all been competing at the national level, volunteers participated in the study (age: 20 ±2 yrs; height: 159,5 ±9,7 cm; weight: 50 ±7,1 Kg; B.M.I.: 19,6 ±0,9 kg∙m-2). Gymnasts performed their floor competition routine on the two different apparatus. Exercises were performed in two different days (day 1: on track; day 2: on FIG approved floor area) and the same warm up protocol was used. HR was continuously recorded with a Polar sport tester (Polar S810i). Blood samples were drawn, from the ear lobe, at rest and 2, 5, 10 min after the end of performance and analyzed for lactate concentration (Accusport, Accutrend, Germany).

Means and standard deviations were calculated for all data. Comparison between BL concentrations was made using AN.O.VA. with repeated measures. Non parametric Chi2 test was used to evaluate differences in HR response.

Results.

Blood Lactate (mmol•l-1) maximal concentration (BLmax) and increase from rest (∆BL) were higher on track than on FIG approved International sprung floor area (BLmax track: 5,7 ±1,6; 12x12: 4,4 ±0,3; ∆BL track: 4,6 ±1,7; 12x12: 3,3 ±0,5). No statistically difference were found (probably due to the small sample). The average HR were 85% HRmax on track and 80% HRmax on 12x12 sprung floor area (Mode: 90% and 86% HRmax). Also HR statistical analysis didn't show significative differences.

Discussion

Difference between BL concentrations after floor exercise executed on the two different surface, show a higher muscular effort on track; higher exercise intensity on track is confirmed by HR monitoring. These differences are probably explained by the track' springing system less effective.

References.

Goswami A., Gupta S. ; Cardiovascular stress and lactate formation during gymnastic routines; The Journal of Sports Medicine and Physical Fitness;Dec 1998;38:317-322.

Jemni M., Friemel F., Lechevalier J.M., Origas M. ; Heart Rate and Blood Lactate Concentration Analysis During a High-Level Men's Gymnastics Competition; Journal of Strenght and Conditioning Association Research;2000;14(4):p.389-394.

Howells S ; Demands of Gymnastics; Lilleshall Spots Injury and Human Performance Centre; England U.K.; 2000.

ASSESSMENT OF LOWER LIMBS' MUSCLES EXPLOSIVE POWER: DIFFERENCES BETWEEN JUMP TEST VS PUSH TEST

Faina, M., Dell'Acqua, M., Gianfelici, A., Mirri, G.B., Besi, M., Mondoni, M., Galvani, C.

Italian National Olympic Committee , Italy

Jump Test is widely accepted in order to assess explosive power of lower limbs. However vertical jump is a complex movement which can cause some problems of repeatability; it can also induce some overload on spine. Push Test on a leg press does not give such problems and has been already used in different studies. However, in our knowledge, no information about the correlation between these two tests is available. Therefore the purposes of this study are to verify the correlation of a Push Test (SP) vs a Jump Test (SJ), to verify if the two tests are comparable and to focus on the optimal load that elicits maximum power output.

19 physically active men attended 2 separate testing sessions: a) SJ were performed from a semi-squat position (knee angle 90°), without lower limbs counter-movement or an arm swing; b) SP were executed on a leg press with the subject seated with a knee and a trunk angle of 90°; the subject was asked to push maximally with both feet while the carriage was free to move backwards on two rails. During each of the 2 testing sessions, 3 repetitions were completed under each of the test conditions: SJ at 100-110-120-130-140-150%BW and SP at 100-120-140-160-180-200%BW. During both tests load displacement was detected by an electronic encoder and data were elaborated by a customized software. Average force and power and jump height have been used to compare the tests. Furthermore force/velocity and power/velocity curves were drawn in order to obtain average peak power and force.

A significant correlation was obtained for all parameters between the 2 different test methodologies, while they resulted significantly different when compared with a T-test, being SJ higher than SP (54% for power, $p<0.0001$). Besides peak power was obtained with 114%BW during SJ and 180%BW during SP.

The results of this study provide the validity of Push Test to assess lower limbs explosive power. For this reason this test can be used for a comparison between subjects and also for a longitudinal monitoring of training program. It can provide different advantages: better protocol standardization, less intervention of coordination and no overload on the spine. However the lower values detected with SP indicate that there is a minor intervention of trunk muscle groups in SP than in SJ. Therefore this test results more specific for lower limbs power assessment, not considering the overall capability of a subject to jump. In both tests, according with different other studies, peak power has been obtained with an overload in comparison to body weight. 180%BW in SP can be explained by the presence of a came on the leg press which decreases the load in the fist angle of the movement.

1) Antonutto G et al (1995). Acta Astronaut, Oct-Dec, 36(8-12):473-8.

2) Bosco C et al (1983). Eur J Appl Physiol Occup Physiol,50(2):273-82.

3) Driss T et al (2001). J Sports Sci, Nov, 19(2):99-105.

4) Komi PV (1992). Strength and Power in Sport, IFSM, IOC Medical Commission.

DETERMINANTS OF REPEATED-SPRINT ABILITY (RSA) IN FEMALES MATCHED FOR SINGLE-SPRINT PERFORMANCE

Bishop, D., Edge, J.

University of Western Australia, Australia

It is commonly believed that a high level of aerobic fitness (as assessed by V*O2max) is important for repeated-sprint ability (RSA). However, low correlation coefficients (0.42 < r < 0.56) are typically reported between V*O2max and RSA1. Furthermore, while endurance-trained athletes (ET) are better able to maintain repeated-sprint performance than team-sport athletes2, ET also produce lower initial sprint performances. This is important, as it has been reported that initial sprint performance is strongly correlated with the sprint decrement that occurs during a repeated-sprint test3 and is inversely related to V*O2max4. Thus, the greater RSA reported in ET may actually be associated with their lower initial sprint performance, rather than their greater V*O2max. The purpose of this study, was to investigate the relationship between V*O2max and RSA, while controlling for the effects of initial sprint performance on sprint decrement. This was achieved via two methods: 1) matching females of low and moderate aerobic fitness (V*O2max: 36.4 ± 4.7 vs 49.6 ± 5.5 mL•kg-1•min-1; P<0.05) for initial sprint performance and then comparing RSA, and 2) semi-partial correlations to adjust for the influence of initial sprint performance on RSA. Tests consisted of a RSA cycle test (5 x 6-s max sprints every 30 s) and a V*O2max test. Muscle biopsies were taken before and after the RSA test. There was no significant difference between groups for work (W1, 3.44 ± 0.57 vs 3.58 ± 0.49 kJ; P=0.59) or power (P1, 788.1 ± 99.2 vs 835.2 ± 127.2 W; P=0.66) on the first sprint, or for total work (Wtot, 15.2 ± 2.2 vs 16.6 ± 2.2 kJ; P=0.25). However, the moderate V*O2max group recorded a smaller work decrement across the five sprints (Wdec, 11.1 ± 2.5 vs 7.6 ± 3.4 %; P=0.045). There were no significant differences between the two groups for muscle buffer capacity, muscle lactate or pH at any time point. When a semi-partial correlation was performed, to control for the contribution of W1 to Wdec, the correlation between V*O2max and Wdec increased from r=-0.41 (P>0.05) to r=-0.50 (P<0.05). These results have shown that subjects with a higher V*O2max, but similar initial sprint performance, have a smaller sprint decrement (Wdec). Given no differences for initial sprint performance, muscle buffer capacity and metabolic responses, these results indicate that the smaller Wdec in the moderately-trained group was associated with their higher V*O2max. This suggests that V*O2max does contribute to the maintenance of performance during repeated-sprint efforts. However, the small variance in Wdec explained by V*O2max suggests that other factors also contribute. As the V*O2max of subjects in this study was low to moderate, caution should be used in extrapolating these results to elite, team-sport athletes.

1. Bishop D, et al (2004b) EJAP. 92: 540-547.

2. Bishop D, & Spencer M (2004) JSMPF 44(1): 1-6

3. Bishop D, et al (2003) JSMS. 6(2): 199-209

4. Bogdanis G, et al (1996) JAP 80(3): 876-88.

ARE SCALED SOCCER MATCHES SUITABLE FOR THE DEVELOPMENT OF TECHNICAL SKILLS IN YOUNG SOCCER PLAYERS?

Tessitore, A. 1+2, Meeusen, R. 2, Pesce, C. 1, Lupo, C. 1, Benvenuti, C. 1, Capranica, L. 1

1 IUSM of Rome, 2 Vrije University of Brussels, Italy

Introduction

To facilitate the development of technical and tactical skills of youth teams, the Italian soccer federation (FIGC) organizes matches according to the age of the young players. Given the lack of information regarding youth soccer matches (Capranica et al., 2001), the aim of this study is to investigate the differences in technical and tactical skills of youth soccer teams ranging from 8 to 10 years old.

Methods

Three youth soccer competitions (8 yrs: two 15-minute 5-a-side periods; 9 yrs: two 18-minute 7-a-side periods; and 10 yrs: two 18-minute 9-a-side periods) were compared. Players' heart rates (HR) were continuously monitored and the competitions were filmed to evaluate the frequency of occurrence of the following technical parameters: the number of players involved in a single action; the number of passes performed in a single action; the number of players involved in a shooting move. Chi-square test was applied to verify significant differences (p<.05) between ages.

Results

During the matches, HR higher than 170 beats/min were observed (5vs5=90±4%; 7vs7=79±11%, and 9vs9=80±8%), with no significant difference between halves. A significant age-related effect was found for the number of players involved in a single action and the number of passes performed. Although most frequently two-three players (8 yrs: 89%; 9 and 10 yrs 72%) were involved in a single action, with increasing age a tendency for a higher involvement of more than three players (8 yrs: 3%; 9 yrs: 13%; 10 yrs 14%) was found. Within a single action players performed most frequently one pass (8 yrs: 68%; 9 and 10 yrs: 45%). However, older players tended to show higher percentages of occurrence for more than 3 passes (8 yrs: 3%; 9 yrs: 13%; 10 yrs 16%). Post hoc analysis maintained the difference only between 5-a-side and the other type of competitions. During a match, 8-year old players performed shoots (14±2) with respect to both the 9-year (13±3) and 10-year (11±3old players. No significant difference was found between age classes for the number of players involved in a shooting move, with a frequent involvement of two-three players (8 and 10 yrs: 50%; 9 yrs: 46%).

Discussion/Conclusion

In agreement with the literature (Capranica et al., 2001), high intensity activities resulted during the matches. From technical aspects, the 5vs5 matches differ from the other matches, probably due to the limited experience of the younger players, that reduce their ability to cooperate with the other team mates. Even though starting from 9 years of age young players tend to play in a more cooperative manner, the reduction of the number of players, the dimension of the pitch, and the duration of the match does not give enough opportunity to develop the soccer skills of young players. Thus, new competitions aiming at enhancing the development of technical aspects in young players are strongly needed.

References

Capranica et al., Journal of Sports Sciences, 2001.

PECULIARITIES IN RECOVERY OF CARDIOVASCULAR INDICES OF HIGHLY SKILLED ATHLETES

Poderys, J., Ezerskis, M., Poderyte, K., Vainoras, A.

Lithuanian Academy of Physical Education, Lithuania

We have studied the sequence in recovery of cardiovascular indices after various exercise test protocols and after heavy physical loads. The study participants were 17 voluntary students non-athletes and 17 well-trained athletes of combative events group (box, judo and wrestling). A computerized ECG analysis system "Kaunas-load" was employed for 12 synchronous lead ECG recording and analysis. We used the model of integral evaluation of body functioning during exercising which integrates a changes of three functional elements: P – periphery system, R – regulatory system (brain), S – supplying system (heart, blood-vessel system). Relation between these systems can be specified by several parameters, which we have used as the simplest and easier calculated from ECG and ABP parameters: heart rate (HR), JT interval, systolic (S) and diastolic (D) blood pressure. Also we studied proportions between parameters: (S-D)/S and JT/RR, where RR = 60/HR.

The recovery of cardiovascular indices after the exercise tests used was assessed by evaluation of half period of recovery time i.e. 1/2T. The slowest recovery of cardiovascular indices was observed after the Bosco test (60-s all-out anaerobic test). We analysed the sequence of recovery of various indices. These results indicate that after all exercise tests and in both groups the sequence in recovery of registered indices was the same. The doubtless faster recovery was the ratio JT/RR, after then recovery of heart rate, then – JT interval. The same sequence in recovery of indices of arterial blood pressure was observed. If these sequences to put on the scheme of the used model the directional marker has the same direction. This means the recovery begins from some ratio between the regulatory and supplying systems of the body, then the recovery in regulatory systems follows and the recovery ends by going down the indices of supplying systems.

The results obtained after heavy training loads have shown some changes only. There was no statistically significant difference between obtained averages and the sequence in recovery of cardiovascular indices was the same. But, if to take into account the individual variations the sequence in recovery was destroyed in some cases, which coincident with the changes in the stability of recovery process about which the Liapunov exponent (LE) has indicated. Individual data analysis showed that the cases when the sequence in recovery of cardiovascular indices was destroyed one or a few of LE indices have changed to a positive mark what indicates about negative influence on the stability of the recovery processes of cardiovascular indices. In summarizing we conclude that exist a defined sequence in recovery of cardiovascular indices and destroying of this sequence is a sign may be indicating about overloads or some symptoms of overtraining as a result of performed hard training program.

EFFECTS OF TWO RESISTANCE TRAINING PROGRAMS ON MUSCLE STRENGTH, BODY COMPOSITION AND PHYSICAL FITNESS OF LOCAL POLICEMAN

Olmedillas, H., Delgado-Guerra, S., Guadalupe, A., Bernales, O., Fuentes, T., Calbet, J.A., Dorado, C., Sanchis-Moysi, J.

University of Las Palmas de Gran Canaria, Spain

The work carried out by local policeman often demands vigorous physical efforts that has a crucial importance in their job. Purpose. The aim of this study was to evaluate the effects of two different strength training programs on muscle strength, physical fitness and body composition in middle-aged local policemen. Methods. Twenty-one male untrained local policemen (mean ± SD), age 36 ± 6.4 years, height 177 ± 5.3 cm and body mass 85.4 ± 12.4 kg, participated in a 12-week strength training program. Subjects were randomly divided into two groups: a low repetition group (Low Rep, n = 9) perfoming 5 repetitions with the load corresponding to 10 RMfor 8 sets of each exercise with 2 min rest between sets and exercises and a high repetition group (High Rep, n = 12) performing 10 RM for 4 sets with 2 min rest. Seven exercises were performed 3 days/week, 4 lower body (LB) and 3 upper body exercises (UB). Maximal strength (one repetition maximum, 1RM), maximal leg extension isometric force (MIF) in the squat position with knees bent at 90º and the peak force, mean power, and the maximal positive mechanical impulse (Ipos) and height jumped (Hj) during countermovement vertical jumps (Cj) and squat jumps (Sj) were assessed with a force plate. Additionally, 30-m running speed, 300-m run (anaerobic capacity), and 20-m shuttle-run tests (maximal aerobic power) were performed. Body mass, fat mass and lean body mass (DXA) and anthropometric variables (body circumferences and skinfolds) were also assessed. Results. Maximal strength significantly increased in both groups (28 vs 24 %, for Low Rep and High Rep, respectively, both $P < 0.05$). The Low Rep improved the maximal strength in the LB exercises by 41 % ($P = 0.06$) and the High Rep by 30 % ($P < 0.001$). The MIF was increased by 13% in the Low Rep ($P < 0.05$) but not in the High Rep. In the Low Rep the circumferences of the leg, medial thigh and waist were significantly higher (all, $P < 0.05$) and the leg skinfold significantly lower ($P<0.001$) at the end of the training program. Ipos significantly increased during the Sj in the High Rep ($P < 0.05$). No significant differences were observed in the 30-m running speed, 300-m run and 20-m shuttle-run tests in both groups. The UB maximal strength increased similarly in both groups (14 vs 17 %, for the Low Rep and High Rep respectively, both $P < 0.05$). In the Low Rep group, lean body mass of both arms increased (the dominant arm by 2%, $P= 0.09$ and the non-dominant arm by 4 %, $P< 0.05$). The % body fat of the whole body showed a tendency to be decreased after de Low Rep training program (from 25.3 ± 4.7 to 23.9 ± 4.5 %, $P= 0.08$). Conclusion. Low Rep strength training contributed to a higher increase of the maximal strength of the lower body and to an improvement of the muscle mass and % of body fat of the whole body.

This Study was funded by a grant from Academia Canaria de Seguridad (Gobierno de Canarias, Spain).

HIGH-INTENSITY INTERVAL TRAINING IMPROVES SHORT-TERM PCR RESYNTHESIS AND REPEATED-SPRINT ABILITY

Edge, J., Goodman, C., Bishop, D.

Massey University, New Zealand

Oxidation is essential for PCr resynthesis during the recovery from exercise. This suggests that individuals with an elevated aerobic fitness should be better able to resynthesise PCr following exercise. Indeed, cross-sectional research supports the hypothesis that endurance training enhances PCr resynthesis following low-intensity exercise. However, we have previously reported no effect of training on PCr resynthesis following severe exercise. As we measured changes in PCr resynthesis after 3 min, it may be that we were unable to detect any short-term improvements in metabolic recovery. The purpose of this study therefore was to investigate the effects of interval training on short-term metabolic recovery following severe exercise and repeated-sprint ability (RSA).

Twelve, moderately-trained females (mean ± SD: age 20 ± 3 y, mass 62.3 ± 10 kg, VO2peak 45.6 ± 5.6 mL•kg-1•min-1), performed a graded exercise test to determine VO2peak and the lactate threshold (LT), followed 48 h later by a constant intensity cycle test (CIT: 45 s at 200% pre-training VO2peak) and a RSA test (5 x 6-s, separated by 24 s). There was a 1-min rest period (passive) between the performance of the CIT and the RSA test. Muscle biopsies (vastus lateralis) were taken before, immediately post and 1 min after the CIT to deter-

mine muscle ATP, PCr and lactate concentration. Subjects were randomly assigned to either high-intensity interval training, with 1-min (HIT-1) or 3-min (HIT-3) rest periods between intervals. Each subject had a matched partner (matched on the LT) in the opposing group, with whom they were required to complete an equal amount of work during each training interval and session (6-12 x 2 min at 150% LT, 3 d.wk-1 x 5 weeks).
There were increases in VO2peak (11% HIT-1 v 9% HIT-3; $p<0.05$) and the LT (8% HIT-1 v 15% HIT-3; $p<0.05$) for both groups, with no differences between groups. Both groups also had similar improvements in total work (J•kg-1; 12-13%) and mean peak power (W; 9-10%) during the RSA test. There was an increase in short-term PCr resynthesis for the HIT-1 (12.0 ± 1.6 to 22.2 ± 3.9 mmol•kg-1dm•min-1, $p<0.05$) and HIT-3 (14.0 ± 3.2 to 18.5 ± 2.7 mmol•kg-1dm•min-1, $p<0.05$) groups following training, with no difference between groups. There were no changes to post exercise ATP resynthesis or muscle Lactate/H+ removal.
We have shown that interval training can significantly improve short-term PCr resynthesis and RSA. There were no differences in RSA between the two interval training protocols, indicating that during very intense interval training, the length of the rest period between intervals (1 v 3 min) does not affect improvements in performance. Furthermore, both methods of interval training employed in the present study can be used to improve short-term (~1 min) PCr resynthesis. The similar improvements in short-term PCr resynthesis may be related to the matched training loads and the similar improvements in aerobic fitness.

ENHANCING MUSCULAR STRENGTH QUALITIES IN UNTRAINED WOMEN: LINEAR VERSUS UNDULATING PERIODIZATION

Kok, L-Y., Hamer, P., Bishop, D.

The University of Western Australia, Australia

Research has suggested that periodized resistance training can help improve muscular hypertrophy, strength and power1,2,3. Despite disagreements in terminology, two periodization models have surfaced, namely linear and undulating periodization (LP and UP). Comparative studies however, have not found agreement whether it is the fluctuations and variability in training intensity and volume, or a greater workload that have resulted in superior results for a particular periodized program2,4. Also, few studies have examined the effects of periodized resistance training on women. Thus, this study examined the efficacy of LP and UP protocols with matched workloads on adaptations in women. Methods 24 active females (mean ± SD: age 20.0 ± 1.9 y, mass 66.1 ± 9.5 kg) with no resistance-training in the previous 6 mth participated in this study. Participants performed pre-training conditioning (3 wk) before being matched and randomly assigned to either LP or UP training, based on their one-repetition maximum squat (1-RM SQ). The LP group varied training intensity and volume every 3 wk while the UP group varied intensity and volume daily, with training (4 upper-body, 4 lower-body exercises) performed 3 d per wk for 9 wk. Overall training volume (LP:175.6 x 103; UP:157.5 x 103, $p = 0.232$) and intensity was similar between groups. Results There were significant improvements in arm (LP:1.14 %; UP:1.73 %) and thigh (LP:1.58 %; UP:1.99 %) girths, rectus femoris (LP:11.4 %; UP:14.8 %, $p < 0.05$) muscle cross-sectional area (CSA), 1-RM bench press (LP:21.8 %; UP:28.3 %) and SQ (LP:34.8 %; UP:41.2 %), average mechanical power output during the bench press throw (BPT) (LP:11.1 %; UP:13.8 %) and countermovement jump (CMJ) (LP:10.4 %; UP:9.5 %), and barbell height during the BPT (LP:56.4 %; UP:44.8 %) and CMJ (LP:28.0 %; UP:21.5 %), but no significant differences between groups except for muscle CSA. Discussion LP and UP training with volume and intensity equalized were equally adept in improving strength qualities, suggesting that higher workloads and repetitions produce superior strength and power adaptations. Furthermore, our results suggest that the differences in total training volume may explain why some previous studies have reported different periodized programs that result in superior gains. Hypertrophic responses were larger and occurred earlier than previously reported3, and are likely to be associated with the improvements in strength and power observed. The non-projected, light-load, explosive training utilized in the study was found capable of bringing about increases in strength and power but should be limited to short periods, as continued use has been suggested to be detrimental to strength and power performances4.

1. Rhea et al. (2002). J. Strength Cond. Res. 16. 250-255.
2. Stone et al. (2000). J. Strength Cond. Res. 14. 332-337.
3. Kraemer et al. (2004). Med. Sci. Sp. Exerc. 36. 697-708.
4. Baker et al. (1994). J. Strength Cond. Res. 8. 235-242.

LOAD THAT MAXIMISES AVERAGE MECHANICAL POWER OUTPUT DURING THE BENCH PRESS THROW AND COUNTERMOVEMENT JUMP IN WOMEN

Kok, L-Y., Hamer, P., Bishop, D.

The University of Western Australia, Australia

Training at the load that maximizes mechanical power has been suggested to be more effective for increasing maximum muscular power1,2. Some studies3,4 have therefore examined loads that could maximize mechanical power but have proposed different percentages of one-repetition maximum (1-RM). The variations are likely due to differences in data collection and analysis, exercise performance and training experience of subjects4,5. Thus, more research is required to help establish the appropriate load stimulus to maximise muscle power, particularly for females, since only one study3 has utilized females. Methods 27 females (mean ± SD: age 19.3 ± 1.3 y, mass 64.0 ± 9.0 kg, resistance-training experience 3 – 24 mth) participated in this study. During test I, participants performed the 1-RM squat (SQ). After resting 45 min, a series of countermovement jumps (CMJ) were performed using 30 – 80 % of 1-RM SQ, presented in a random order. Three trials were given for each load. Similar procedures were utilized one week later for the 1-RM bench press (BP) and the bench press throws (BPT). All tests of maximum strength and power were performed using a modified Plyometric Power System. Results The nine strongest (GrpH) subjects were 56 and 59 % stronger than the nine weakest (GrpL) subjects in the 1-RM SQ and BP respectively, and utilized heavier loads during the CMJ and BPT. Average mechanical power output was maximised at 30 % of 1 RM for the CMJ in both GrpH and GrpL. This load however, was not significantly different from 40 % of 1-RM SQ for GrpH, and also not significantly different from 40–60 % of 1-RM SQ for GrpL. Average mechanical power was maximized during the BPT at 60 % of 1-RM for both groups, with no significance difference between this load and 40 -50 % of 1-RM BP for GrpH women, and 50, 70 and 80 % of 1-RM BP for the GrpL women. Discussion These results indicate that different percentages of 1-RM maximize power for the upper- and lower-body. The lack of difference between the optimal loads with other percentages of 1-RM, and conflicting results with some previous studies, indicate that lower percentages of 1-RM may be more suitable for power-training, with heavier loads used for maximal strength training. Comparisons suggest that stronger and more powerful females, and also stronger and more powerful parts of the body within the same subjects, utilize lower percentages of 1-RM to produce high power compared to less strong and less powerful females and body parts. These

lower percentages utilized by the stronger females are heavier in absolute terms, and have more initial inertia to overcome, resulting in optimal power production at lower percentage loads4.

1. Kaneko et al. (1983). Scand. J. Sp. Science. 5. 50-55
2. Wilson et al. (1993). Med. Sci. Sp. Exerc. 25. 1279-1286.
3. Thomas et al. (1996). Med. Sci. Sp. Exerc. 28. 1321-1326.
4. Baker et al. (2001). J. Strength Cond. Res. 15. 92-97.
5. Dugan et al. (2004). J. Strength Cond. Res. 18. 668-674.

DIFFERENCES BETWEEN 100 M, 400 M AND MIDDLE DISTANCE RUNNERS IN EXPLOSIVE LEG STRENGTH AND LEG STIFFNESS TESTS

Babic, V., Vucetic, V., Sentija, D.

University of Zagreb, Faculty of Kinesiology, Zagreb, Croatia, Croatia

Introduction: The performance in running events is determined by several neuromuscular factors, but the optimal level of muscle power, strength and stiffness for specific running events is not fully elucidated. The purpose of this study is to investigate the difference in those parameters among athletes who compete in different running events.

Methods

Thirty-one regional to national level male athletes: ten 100m (S) (182.6±5.7 cm, 75.7±4.2 kg), personal best (PB) on 100m sprint = 10.87±0.41s, eleven 400m (S4)(181.9±4.7 cm, 74.0±5.0 kg), PB on 400m 49.5±1.9s, and ten middle distance runners (MD) (180.1±5.4 cm, 68.7±6.3 kg) participated in this study. Several biomechanical variables were measured on a force plate (QuadroJump, Kistler) for evaluation of explosive leg strength: the squat jump (SJ), counter movement jump performed with both legs without hands (CMJ) and with hands (CMJH), as well as CMJ performed on each leg separately (CMJL and CMJR). Leg stiffness was evaluated by performing ten successive maximal hops (HOP) on the same force plate. Standing long jump (SLJ), as a commonly used field test, was also measured. Analysis of variance (with Scheffe's post hoc test) was used to determine significant differences between groups of runners.

Results

The 100m sprinters achieved the highest values while the middle distance runners achieved the lowest values in all measured parameters (SJ: 56.4±6.0 cm, 46.3±3.6 cm, 42.0±3.4 cm; CMJ: 62.3±4.8 cm, 52.9±3.5 cm, 45.4±4.1 cm; CMJH: 68.8±6.1 cm, 61.8±3.5 cm, 51.8±4.1 cm; CMJL: 42.5±8.4 cm, 34.1±1.7 cm, 30.4±4.6 cm; CMJD: 41.3±6.6 cm, 34.4±3.6 cm, 29.0±3.8 cm; HOP: 52.5±4.8 cm, 48.6±4.3 cm, 41.8±5.2 cm; SLJ: 276.0±16.1 cm, 255.6±11.8 cm, 231.5±11.9 cm; for S, S4 and MD respectively). The analysis of variance revealed significant differences between 100 m, 400 m and middle distance runners ($p < 0.01$). The only no significant differences between S and S4 were in the HOP test and between S4 and MD runners in the SJ, CMJL and CMJD tests.

Discussion and conclusions

The results of this study indicate the specificity of explosive strength and leg stiffness regarding the considered running events, which increase significantly with the increase in running speed for a specific event.

References

1. Weyand PG, Davis A. (2005) J Exp Biol 208:2625-31
2. Bret C. et al. (2002) J Sports Med Phys Fitness 42:274-81
3. Chelly SM., Denis C. (2001) Med Sci Sports Exerc 33:326-33
4. Farley CT., Morgenroth DC. (1999) J Biomech 32:267-73
5. McMahon TA., Chen GC. (1990) J Biomech 23, Suppl 1: 65-78.

BODY COMPOSITION AND FUNCTIONAL PROFILE IN ELITE FEMALE PROFESSIONAL YOGA TEACHERS

Boniello, S., Cè, E., Merati, G., Maggioni, M.A., Bertoli, S., Veicsteinas, A.

Institute of Physical Exercise, Health and Sport Activities (IEFSAS), University of Milan, Italy

Introduction – Hatha Yoga is characterized by a sequence of various static postures (asana) of a duration from 8 to 15 minutes. Each asana have to be maintained for at least 30 s up to 60 s and the transition from consecutive postures should be well controlled and slowly performed. A high degree of neuro-muscular control and force is required to correctly perform the entire asana sequence.

Aims – To assess body composition, functional profile and energy cost of asana in a group of elite Yoga Professional females (YP).

Methods – Eight YP (32 [means (SD)] (3) yrs, BMI 21 (2) kg/m2, training hours/day 6 (2)) and 8 sex and age-matched sedentary subjects (C, 32 (6) yrs, BMI (23 (4) kg/m2) participated in the study. Measurement were carried out in 3 different days. In day 1, body composition (Fat Mass, %FM, Fat Free Mass, %FFM and Mineral Bone Density [MBD]) were assessed by means of a Dual X-Ray Absorptiometry (DXA); in day 2, breath-by-breath oxygen uptake (VO_2), pulmonary ventilation and heart rate (HR) were measured during each asana sequence, being each asana maintained for 3 minutes (5 min of rest between 2 asanas) , and during incremental bicycle exercise up to exhaustion (Vo_2 peak); in day 3, the quadriceps Maximal Voluntary Isometric Contraction (MVC, knee angles at 30° and 60°) and the maximal anaerobic power (jump of a force platform, CMJ) were assessed.

Results – % FM was significantly lower (15.5±4.1%) and %FFM and MBD were significantly higher in YP than in C ($p<0.05$ for both comparisons). HR and VE above resting increased by 8±2 bpm and 3.3±1.0 l.min-1 respectively during yoga exercise. VO_2 increased up to 250 ml/min during each asana, and VO_2 peak was 10 % higher in YP than in C (p=ns). MVC values were significantly higher in YP than C at both knee angles ($p<0.01$), despite no differences in CMJ power.

Conclusions – Elite female professional yoga teachers are characterized by significant changes in body composition, with a higher maximal isometric force in lower limbs, compared to sedentary counterparts. However, they appear not to be able to transmit their increased force in powerful dynamic tasks. Due to the high level of training, only a slight increase in the energy cost of each asana was observed. The practice of yoga for years appears to highly improve the body composition and the functional profile of young women as well as the cardiorespiratory adjustment to exercise.

References

Roggla G, Lancet, 2001 ; 357-807
Schmidt T, Acta Physiol Scand Suppl 1997; 640: 158-162
Telles S, Appl Psychophysiol Feedback, 2000; 25: 221-227.

SKILL ACQUISITION IN BASKETBALL AFTER FATIGUING EXERCISE

Augste, C.

University of Augsburg, Germany

Introduction

When children intend to learn a new skill in their sports training, the question arises how much activation is necessary for optimal learning. The theory says that, during a training session, beginners should do skill acquisition training before fitness training (e.g. Schnabel, 1998; Hohmann et al., 2002). However, there exist some findings that even high loads do not influence the learning process negatively when a new simple motor skill is acquired (Olivier 1996). The aim of the present study was to check whether these findings hold in a sport specific setting for a complex task.

Method

122 young basketball players (27 female, 95 male, age 12.3 ± 1.0 years) of 9 different teams learned the hook shot. After a pre-test containing of 15 shots in a relaxed state and 15 shots in a fatigued state the subjects were organised in two parallel treatment groups. One group performed the skill acquisition training after a short warming-up (non-fatigue group (NF)), the other group after a fatiguing basketball specific circuit training (fatigue group (F)). After 12 training sessions the results of skill acquisition were measured in a post-test.

Results

The three-way repeated measures ANOVA showed a significant interaction between the factors time, treatment and skill level (F=8,652; p=0.004) for the shots performed in relaxed condition. While the advanced group had non-significant better learning results when practicing under heavy loads (F=3.059; p=0.089) the group of beginners practicing under fatigue learned significantly less than the relaxed group (F=5.836; p=0.021). The same tendency is found for the transfer test performed under fatigued conditions. For the advanced group again there was no significant difference between the F-group and the NF-group. Beginners of the F-group, however, learned significantly less than the NF-group (F=12.369; p=0.001), even though the situation during training was the same as during testing. This is in contrary to the specificity-hypothesis (Magill, 1998). Nevertheless the study confirms the recommendations for skill acquisition. Absolute beginners should learn complex sports skills under non-fatigued conditions. If the skill is controlled to some extent, however, the combination of fitness training and technical training seems to be more advantageous.

Literature

Hohmann, A., Lames, M. & Letzelter, M. (2002). Einführung in die Trainingswissenschaft. Wiebelsheim: Limpert.

Magill, R. A. (1998). Motor Learning: Concepts and Applications. Boston: McGraw-Hill.

Olivier, N. (1996). Techniktraining unter konditioneller Belastung. Zum Einfluss konditioneller Belastungen auf das sportmotorische Lernen und Techniktraining. Schorndorf: Hofmann.

Schnabel, G. (1998). Motorisches Lernen im Sport. In K. Meinel & G. Schnabel (Hrsg.), Bewegungslehre – Sportmotorik (S. 146-205). Berlin: Sportverlag.

GENDER DIFFERENCE ON MUSCLE AND BONE COMPOSITION IN JAPANESE RHYTHMIC GYMNASTS

Aoba, T., Matsumoto, T., Asakura, M., Tsunoda, N.

Faculty of Physical Education, Japan

Muscle and bone composition were affected by athletic training modes. The characteristics of lean tissue mass (LTM) and bone mineral contents (BMC) on whole body in male athletes were reported previously. Difference of composition characteristics on whole and regional parts of the body between genders in athlete was not yet observed. Thus, the purpose of this study was to observe the effects of gender differences on bone and muscle composition in male and female athletes.

The subjects were forty athletes, 20 college male rhythmic gymnasts (MRG) and 20 college female rhythmic gymnasts (FRG). Theirs mean age was 19.7±1.6 years old, mean height was 169.1±5.7cm, weight was 62.5±4.8kg and 6.0±2.4 years training in MRG. Whereas, mean age was 19.6±1.1 years old, mean height was 161.1±5.3cm, weight was 49.4±3.9kg and 10.2±2.6 years training in FRG respectively. The bone and muscle composition were measured by Dual Energy X-ray absorptionetry (DXA method: XR-26 Norland USA). Each regional parts were measured by a program mode of absorptionetry, and the ratio of regional parts values were calculated on the trunk, arms and legs in whole body from them. Analysis from the unpaired t-test comparison by groups, and the correlation coefficient between LTM and BMC. Statistical significance level was used at $p<0.05$.

LTM was 50.53±3.90kg, BMC was 3.10±0.26kg, bone mineral density (BMD) was 1.086±0.060g/cm2 in MRG, whereas, LTM was 34.91±2.60kg, BMC was 2.54±0.20kg and BMD was 0.995±0.100g/cm2 in FRG. LTM, BMC and BMD values for whole and regional parts of FRG were significantly lower than that of MRG. BMC on whole body was significant related to LTM in MRG ($r=0.648$, $p<0.01$) and FRG ($r=0.669$, $p<0.01$). Relative values of arms to legs for LTM and BMC showed significant higher in MRG than that of FRG.

From these results, it was considered that muscle and bone composition on limbs may affect by gender difference in rhythmic gymnasts training.

ON-ICE PERFORMANCE CHARACTERISTICS OF MEN'S ICE HOCKEY PLAYERS OF TURKISH NATIONAL TEAM

Koz, M., Tasdemir, G., Dogramaci, E.

Ankara University, Turkey

Purpose

The sport of ice hokey has been played in Turkey since 1989, and has developed significanly. Despite its development, there has been no serious study about ice hockey or of players attributes in Turkey either.

The purpose of this study was to evaluate skating performance with on-ice fitness and off-ice fitness testingof elite men's ice hockey players.

Methods

Nine men ice hockey players between the ages of 21 and 28 years (x age = 23.44 ± 2.60 years, x playing experience (PE) = 7.77 ± 2.04 years) participated in the study. All of the players were members of the 2004/ 2005 Turkish National Team.

On-ice tests included (a) agility cornering S turn (AGL), (b) 6.10-m acceleration (ACC), (c) 47.85-m speed (SPD), (d) 15.20-m full speed (FSPD). Two trials of each test were measured with a photoelectric timing system.The off-ice variables that were evaluated included age, years of

playing experience, height, body mass, predicted body fat percentage(BF), sit-and-reach flexibility (SRF), vertical jump height(VJ). Pearson product moment correlations were used to quantify the relationships between the variables.

Results

The mean (± SD) values of AGL, ACC, SPD and FSPD were 9.94 (0.37), 1.63 (0.28), 5.78 (0.33), 1.99 (0.09) second, respectively. The mean (± SD) values of % BF, SRF, VJ were 10.70 (6.01), 31.38(4.39) cm, 56.66 (3.46) cm, respectively. Significant correlations ($p < 0.05$) were found between skating performance tests and off-ice variables. For example, correlation coaficients (r) between ACC and BF, SRF, VJH and PE were -0.64, 0.83, - 0.68, - 0.71, respectively.

Conclusions

The results demonstrate that on-ice performance characteristics of men's ice hockey players of Turkish National Team are very paltry than members of the other national team. Strong significant correlation ($r = 0.83$) between ACC and SRF were not fully explained and required further research. The sports of ice hokey to reach international level in Turkey are needed extra research in this area.

ENHANCING VERTICAL JUMP PERFORMANCE OF VOLLEYBALL ATHLETES - A COMPARATIVE STUDY BETWEEN BALLISTIC AND STATIC TYPE STRETCHING WARM-UP METHODOLOGIES

Angelo, R., Carvalho, A., Mourão, P., Moutinho, C., Carvalho, C.

Higher Education Institute of Maia, Portugal

Introduction: High performance levels all together with the evergrowing abilities of world class athletic performers demand that emerging issues regarding possible competitive performance enhancement techniques, should be brought to light in face of distinct interpretational views, originating from psicophysiology, biomechanics and also from the theoretical basis of different training methodologies. As such, different motor skills play specific roles in the wide array construct of human competitive performance. Thus flexibility training also presents itself as one major determinant of success in volleyball, building the basis for more efficient gameplay through the significant optimization of articular range of motion. In this way our study's main objective was to assess and compare the acute effect of ballistic type and static type stretching on vertical jump performance of volleyball athletes.

Methods: For this purpose we used a sample of 20 volleyball players randomly assigned into two distinct groups of ten athletes, one of which used static type stretching and the other one ballistic type strething. In order to assess the acute effect of each of the specific stretching methodologies, both of the groups were subjected to a pre-post warm up assessment experimental design, in wich all players were assessed in their maximal vertical jump performance ability before and after specific stretching warm-up strategies. All of the exercises defined for group 1 (Static type stretching) consisted in 4 sets of static 20 second stretching, with a 10 second rest interval between sets. In the same way all of the exercises selected for group 2 followed the same volume protocol, however each of the exercises was performed in groups of 20 fast segmental displacements, hence assuming ballistic characteristics.

All test subjects were thouroughly measured in terms of anthropometrical indicators (weight and height), and also in terms of vertical jump blocking and spiking performance expressed in maximal vertical jump height assessed through the use of the Ergojump electromechanical device.

Results: Our results demonstrated a performance enhancement effect of ballistic type stretching exercises on lower limb power output reflected in a stattisttically significant increase in vertical jump height of 4,3 cm in blocking and 5 cm in spiking. In contrast static stretching showed evidence of a performance-damping effect expressed in negative results of a decreased vertical jump height of minus 0,4 cm in blocking and minus 1,9 cm in spiking.

Conclusion: After reviewing our results we may conclude that given the importance of vertical jump height and lower limb power output on volleyball game performance, we strongly suggest that for optimizing jumping performance volleyball coaches should include ballistic type stretching routines in pre-training or pre-game warm-up procedures in order to positively enhance their athletes ability to jump.

METABOLIC CONSIDERATIONS OF STRENGTH TRAINING IN THE ELDERLY, RECREATIONAL AND ELITE SPORTS

Marzin, T., Hartmann, U., Niessen, M.

Departement for Theory and Practice in Sport, Technical University Munich, Germany, Germany

Introduction

Planning strength training intensities mostly refer to the one repetition maximum. This has been subject to several critical reviews (Buskies et al., 1999; Marschall et al., 1999). The influence of metabolic pathways is normally not taken into account. For this reason metabolic and methodical parameters of non-standardised strength training sessions are described.

Methods

A group of 30 subjects (21♂, 42±18 J, 181,9±6,3 cm, 89,2±15,5 kg; 9♀, 31±14 J, 168,5±3,9 cm, 59,0±4,3 kg) participated in the study. Oxygen uptake (VO2), lactic acid (LA), heart rate (HR) and rate of perceived exertion (RPE) where determined during a strength training session (ST). The number of repetitions (reps), duration per set (tset), gross and net training duration (tgross; tnet) were recorded. A caloric equivalent of 5 kcal/l O2 was assumed to calculate the energy demand. Each subject completed an incremental test on a bicycle ergometer (Lode Excalibur) to determine the anaerobic threshold (P4) (according to Mader et al., 1976). Additionally 21 subjects completed a supramaximal test of constant load (100-150 watt > P4) lasting 2-5 min in order to determine VO2 peak (MetaMax I).

Results

Mean VO2 during ST were about 12-15 ml/min*kg, representing average 30,1±5,1 % of VO2 peak. Interindividual differences concerning mean LA concentration were between 2,0±0,4 mmol/l and 9,6±2,6 mmol/l. Resulting gross energy turn-overs were about 6,0-6,5 kcal/min (♂) and 4,0 kcal/min (♀). The average number of reps per set for the entire sample was 26±6 reps, respectively tset 39±10 s. Mean tgross for the three categories was 80-120 min, mean tnet 15-30 min, resulting in a mean work/rest ratio of about 15-30%.

Conclusion

Representing the energy demand of muscle tissue, the VO2 during ST show - with a short time delay – immediate reactions to muscle work. The calculated energy demand of the analysed ST pointed out an increased energy turn-over above resting conditions. However this turn-over was lower than in most aerobic endurance training activities. For that reason described ST seems to be of minor importance in enhancing energy turn-over or reducing body weight compared to typical aerobic endurance sports. LA is not representing the load of ST sufficiently, due to the delayed accumulation in blood. Individual mean LA during ST of 9,4±2,6 mmol/l might have suggested a more extended share of anaerobic supplied work. Furthermore it is not possible to quantify the portions of metabolic pathways in con-

tracting muscle directly. Yet this would be necessary to draw conclusions concerning cellular adaptations in ST. Above all the quantification of the exact muscle power output of active muscle tissue remains a practical problem.

References

Buskies W, Boeckh-Behrens W-U (1999). Leistungssport. 29(3), 4-8.

Mader A et al. (1976). Sportarzt und Sportmedizin. 4, 80-88.

Marschall F, Fröhlich M (1999). Dt Z für Sportmed. 50(10), 311-315.

EFFECTS OF REPEATED SPRINTS VERSUS AEROBIC INTERVAL TRAINING IN SOCCER PLAYERS

Ferrari Bravo, D., Rampinini, E., Impellizzeri, F.M.

S.S.MAPEI, Castellanza, Italy, Italy

Repeated sprint ability (RSA) is considered an important fitness component of soccer physical performance and a recent study has shown that RSA test is correlated to high intensity activity during actual match-play. Several studies have also shown that a good level of aerobic fitness is required to meet the physiological demands of soccer and to aid recovery during high-intensity intermittent exercise. While various studies have shown the effectiveness of generic and specific aerobic interval training in soccer players, no studies have investigated the effect of RSA-based training on soccer players physical fitness. Therefore, the aim of this study was to compared the effects of repeated sprint versus aerobic interval training on some physical fitness components included RSA in soccer players. Twenty-six soccer players were randomly assigned to either repeated sprint (RSG)(N=13) or interval aerobic training group (ITG)(N=13). Repeated sprint training consisting of 3 bouts of six sprints of 40-m with direction changes and 20 sec recovery between sprints and 3 min active rest periods between bouts. Interval training consisting of 4 bouts of 4 min at 90 -95% of maximum heart rate with 3 min active rest periods. Both training programs were completed twice a week. The following outcomes were measured at baseline (Pre) and after 7 weeks of training during the regular season (Post): maximum oxygen uptake (VO2max), ventilatory threshold (VT), 10-m sprint test, RSA shuttle test, counter movement jump and Yo-Yo Intermittent Recovery test (YYIR). No interactions were found between groups for the parameters of aerobic fitness. Specifically, the two groups increased VO2max from 54.3 to 57.4 ml/kg/min and VO2 at VT from 45.0 to 46.1 ml/kg/min ($P<0.05$). Significant training group x time interactions ($P<0.001$) were found for the distance covered during YYIR and mean time in the RSA test. ITG increased YYIR by 13% (from 1846 m to 2077 m) while RSG increased by 28% (from 1917 to 2455 m) ($P<0.0001$). RSG also decreased the mean time during RSA test by 2.1% (from 7.53 to 7.37 s, $P<0.001$) while the ITG did not change (7.42 s pre vs 7.40 s post). No changes after the 7 weeks of training were found in both group in vertical jump height, 10-m sprint time and RSA decrement. Our results showed that sprint training and running interval training determined similar improvement in aerobic fitness. On the other hand sprint training induced higher gain in soccer specific endurance characterized by aerobic and anaerobic intermittent activity and direction changes. Sprint training also produced higher improvement in RSA test compared to running interval training. In conclusion, the RSA-based training used in the present study is an effective training for the improvement of important match-related physical performance and physiological characteristics in soccer players.

MONITORING OF TECHNICAL-TACTICAL TRAINING SESSIONS IN BASKETBALL

Ribera-Nebot, D., Reverter, J.

Barcelona University, Spain

Dynamic complex systems theories will provide us the best theoretical basis to construct a specific training science for team sports in which this specific athlete is able to achieve his/her auto-structuring by differential optimization / 1 /. Training monitoring, a necessity to help coach in training guide, is based on recording changes in an athlete during various stages of training or under the influence of main elements of sport activities (training session, competition, microcycle) / 2 /. In team sports the monitoring of technical-tactical training sessions is highly relevant in order to achieve an integrated control of the training load / 3 /.

The aim of this work is to suggest a method for monitoring technical-tactical training sessions as a complex system in basketball. This proposal has been experienced in basketball teams since 2000. It involves evaluating the following training load components of every technical-tactical training session: total duration of every exercise; total rest time in between exercises; approximate number of execution-participations and its duration for a reference player in each exercise; the biological-conditioning load, the technical-coordination load and the tactical-cognitive load of every exercise and of the training session; the volume of each group of exercises classified depending on the type of content and quality level; the biological-conditioning training load structure, the technical-coordination training load structure and the tactical-cognitive training load structure of the training session; relevant individual or group information pointed out by the coaches related to any of the basic training components (biological-conditioning, technical-coordination, tactical-cognitive, social-affective, emotional-volitive, creative-expressive, mental).

The proposed monitoring of technical-tactical training sessions in basketball as a part of the integrated monitoring of training load will provide useful information for making effective changes in training design, mainly on the following: (1) structure of technical-tactical training sessions, (2) structure of microcycles, (3) planning of training loads, (4) planning of selective technical-tactical and physical conditioning capacities.

References:

1. Seirul·lo Vargas, F. (2003). Dynamic systems and performance in team sports. 1st meeting of complex systems and sport. Barcelona.

2. Viru, A., Viru, M. and Volver A (2004). Monitoring. 7th International Sports Science Conference. Vilnius.

3. Ribera-Nebot, D. (2005). Integrated monitoring of training load in team sports. 8th International Sports Science Conference. Vilnius.

ACCURACY AND RELIABILITY OF A COMMERCIAL VIDEO-COMPUTERIZED, SEMI-AUTOMATIC, SOCCER-MATCH ANALYSIS SYSTEM: PRELIMINARY RESULTS

Impellizzeri, F.M., Sassi, A., Rampinini, E.

S.S. MAPEI, Castellanza, Italy, Italy

Commercial semi-automated, video-computerized, image recognition match analysis systems can now supply professional soccer teams with match analysis data on all players just a few hours after the end of the game. Despite the popularity of these systems among professional soccer teams and researchers, no data are available about their validity. Therefore, the aim of this study was to provide preliminary evidence on the accuracy and reliability of one of these commercial match analysis systems (SICS, Bassano del Grappa, Italy).

Both radar and video analysis data were collected on a soccer player while performing an intense match phase simulation (350 m) including sprinting, striding and jogging in 4 different zones of the pitch. In a 5th pitch zone, 6 maximal 30-m sprint were also completed. Players velocities measured with the video-analysis system were compared with those measured using a radar system (Stalker, ATS). Data were filtered using a zero lag Butterworth filter, and the first and last 10% of the data were excluded from the computation of TE to avoid the edge effect due to filtering algorithm. Data from video analysis were tracked twice by two different operators. Accuracy and reliability for low intensity running (<15 km/h, LIR), high intensity running (>15km/h, HIR) and total distance (TD) of the intense match phase simulation were determined using the typical error (TE) expressed as coefficient of variation (Hopkins, 2000). Similarly, TE was calculated for sprinting (>19 km/h) and peak running speed (PS) during the 30-m sprints. The mean TE of the instantaneous velocities measured using the video-match analysis system taken with respect to the radar velocities was also calculated as indicator of overall velocity accuracy. During intense match phase simulation accuracy for LIR was 2.1 and 3.1%, for HIR was 3.6 and 5.6% and for TD resulted 1.0 and 1.5%, for the first and second tracking respectively. Reliability was 1.0% for LIR, 3.2% for HIR and 1.0% for TD. During sprinting accuracy was 1.8 and 1.7% for sprinting distance, and 1.3 and 0.9% for PS, for the first and second tracking respectively. Reliability was 3.2% for sprinting and 0.6% for PS. The overall accuracy of displacement data (velocity) was 5.6%. The preliminary results of this study showed high accuracy and reliability of a commercial match analysis system suggesting its validity for the quantification of match-related physical activities in soccer players for practical and research purposes. Further studies with larger sample size and using 90-m soccer-match simulation are necessary to fully validate video-match analysis systems.

Hopkins WG. Sports Med. 30: 1-15, 2000.

CHANGES IN THE MAXIMAL STRENGTH AND RATE OF FORCE DEVELOPMENT AFTER A SESSION OF PASSIVE STATIC STRETCHING

Fantini, C., Moreira Júnior, L., Menzel, H.-J., Chagas, M., Schmidtbleicher, D.

Federal University of Minas Gerais, Brazil

The maximal strength (Fmax) is decisive for the efficiency in some sports. However, the maximal rate of force development (MRFD) is one of the main parameters to be considered in activities in which the available time for strength production is limited (Schmidtbleicher, 1992). In spite of the importance of the MRFD for some sports, there is a lack of information related to the stretching effect in this strength component. The purpose of this study was to analyze the Fmax and MRFD performances measured in a maximal isometric muscle action, after a stretching session of the hamstring muscles. The subjects (n=16, age: 24,7±2,7 yrs; height 177,1±8,8 cm; weight: 68,6±12,7 kg) took the strength test followed by the flexibility test in both lower limbs before the hamstring flexibility training session began. The passive static stretching session was made of 3 sets of 3 stretching cycles, 1 minute-pause and the stretch was held for 15s. Immediately after the training session, the flexibility performance was measured. Flexibility training and measurements were performed by a custom made test apparatus (Flexmachine). The participants were seated in a straight-back chair with the limb to be tested elevated at 35o horizontally rested on a padded arm. In order to extend the knee joint passively, a mechanical arm connected parallel to the chair was used. To measure the range of motion (ROM) a potentiometer was fixed on the rotation axis of the arm. The strength test was performed on the IKM-System and the parameters analyzed were Fmax and MRFD. The subject was placed in a supine position with the lower limbs to be tested at 90° of hip and knee flexion. The heel of the lower limb tested was placed over a load cell that registered the isometric strength of the knee flexion. During the test, each contraction lasted 3 to 4 seconds. Three contractions were performed with a 2-minute interval between them. Student's T test was used ($p<0,05$) in order to compare the average values before and after the flexibility training session. The ROM increased significantly (before: 65,7°±15,5; after: 78,3°±16,9). The parameters Fmax and MRFD were reduced significantly (before: 274,69±7,79 N; after: 256,97±2,71 N and before: 2,47±0,93 N/ms; after: 2,23±0,87 N/ms, respectively). A stretching session with characteristics similar to the ones used in this study presents a negative effect on the Fmax and MRFD performance in the single joint isometric test. Different mechanisms have been postulated for the observed impairment in muscle strength output after stretching. Impairment of the strength transmission system via changes in muscle stiffness and changes in motor neuron excitability states has been theorized to reduce muscle strength output. Because stretching routines prior to physical activities are commonly used, more investigations about the transfer of these results to dynamic activities are necessary.

Schmidtbleicher, D. Training for power events In: Komi, P.V.,1992, p.381-395.

DIFFERENCES BETWEEN CROATIAN AND JAPANESE PROFESSIONAL BASKETBALL PLAYERS SHOWN THROUGH STRENGHT AND CONDITIONING INDICATORS

Milanovic, D. 1, Milanovic, M. 1, Pavlicevic, Z. 2

1 Faculty of Kinesiology University of Zagreb, 2 Japan Basketball Federation, Croatia

INTRODUCTION

Some of the previous research has demonstrated the significant differences between male and female basketball players, basketball players of different ages, in other words cadets, juniors and seniors as well as basketball players of different quality levels. The differential analysis through conditioning indicators of Croatian and Japanese professional basketball players as well as national team members is the very subject of this paper.

MATERIALS AND METHODS

The research subjects were selected from two groups of athletes that participated in the preparation process for large competitions in 2005. The first group is comprised of ten basketball players, members of the Croatian senior national team, and the second of 14 members of the Japanese senior national basketball team. The variable sample was made out of ten tests which, in theory, cover some of the typical motor and functional abilities such as: agility, maximum strength, maximum speed, explosive jumping and throwing power, flexibility, and repetitive body power and speed endurance. A multivariate (MANOVA) and univariate (ANOVA) variance analysis was used to determine the differences between the two groups of basketball players through physical conditioning indicators.

RESULTS AND DISCUSSION

The results of the multivariate variance analysis (Wilks Lambda-0,23 and Rao's difference coefficient-4,88) show that the two observed national basketball teams significantly differ (p-0.00) from one another in variables of physical conditioning. The results of the univariate variance analysis in Table 1 show a statistically significant difference between players of the Croatian and Japanese national basketball teams in each of the variables of physical preparedness. The statistically significant differences with a 99% certainty (p=0,01) were obtained in the variables for evaluating explosive throwing power (throwing from the chest line –concentrically (MEBLGk), throwing from the chest line –plyometrically (MEBLGp)), repetitive body power (sit-ups ABC - MRPOT3Z) and absolute power of the arms and shoulder area

(bench press - MASBP). The differences are, before all, determined by the training system and the level of physical conditioning. But the fact is that the basketball players of the two national basketball teams also differ with regard to the region they come from and the level of professional involvement in the training process.

CONCLUSION

The results of this research show statistically significant differences between 12 Croatian and 14 Japanese professional basketball players in some of the ten indicators of physical conditioning status that were used.

REFERENCES

Milanović, D., Jukicć, I., Dizdar, D. (1996). Dijagnostika funkcionalnih i motoričkih sposobnosti kao kriterij za selekciju košarkaša. Kineziologija, 28(2), str.42-45.

Milanović, D., Jukicć, I. (1997). Measurement of anthropological characteristics of top basketball players. AIESEP Singapore, Programme Abstract, pp. 81.

RELATIONSHIP BETWEEN JUMPING ABILITY AND MUSCLE ARCHITECTURAL CHARACTERISTICS OF BASKETBALL PLAYERS

Manou, V. 1, Miroti, O. 2, Stavropoulos, N. 2, Kellis, S. 2

1 University of Thessaly, 2 Aristotle University of Thessaloniki, Greece

Introduction: The jumping ability of a basketball player, as an expression of power, is a basic factor for good performance (Klinzing, 1991). This ability requires high shortening velocity which is determined by biochemical and muscle architectural characteristics (Lieber & Friden, 2000; 2001). Purpose: The purpose of this study was to investigate the relationship between jumping performance and muscle architectural characteristics of basketball players. Methods: Thirty four basketball players of Greek national A2 league volunteered to participate in this study (age: 23.5 ± 3.9 years; weight: 92.5 ± 11.8 kg; height: 1.94 ± 7.5 m; fat 13.4 ± 4.0 %). Muscle thickness and pennation angle of of vastus lateralis muscle were measured by B-mode ultrasonography, and fascicle length was estimated (Abe et al. 1999). Three types of vertical jumps performed on a Bertec force plate (type 4060H): squat jump, countermovement jump and counter movement jump with arm swing. The relationship between vertical jump performance and vastus lateralis architectural characteristics was examined using Pearson's product correlation test. Results: There was no correlation between vertical jumping performance (jumping height, take-off velocity, power) and pennation angle which is correlated negatively with muscle fascicle length relative to limb length ($r = -0.79$, $p<0.01$). Likewise vertical jumping performance was not correlated with muscle fascicle length relative to limb length which was correlated positively with muscle thickness ($r = 0.57$, $p<0.01$). Conclusion: The jumping ability as an expression of vertical jumping performance is not related with vastus lateralis architectural characteristics of basketball players. In contrary according to Abe et al. (2001) and Kumagai et al. (2000), sprinting performance is related to sprinter's muscle fascicle length.

References

Abe et al. (1999). Med Sci Sports Exerc, 31(10): 1448-1452.

Abe et al. (2001). J Physiol Anthropol Appl Human Sci, 20(2): 141-147.

Klinzing (1991). Nat Strength Cond Assoc J, 13: 27-32.

Kumagai et al. (2000). J Appl Physiol, 88: 811-816.

Lieber & Friden (2000). Muscle Nerve, 23(11): 1647-1666.

Lieber & Friden (2001). Clin Orthop Relat Res, (383): 140-151.

SUB MAXIMAL ERGOMETER TEST VALID PREDICTOR OF MAXIMAL ROWING PERFORMANCE

Nederhof, E., Broenink, M., Helmantel, A., Lemmink, K.

University Medical Center Groningen, University of Groningen, Netherlands

Introduction

Rowing performance can be predicted by incremental graded exercise tests and by maximal exercise tests (e.g., Coen et al., 2003; Cosgrove et al., 1999). Sub maximal performance tests are preferred by coaches and athletes, but nothing is known about their predictive value. The purpose of the current study is to investigate the validity of a sub maximal rowing ergometer test.

Methods

The sub maximal rowing ergometer test consisted of three times 20 min at 80% of the heart rate reserve (3x20 test). Heart rate was monitored continuously and registered every 5 min. The test started with a 5 min warming-up followed by the first 20 min of the test with 5 min rest after each bout. The average distance rowed in 20 min was used as the 3x20 test score. The 3x20 test was validated against a maximal test on a Concept II rowing ergometer over 2 km by 35 (22 male; 13 female) rowers of national level. The 3x20 test was also validated against a 3 km maximal performance trial in a skiff (single, two oars) by 19 (9 male; 10 female) rowers. All rowers rowed the skiff trial on the same day. The 2 km test or the skiff trial was performed within two weeks of the 3x20 test.

Results

Performance on the 2 km maximal ergometer test was significantly predicted by gender (β = 0.60, $p < .001$), weight category (β = 0.39, $p < .001$) and 3x20 test score (β = -0.58, $p < .001$). The complete model predicted 91% of the variance. Performance on the 3 km skiff trial was predicted by gender (β = -1.09, $p < .05$) and 3x20 test score (β = -1.66, $p < .01$), but not by weight category (β = -0.27, $p > .05$). This model predicted 55% of the variance.

Discussion

The 3x20 test showed to be a valid predictor of maximal ergometer performance, but showed to be a weak predictor of rowing performance. Close inspection of the data showed that the relationship between 3x20 test scores and rowing performance was particularly weak for slower rowers. A linear trend was visible for those rowers who completed the 3km skiff trial in less than 13min40s. Thus, it is possible that poor rowing technique influenced the relationship between 3x20 test score and 3 km skiff trial performance. It is concluded that the 3x20 test is a valid rowing performance test especially for high level rowers.

Coen, B., Urhausen, A. & Kindermann, W. (2003). Sport specific performance diagnosis in rowing: A incremental graded exercise test in coxless pairs. Int J Sports Med, 24; 428-432.

Cosgrove, M.J., Wilson, J., Watt, D. & Grant, S.F. (1999). The relationship between selected physiological variables of rowers and rowing performance as determined by a 2000m ergometer test. J Sports Sci, 17; 845-852.

HEAT TRANSFER VARIATIONS OF BICYCLE HELMETS--WHAT WORKS BEST?

Brühwiler, P., Buyan, M., Huber, R., Bogerd, C.P., Sznitman, J., Graf, S.F., Rösgen, T.

Empa, Materials Science and Technology, Switzerland

Bicycle helmets exhibit complex structures so as to combine impact protection with ventilation. A quantitative experimental measure of the state of the art and variations therein is a first step towards establishing principles of bicycle helmet ventilation. A thermal headform mounted in a climate-regulated wind tunnel was used to study the ventilation efficiency of 24 bicycle helmets at two wind speeds. Flow visualization in a water tunnel with a second headform demonstrated the flow patterns involved. The influence of design details such as channel length and vent placement was studied, as well as the impact of hair.

Differences in heat transfer among the helmets of up to 30% (scalp) and 10% (face) were observed, with the nude headform showing the highest values. On occasion, a negative role of some vents for forced convection was demonstrated. A weak correlation was found between the projected vent cross-section and heat transfer variations, as well as between exposed scalp area and heat transfer. A simple analytical model is introduced that facilitates the understanding of forced convection phenomena in such helmets. Adding a wig reduces the heat transfer by approximately a factor of 8 in the scalp region and up to one-third for the rest of the head for a selection of the best ventilated helmets. The role of the visor was also studied, and showed large variations from helmet to helmet and as a function of angle. Similar variations were observed with regard to solar radiant heat flow rejection.

The results suggest that there is significant optimization potential within the basic structure represented in modern bicycle helmets. Given the good correlation between heat transfer variations as measured with a thermal manikin, and variations felt by human subjects [1, 2], we conclude that wearer comfort would benefit from a more systematic approach to bicycle helmet design. For elite athletes, performance benefits of improved designs are anticipated on the basis of improved heat transfer.

[1] P.A. Brühwiler, C. Ducas, R. Huber, P.A. Bishop, Bicycle helmet ventilation and comfort angle dependence, European Journal of Applied Physiology 92 (2004) 698-701.

[2] M. Buyan, P.A. Brühwiler, A. Azens, G. Gustavsson, R. Karmhag, C.G. Granqvist, Facial Warming and Tinted Helmet Visors, International Journal of Industrial Ergonomics 36 (2006) 11-16.

AGE- AND GENDER-SPECIFIC PHYSIOLOGICAL CHARACTERISTICS OF JUDO ATHLETES

Pocecco, E.

Institute of Sports Science, Austria

Introduction. In judo, besides technical skill and tactical strategies, conditional characteristics are also indispensable for a successful performance. Few studies have examined physiological profiles of judo athletes and apparently no research until now has focused attention on the development of laboratory tests lasting the duration of a judo competition, regarding maximum arm and leg performance.

The aim of this study was to describe gender, age and rank dependent maximum arm and leg performance of judo athletes, derived from laboratory tests, which are similar in duration to a judo competition (5 min).

Material and Methods. The test group consisted of 4 female and 14 male (8 adolescents and 6 adults) judokas of different rank.

Anthropometric measurements included height, body weight and body composition (BIA). Peak oxygen uptake (VO2peak), ventilation (VE), heart rate (HR) and respiratory exchange ratio (RER) were measured during a continuous incremental test with an arm crank ergometer. Maximum power (Pmax) and total crank time to exhaustion were also recorded. VO2peak, VE, HR, RER and mean power (Pmean) were assessed during a continuous 5 min maximum test on the cycle ergometer.

Results. Women – upper body (ub): Pmax=2.3±0.2W/kg, VO2peak=29.5±1.0ml/min/kg; lower body (lb): Pmean=3.1±0.1W/kg, VO2peak=44.1±7.2ml/min/kg; young men – ub: Pmax=2.6±0.2W/kg, VO2peak=35.5±4.3ml/min/kg; lb: Pmean=3.6±0.2W/kg, VO2peak=49.4±5.7ml/min/kg; adult men – ub: Pmax=2.8±0.3W/kg, VO2peak=30.0±3.5ml/min/kg; lb: Pmean=4.0±0.5W/kg, VO2peak=50.2±6.4ml/min/kg.

Concerning relative parameters of the total group, arm Pmax correlated positively with lower body's Pmean ($r=0.812$, $p<0.001$) and VO2peak ($r=0.637$, $p<0.004$), whereas arm VO2peak correlated positively only with legs' VO2peak ($r=0.574$, $p<0.013$).

Discussion. Because the differences in relative upper and lower body power were significant only between men and women, we can assume that gender is more important than age in influencing this parameter. A high relative VO2peak for upper body distinguished adolescent male judokas from the others, suggesting that young athletes' aerobic capacity with the arms is more important than for the older ones, who are more anaerobically dominant. As no significant differences in lower body relative VO2peak were noticed, it is possible that the percentage of the different energy systems involved during this test was about the same for the three groups of judo athletes.

The correlations between upper and lower body's physiological parameters reflected the general state of training of the whole body required in judo.

The only parameter the rank was related to, was relative Pmax of upper body among adult men ($r=0.829$, $p<0.042$). This may be partly due to the higher importance focused on strength training with increasing age and rank, but perhaps also to the high variability of rank across this group. Anyway, apparently no study available in literature has shown such a correlation.

FATIGUE STATES IN COMPETITIVE SWIMMERS DURING A TRAINING SEASON

Alves, F., Pessoa, P., Rama, L.

Faculty of Human Kinetics, Portugal

The decrease of a ratio (Q) of blood lactate concentration (La) to ratings of perceived exertion (RPE) has been indicated as a marker of overreaching in endurance athletes (Snyder et al, 1993; Bosquet et al, 2001, Garcin et al 2002). The purpose of this study was to compare the effects of three training microcycles (a normal preparation microcycle (MC1), a microcycle of "shock" (MC2) and the first week of taper (MC3) in a group of national level swimmers, using several physiological and psychological markers of fatigue. Ten well-trained swimmers, 5 of each gender (female: 17.36 ± 2.20 years, 58.4 ± 4.92 kg, 171 ± 4 cm; male: 20.08 ±1.79 years, 70.6 ± 2.70 kg, 183 ± 5.83 cm) voluntered for this study. Q (multiplied by 100) was determined using an adapted "2 speed test" (Olbrecht et al, 1985) of 2 x 200m in the

best stroke with full rest. The first bout was submaximal (85% of best time), and was repeated at a fixed velocity in the three moments of evaluation. The second bout was performed at maximal intensity. OBLA was detemined. All the measurements were done in the beginning of the first training session of the week, after 36 hours of rest. Blood samples were collected one and three minutes after the end of each exercise bout. RPE was inquired at the completion of each repetition using the Cr-10 Borg's scale. Before each testing situation, swimmers were asked to fill a short version of POMS inquiry (BAM - Brief Assessment of Mood, developed by Dean et al, 1989) regarding the mood states dominant in previous training weak. Average swim velocities and submaximal La did not change among the evaluations in spite of a clear reduction of the latter displayed by some swimmers and an OBLA increase from MC2 to MC3, indicating a positive effect of the taper on the energy cost of submaximal swimming. Maximal average velocity decreased from MC1 to MC2, with recovery and overcompensation in MC3. Submaximal RPE scores were consistently higher after MC2. Maximal Q was significantly reduced from MC1 to MC2 but only some of the subjects returned to MC1 levels after the first weak of the taper phase. BAM scores variation was highly sensitive to changes in weak work loads. None of the swimmers evaluated showed signs of overreaching. Utilization of submaximal Q seems to be a good indicator of the fatigue state of swimmers during heavier work load periods, showing several swimmers an increase of RPE for the same swim velocity.

Bosquet et al (2001). Eur J Appl Physiol, 84(1-2): 107-14.

Dean et al (1990). 1990 Annual Conference for the Advancement of Applied Sports Psychology, San Antonio, TX.

Garcin et al (2002). Int J Sports Med, 23(1): 16-21.

Olbrecht et al (1985). Int J Sports Med, 6(2): 74-77.

Snyder et al (1993). Int J Sports Med, 14(1), 29-32.

EFFECT OF PROPRIOCEPTIVE TRAINING ON AGILITY PERFORMANCE

Simek, S., Jukic, I., Milanovic, L.

University of Zagreb, Croatia

Only few studies on effects of proprioceptive training focused on physical characteristics improvement such as leg muscles strength (Heitkamp et al., 2001; Tropp & Askling, 1988) or jumping ability (Ziegler, 2002). The purpose of this study was to determine proprioceptive training effects on agility performance. Seventy-five healthy and physically active men participated in this study (age: 19 ± 1.2 yr). They were randomly allocated into experimental (n=37) and control group (n=38). Agility was assessed before and after the experiment using three tests: 20 yards running with 180° turns (y20), lateral shuffle 6x4m (LAT) and lateral hops over 30cm high bench in 10 seconds (HOPS). Experimental group carried out a 10 week proprioceptive training program. Differences within and between groups were analysed using repeated-measures two-way ANOVA and Post hoc Tukey test. Results in y20 showed significant changes induced by experimental program. Post hoc Tukey test revealed that the difference between groups exists at the end of experiment ($p<0.01$), but also that the significant difference exists in pre- and post- experiment results in control group ($p<0.05$). Specifically, control group had lower values achieved in this test at the end of experiment, while the results of experiment group did not differ significantly from their pre-test values. In LAT and HOPS no significant changes were found as a result of experimental program.

Although previous results showed improvement in strength of leg flexors and extenstors and foot flexors and extensors, as well as higher force development after ground contact in jumping (Bruhn et al., 2004) after proprioceptive training that could possibly lead to changes in agility performance, in this study no significant changes in agility performance were found. Since the agility is a complex movement, possible partial effects did not result in improvement of total task efficiency. Kaminski et al. (2003) did not found improvements in strength of foot invertors and evertors after the proprioceptive training program. According to specificity of lateral movement, strength of those muscles and leg adductors and abductors could have high influence on test result. This training program was more focused on anterio-posterior direction exercises, than medio-lateral ankle joint movements. Also, leg adductors and abductors were not specifically targeted. Further research on proprioceptive training effects on agility performance is needed.

References

Blackburn, T., Guskiewicz, K.M., Petschauer, M.A., Prentice, W.E. (2000). Journal of Sport Rehabilitation. 9(4):315-328.

Bruhn S, Kullmann N, Gollhofer A. (2004). Int J Sports Med. 2004 Jan;25(1):56-60.

Kaminski TW, Buckley BD, Powers ME, Hubbard TJ, Ortiz C. (2003). Br J Sports Med. 2003;37(5):410-5

Tropp, H., Askling, C. (1988). Clinical Biomechanics, Vol. 3, str. 88-91.

Ziegler , A. (2002). NSCA Conference Las Vegas, July 10-13.

QUANTIFICATION OF HIGH INTENSITY ACTIVITY FROM THE ENERGY COST OF SPEED CHANGES MEASURED DURING PROFESSIONAL SOCCER MATCHES

Sassi, A., Rampinini, E., Impellizzeri, F.M.

S.S. MAPEI, Castellanza, Italy, Italy

The distances covered in selected speed zones measured by video match-analysis systems are commonly used to evaluate the physical work of soccer players during match-play. However, the use of speed ranges to quantify the effort may underestimate the physiological strain because it does not take into account the short sprints and striding, where the player does not reach speed values classified as high intense activities. The aim of this study was to compare the quantification of the high intense match activities using the classification based on running speed ranges, to that determined from the estimation of the energy cost of running including acceleration and decelerations. Match speed raw data of 10 players during official matches (Serie A) were determined using a commercial video-computerized, semi-automatic, match analysis system (SICS, Bassano del Grappa, Italy). Three intensity zones based on speed ranges were determined: walking (0-2.2 m/s), running (2.2-4.4 m/s), and sprinting (>4.4 m/s). For the same intensity zones, the speed thresholds were converted in metabolic power: 0-5.4 W /kg for walking, 5.4-16.2 W/kg for running, and >16.2 W/kg for sprinting. The movement energy cost including speed changes was calculated adding, to the cost of walking (2.5 J/kg/m) or running (3.6 J/kg/m), the energy spent for kinetic energy variations. The latter was calculated assuming a player's body mass of 75 kg, and an efficiency of 25% for the mechanical work performed while accelerating, and four times higher for the negative work performed while decelerating. Using the speed ranges method, the distances covered while walking, running and sprinting were 4094±454 m, 5067±1182 m and 1585±381 m, respectively. These values corresponded to 38%, 47% and 15% of the total distance covered (10745±1072 m), respectively. Using the metabolic power thresholds the distance covered while walking and running decreased to 2721±355 m and 4094±723 m ($P<0.001$) corresponding to 25% and 38% of total distance, respectively. The distance covered sprinting increased to 3930±672 m ($P<0.001$) or 37% of total distance.

During soccer match, the total energy cost estimated from the average distance covered at the various intensities was 29.6±3.6 kJ/kg. If speed changes were taken into account the energy cost increased by 77%, i.e. 52.4±5.4 kJ/kg (P>0.001). Our results confirmed that classifying the physical strain using the speed categories method the physiological effort is underestimated. In fact, taking into account the frequent acceleration and deceleration running phases, the distance covered at high metabolic cost increased from 15 to 37%. However, the total energy cost estimated with the present method is still lower than the about 70 kJ/kg reported in the literature, suggesting that the total energy cost is influenced by other factors such as the additional cost of unorthodox movements and running with the ball, or a higher cost of running on grass surface.

EFFECTS OF 8-WEEKS STRENGTH AND POWER TRAINING ON MAXIMAL CONCENTRIC FORCE, MAXIMAL AEROBIC POWER, ALACTACID ANAEROBIC POWER AND BODY COMPOSITION IN ELITE RUGBY PLAYERS

Cè, E., Biasetti, F., Dugnani, S., Calì, S.

Faculty of Exercise Sciences, University of Milan, Italy

Introduction – Rugby player is characterised by high levels of maximal force and power, high anaerobic power and fairly good level of maximal aerobic power. However, the effects of a strength or a power training on such parameters are still controversial.

Aims – To compare the effects of 8-weeks strength or power training on maximal concentric force, maximal aerobic and anaerobic power and body composition in elite rugby players.

Methods – Thirty-six elite rugby players participated in the study. Players were divided in 2 groups, based on their role: midfielder (MF) (n = 20; 25 (3) [mean (SD)] yrs; 187 (6) cm; 106 (8) kg) and three-quarters (TQ) (n = 16; 24 (4) yrs; 181 (5) cm; 86 (8) kg). The members of each group were randomly assigned to an 8-weeks strength training program (ST, n =18) or an equal period of power training (PT, n =18) 2 times a week. ST consisted in 6 series of 6 repetitions with a load equal to 80%1RM. PT consisted in 3 series of 3 repetitions using 80%1RM + 5 repetitions with 30%1RM. During both trainings, a pause of 3 minutes through the series was observed. The exercises adopted for both the trainings were those used during 1RM Pre-Post-test. Loads were adjusted each 7 weeks. Training programs were carried out during off-season period. Pre-Post-test consisted in: 1RM assessment during the exercises of Bench Press, Throw; Squat, maximal repetition number of Body Weight Traction (BWT), 10 Meters Speed Test, 30 Meters Speed Test and a Modified Leger Test. Body mass (BMI) and composition (%FM and Lean Body Mass [LBM]: skin-folds technique) were assessed before and after the training period.

Results – After ST, 1RM test significantly increased in Bench Press in MF but not in TQ; Throw (TQ); Squat (MF and TQ), $p<0.05$. 30 Meters Speed Test results were significantly higher in MF, $p<0.05$. Modified Leger Test significantly increase in both MF and TQ, $p<0.05$. After PT, 1RM test significantly increased in Bench Press (TQ), Throw and Squat (MF and TQ), $p<0.05$. 30 Meters Speed Test increased in TQ only, $p<0.05$. BWT slightly increased in both MF and TQ. No significant differences were found in BMI, %FM and LBM after both training programs in both groups.

Conclusions – In rugby players power training seems to be generally more appropriate to increase maximal concentric force irrespective of the role of the players. Strength training seems to improve maximal aerobic power both in MF and TQ. Maximal anaerobic power response seems to be role-dependent. Finally, body composition seems to be unaffected by the proposed training programs.

References

Gabbett TJ, J Sports Sci. 2005 Sep;23(9):961-76

Gabbett TJ, Br J Sports Med. 2002 Jan (36): 334-339

Baker D, J Strength Cond Res. 2001 May;15(2):172-7.

ANTHROPOMETRIC CHARACTERISTICS OF ELITE TURKISH WEIGHT LIFTERS

Akkus, H.

Selcuk University, Turkey

Studies show that there are differences between athletes of different events and even different categories of the same event on anthropometric characteristisc (3,8,9,11,17).

Weight lifters have different structures and body weights in terms of anthropometric data. They compete in different categories according to their age and body weight.

In this study, a total of 50 elite Turkish weight lifters served as subjects. They were the members of the turkish national team.

The aim of this study was to investigate the anthropometric characteristics, body compositon and somatotype of weight lifters and to compare with both reference data and data reported in previous studies especially very old olympic games on weightlifting competing at international events.

Material and Methods

50 elite turkish weight lifters investigated whose average age was 24,65±2,08 years who were medalists in national and international competitions.

Anthoropometric Parameters

1. Body weight (kg) using a steelyard, with allowance of 20 gr, with the subject undressed.

2. Height (cm) in the erect position, was measured with a Holtain yard stick, with allowance of 1 mm.

3. The body mass index (BMI) was obtained according to the following formula:

Weight (kg)/height(m)2

4. The relationship between the trunk and the lover limbs, was obtained by appliying the following formula:

Sitting height (cm) x 100 / height (cm)

5. The extension of the arms (cm) or the armspan, was taken with the subject in the upright position, arms streched out and the backs of the hand pressed against the graph paper placed on the walls.

Body Composition

1. The thickness of subcutaneous peniculus adiposus was evaluated by means of biceps, triceps, subscapular and suprailiac skinfolds.

The measurements, which were carried out by one operator only, were taken from the left half of the body using a Holtain Skinfold Caliber (10 gr/mm2) with allowance of 0.2 mm.

2. Body Density= 1,1369-0,0598 * (sum of the skinfolds)

3. The percentage of body fat was calculated according to Siri's formula:

% Fat= ((4,95/body density)-4,5)*100
Somatotype
The method of somatotyping used in this study was the Heat-Carter method.
Statistical Analysis
Weight lifters were groupen into four weight groups: Less than 60 kg, 60-79,9 kg, 80-99 kg, and 100 kg or more.
For all variables, mean and standard deviation were calculated.
As can be seen from somatocharts, the somatoplot distribution of olympic weightlifters and the Elite Turkish weightlifters are similar except group of <60 kg.
This study shown that there were many similarities between Elite Turkish Weightlifters and very old Olympic Games' weightlifters.
To sum up, it can be said that there exists a universal physique specific to any event because weigth categories and lifting style and training methods changed many times in last 40 years in weightlifting but somatotype and anthropometric characteristics are still same.

EFFECT OF PLAYING BASKETBALL IN YOUNG BASKETBALL PLAYERS

Castagna, C. 1+2, Manzi, V. 2, Marini, M. 1, Annino, G. 2, Padua, E. 2, D'Ottavio, S. 2
1 Scuola Regionale dello Sport delle Marche, CONI, Ancona, Italy, 2 School of Sports and Exercise Sciences, Faculty of Medicine and Surgery, University of Roma Tor Vergata, Rome, Italy , Italy

Competitive basketball is considered as an intermittent high-intensity physical activity that requires a well-developed aerobic and anaerobic fitness (McInnes, Carlson et al. 1995). However the information available is almost all related to adult basketball. Therefore the aim of this study was to assess the physiological demands of youth basketball, in order to obtain information useful for training and competition. Twenty basketball-players (Stamura Basket Ancona, body mass 72.4 ± 11.4 kg, height 181.7 ± 6.9 cm, and age 16.8 ± 2 yrs, VO2max 60.4±5.1 ml kg-1 min-1, VT 40.2±4.7 ml kg-1 min-1) were observed during between-peers games consisting in two 10 min periods of effective play (30 min total play) interspersed with a 2 min interval without substitutions. Heart rate (Polar Team System, Polar Electro Oy, Kempele, Finland) and earlobe blood-lactate concentration (Lactate Pro, Arkray, Tokyo, Japan) were monitored throughout the games. Before and after competition vertical jump (CMJ, Muscle Lab, Bosco System, Rieti, Italy), 15m shuttle running sprint (15mSR, Microgate Polifemo, Bolzano, Italy) and line-drill (LD) performance were assessed in random order in each player (Hoffman, Nusse et al. 2003). Games were performed in a air-conditioned gymnasium in order to keep environmental condition constant. During the first and the second half of the experimental game, players attained 86.2±5.3 and 86.7±4.3% of the individual HRmax, respectively (p=0.42). Average game intensity was 71.5 and 105% of the VO2max and VT, respectively. Experimental-games blood lactate concentration was 3.72±1.39 mmol l-1. Pre to Post games Counter-movement jump, 15mSR and LD scores were 39.9±5.9 vs 40.3±5.7 cm, 5.80±0.25 vs 5.77±0.22 and 26.7±1.3 vs 27.7±2.7 s. Line-drill performance significantly decreased post-game (p=0.001). Although observations were made using an experimental-game, the intensity attained by players during competition is in line to what reported for professional basketball players during highly competitive games (McInnes, Carlson et al. 1995). This supporting the validity of the research design devised for this investigation. Only LD showed significant post-game decrements. The results of this study showed that youth basketball imposes physiological stresses similar to those reported for adult basketball. Performance decrements of prolonged basketball-specific sprinting suggest that the ability to repeat sprint may be a limiting factor in basketball performance. However conclusion about the actual game-limiting factors may be drawn only after specific time-motion analyses.

Hoffman, J. R., V. Nusse, et al. (2003).

THE REACTION OF BLOOD BIOCHEMISTRY AND METABOLISM BY INHALING HYPEROXIA (97%) IN RECOVERY PHASE AFTER HIGH ANAEROBIC INTENSITY EXERCISE

Jang, J.T., Smith, R.W., Huang, L.C.
Institute of Coaching Science, Taiwan

Abstract
The three purposes of this study were to investigate: (1) whether the metabolism of blood lactate is in any way influenced by inhaling hyperoxia (97%) during interval and after an exercise session? (2) will blood ammonia (NH3) be removed quicker by inhaling hyperoxia (97%)? and (3) whether hyperoxia (97%) inhaled after intense exercise will produce free radicals?
Seven 800-meter female runners participated in this study which consisted of two tests (2xTest). Test one (T-1) was conducted using normoxia, and after one day of rest, test two (T-2) was conducted using hyperoxia (97%) and nitrogen (3%) during a 10 min rest interval after Set-1 and 15 min after Set two(Set-2).
Results showed that in the two tests, there were no significant differences in blood lactate and NH3 in Set-1 ($p>0.05$). However, in Set-2 the metabolism rate of blood lactate was significantly decreased ($p<0.05$), while, NH3 showed no difference in Set-2 ($p>0.05$). The production of Hydrogen Peroxide (H2O2) was not affected by the inhaling of hyperoxia. In conclusion, the intake of hyperoxia after exercise had a positive effect on reducing blood lactate, but no effect on blood NH3 or increasing the reaction of free radicals.

ACUTE EFFECTS OF PASSIVE VS. CONTRACT-RELAX STRETCHING MODALITIES ON THE NEUROMUSCULAR PROPERTIES OF PLANTAR FLEXOR MUSCLES

Babault, N., Kouassi, B.Y., Desbrosses, K., Cometti, G.
UFR STAPS Strasbourg, France

Acute passive stretching is now well known to have detrimental effects on strength production capacity (Cramer et al., 2005). The present investigation aimed to determine whether these effects could be reduced by modifying stretching modalities. We therefore tested the hypothesis that neuromuscular properties of plantar flexor muscles were better maintained using a contract-relax stretching modality than with passive stretches.
Eight male volunteers took part in the experimentation. Subjects were tested on two separate sessions, before and immediately after a 15min passive or contract-relax stretching program of plantar flexor muscles (20 stretches). Passive stretching consisted in 30s stretches to the point of discomfort. For the contract-relax stretching modality, subjects performed 6s sub-maximal isometric plantar flexion before 24s passive stretches. 15s rest periods were allowed between stretches. Stretching modalities were presented in a random order with at least two weeks between sessions. Measurements included maximal voluntary isometric torque (MVT) and the corresponding electromy-

ographic activity of soleus and medial gastrocnemius muscles (quantified by RMS values), as well as maximal peak torque (Pt) elicited by single supramaximal electrical stimulation of the tibial nerve.

The repeated measures ANOVA only revealed significant time effect (pre vs. post-stretching) for MVT ($P < 0.01$) and soleus RMS ($P < 0.05$). After stretching, the mean MVT and soleus RMS decreases were -10.3 ± 14.2% and -8.2 ± 12.8%, respectively. No significant change was obtained neither for Pt nor medial gastrocnemius RMS. Although MVT and soleus RMS changes were more pronounced after passive stretches, no significant stretching modality effect was obtained. For example, after passive and contract-relax stretching modalities, MVT decreases were -17.1 ± 9.9% and -3.4 ± 15.0%, respectively.

Performing passive or contract-relax stretching modalities had detrimental effects on the neuromuscular properties of plantar flexor muscles. Inclusion of short isometric contractions before stretch did not reduce this negative effect. After 15min stretch, the decreased strength production capacity appears to be primarily related to neural factors, as exhibited by the reduced soleus RMS. The lack of Pt modification after stretch suggests a reduced contribution of mechanical properties on MVT reduction. However, contractile properties alterations, such as a shift in the length-tension properties, may account for the unmodified Pt (e.g., Weir et al., 2005).

Cramer JT, Housh TJ, Weir JP, Johnson GO, Coburn JW, Beck TW (2005) Eur J Appl Physiol 93: 530-539.

Weir DE, Tingley J, Elder GCB (2005) Eur J Appl Physiol 93: 614-623.

CHANGES IN ENERGY ABSORPTION CAPACITY OF RUNNING SHOES FOLLOWED BY SIX MONTHS OF WEAR

Koivu, M., Aschan, C., Mäki, S., Santtila, M., Kyröläinen, H.

Finnish National Defence College, Finland

Human movement is a complex phenomenon, where physiological components interact with the external conditions of the shoe and the surface. One of the purposes of the present study was to determine energy absorption capacity of the running shoes in association with the level of physical activity.

The number of steps of 41 volunteered conscripts was measured by pedometers (OMRON walking style II) for evaluating the physical activity of the conscripts. Changes in properties of athletic shoes were tested before and after wearing for six months. The energy absorption of seat region of four different brand running shoes was tested by using the standardized test method described in EN ISO 20344:2004, Personal Protective Equipment - Test methods for footwear. In the test procedure, the running shoe sample was placed on a steel base and a test punch was pressed against the bottom unit from the inside at the centre of the heel area until the force of 5000 N was obtained. In addition, running shoes repeated energy absorption capacity was tested by pressuring them twice a day for 20 times in total.

During a day, the conscripts took an average of 12524 steps, corresponding to about 10.9 km. The highest energy absorption capacity of the new running shoes varied between 38 J and 41 J in two brands. However, during the basic training period of six months, energy absorption capacity of those running shoes decreased significantly (38 ± 2 J vs. 35 ±2 J, $p < 0.01$ and 41±3 J vs. 37±2 J, $p < 0.05$, respectively). Among all the tested shoes, the energy absorption of seat region differed (36 ± 5 J vs. 33 ± 3 J, < 0.001) between the new and worn running shoe samples. These changes were, however, smaller in those two brands of which initial energy absorption capacity also were the smallest. Energy absorption capacity of worn running shoes never reduced below the requirements set for professional, e.g. safety, footwear.

The results obtained after repeated tests were of the same order of magnitude than those obtained after wearing them six months by conscripts. This may indicate that the repeated tests could be used to simulate the effects of wear on footwear on energy absorption of seat region. These findings demonstrate, furthermore, that the basic training of six months alters statistically significantly energy absorption capacity of some running shoes. Thus, it might be questionable to wear same running shoes again with the next incoming conscripts. It is noteworthy that the significant decline in energy absorption occurred with the two highest scoring running shoes. This might indicate that energy absorption capacity of unused running shoes might not be an only criterion that should be used when purchasing them. Furthermore, the results from the repeated energy absorption test proved that this test can be used to simulate ability of running shoes to maintain energy absorption capacity. For that reason it carries an important role when establishing a purchasing criterion for running shoes, which enable safe physical activity without injury risks.

ELABORATING PLAYING TEAMS BASED ON BEHAVIORAL SAFETY OF HANDBALLERS

Ortanescu, D., Ortanescu, C.

University of Craiova, Romania

Introduction: Elaborating the team is a difficult task, for the coach, based on complex data, on feeling or interests adjacent to performance. Considering the usual approaches the physic factor is of the main variables that we follow for choosing the team's components. Although some coaches prefer rather a sportive with lower results in selection tests who is constant in his performances, then one with high physic performances. The practice has shown that the coach isn't always right.

Method: The need of objectivity for the selection of team's components for certain competitions has lead to elaborate present work which approaches aspects of constant technique and tactic executions during the game of handball. For these we have chosen a sample made of 20 sportive of 11-12 ears old with perspectives to become titular, 2 on the post of goalkeeper and 3 for each post of field player, with the intention to determine the correspondences between establishing motrical emotional balance, vestibular and motor coordination and stability, certainty of technique and tactic execution during official games.

The testes were: Chappuis test for valuing emotional balance, from Bruininsk – Obseretsky battery, test used to estimate the direction of the movement and 8 items for valuing static and dynamic balance whose data were correlated to those obtained after registering of 4 games, where the number of tactic and technical mistakes was registered for each sportive involved in our study.

Discussions: After data centralization we can notice the existence of a positive correlation between metrical and emotional balance and between these and the number of succeeded technical and tactic actions. The safety of executions during registered games is correlated to the motrical balance, while complex actions – technical and tactic actions too – involve more the emotional balance. We noticed that good technical training affects the safety of executions, motrical balance and the capacity to estimate distances and the experience from competitions influence positively the results of the test regarding emotional balance.

Conclusions: Standard tests can be instruments of selection for participant groups in competitions, stability and safety of executions being preferred. It is in teams' advantage to rely on balanced and not on inconstant components, even if they have from time to time excellent success. Regarding the games' level all sportive have to play, to gather experience and self trust, to sustain the activity during training as well as during competition.

VARIABLES THAT EMPHASIZE THE QUALITY OF LEARNING TECHNICAL ACROBATIC ELEMENTS

Ortanescu, D., Ortanescu, C.

University of Craiova, Romania

Introduction: Representing one of the basic factors for obtaining sportive performance, the technical training relies on the quality of motrical training. Emphasized through accurate and stable exercises, it is considered as synthesis of complex of congruent components, aspect that makes difficult to study the weight of each one, and establishing interdependence relations even if considering one sportive branch.

Method: The present work is orientated only on establishing the correspondence between basics parameters of visual, auditory and motrical memory, of focused and distributive attention, and of the quality of acrobatic, creative combinations considering the learning process, for a group of 10 gymnasts, 10/12 years old, registered in 10 training lessons assigned to each tracked structures using a constant and unique dosing.

Chosen testes were: Ray test, Lalaumé test, Praga test, Toulouse-Pieron test and a motrical memory test made by us concerning 10 bounded elements specific for artistic gymnastics, executed after first visualization and registered as number of mistakes. The results of the tests were correlated with the number of wrong answers from the execution of each learned element, of manifest interferences during variants and their combined errors, respective to acrobatic elements: flick backwards, grouped backward jump, square and stretched, tempo-jump and the combinations: flick - tempo-jump – flick, flick - grouped backward jump, flick– stretched jump, flick - square jump, flick - tempo-jump - grouped backward jump, summarizing 5 unique tracked answers and 5 answers for the combinations.

Discussions: The data was statistically worked, arithmetic averages identify 2 categories of subjects: some gives constantly good answers, average or wrong and others and inconsequent. For the first category we must notice: constant values of the memory and attention, daily insignificant differences, a positive correlation index for these values and the motrical answers, between the auditory memory, focused attention and unique answers, with negative transfer for bonding elements; between visual memory, distributive attention and acrobatic combinations with positive transfer based probably on the complete idea - motor image at an individual level less ordinate or led by a coach. The second category of subjects manifested inconsequence in the results, only at 1 test or several, and we noticed a positive correlation between them and the number of errors. We notice the direct involvement of the quality of focused attention but also of visual memory, which low values in certain training days directly influenced the rise of the error number in motric answers.

Conclusions: There is direct correspondence between the memory qualities, attention and the fidelity of technical executions, each of them contributing to certain steps of learning for a correct apprehension.

DISPLACEMENT VELOCITY IN TEAM SPORT: RELIABILITY OF A NEW AGILITY TEST

Benvenuti, C. 1, De Pero, R. 1, Tessitore, A. 1+2, Capranica, L. 1

1 IUSM od Rome, 2 Vrije University of Brussels, Italy

Introduction

Agility is a crucial aspect for team games performance where the players have to move according to the uncertainty of the game (Rosch et al., 2000, Benedek & Palfai, 1980). Although several tests aim at evaluating agility (Draper & Lancaster, 1985; Butifant, Graham, Cross, 1999), there is a lack of information regarding the athletes' ability to accelerate, decelerate, and change direction of movement according to the changing requirements of the environment. Thus, the aim of the present study was to investigate the reliability of a field test developed to evaluate the athlete's ability to run according to unexpected visual stimuli.

Methods

Thirty athletes (15 females: age 22±2, body mass 59.5±7.08 kg, height 166±5 cm; 15 males: age 23±3, body mass 71.8±8.4 kg, height 174±5 cm) practicing futsal, gymnastics, or martial arts volunteered in this study. Four luminous semi-spheres were placed at the corners of a 7.5x7.5 m court. Three sequences of 6 successive lightings (total distance: 51 m; lighting sequence: A=321241; B=231421; C=342123) were randomly administered with a 5 min rest between trials. The time needed to run and kick the lighted semi-spheres to switch them off was calculated. Participants were administered the sequences during three experimental sessions, with a three-day rest in between. ANOVA was applied to verify significant ($p<0.05$) differences between trials and experimental sessions, while intraclass correlation coefficients (ICC) were calculated to verify the reliability of the test.

Results

No significant difference was found for trials and experimental sessions (first session: sequence A = 203.3±13.5 s, sequence B = 200.0±9.6 s, sequence C = 199.4±11.2 s; second session: sequence A = 197.8±8.9, sequence B = 198.4 ±15.6 s, sequence C = 198.7±11.9 s; third session: sequence A = 195.2±8.2 s, sequence B = 195.1±8.4 s, sequence C = 194.9±12.3 s). The average ICC was .80.

Discussion/Conclusion

The present test aimed at evaluating the athletes' ability to move according to unknown visual stimuli, especially relevant for team sports players. The test showed a good internal consistency (Vincent, 1999) and no learning effect emerged. Given the lack of significant difference between sequences performed in the three experimental days, a single experimental session and a single sequence can be used. However to evaluate the athlete's best performance, it could be advisable to administer three different sequences within a single session.

References

Benedek & Palfai J (1980) Fussball-600 Uebungen, Bartels & Wernitz

Butifant D Graham K Cross K (1999). Science and Football, 57

Draper JA Lancaster MG (1985). Aust. J. Sci. Med. Sport, 17, 15-18.

Vincent WJ (1999). Statistics in kinesiology, Human Kinetics Publ

Rosch et al., (2000) Am J Sports Med., 28, S-29-S-39.

EFFECT OF 4 WEEKS SPORTS TRAINING ON ENDURANCE PERFORMANCE OF THE PLAYERS OF FUTSAL EVALUATED BY MEANS OF A NEW FUTSAL INTERMITTENT ENDURANCE TEST AND THE 20 METER SHUTTLE RUN TEST

Barbero-Álvarez, J.C., Granero, P., Miladi, I., Castagna, C., Granda, J., Ahmaidi, S.

Granada of University, Spain

In professional soccer indoor or futsal players, many physiological stresses associated with the competition require great physical fitness. To perform at the higher level, players need a well-developed capacity to perform high intensity activities such as cruising and sprinting, as well as the capacity to quickly recover during low-intensity activities.

Physical capacity in multiple-sprint athletes is often evaluated using sport-specific field tests. Actually, the most used common test for assessing aerobic fitness is the multistage 20 meter shuttle run test (Léger and Lambert 1982, Ahmaidi et al. 1992). Recently, a new developed futsal intermittent endurance test (FIET) was developed to simulate the exercise and rest rates observed during a futsal match-play (Barbero et al. 2005). The aim of this study was thus to compare the FIET and the conventional 20 meter shuttle running test (SRT) in 14 in Spanish Futsal League athletes before and after a pre-season training period.

All subjects have performed both SRT and FIET tests in random order. The SRT was performed according to Léger and Lambert (1982) and Ahmaidi et al. (1992) studies.

The FIET consisted of 45 m shuttle runs (3 x 15 m) with a progressive increased speed through recorded beeps. Between each running bout, the participants have a 10 s active rest based on jogging after 30 s period of passive recovery. For both tests, when the subjects have failed twice to reach the finishing line in time with respect to the beeps, the distance covered (m) and final speed (Km/h) are recorded representing the tests results.

The results obtained for the two tests before and after pre-season training showed that the distance covered and the final speed reached (peak running speed) in the FIET are significantly increased (1433.7 ± 171.9 vs. 1587.9 ± 166.9, $P<0.001$). However, distance and speed remain without improvement during SRT (2057.8 ± 347.2 vs. 2097.8 ± 252.9). Moreover, strong correlation ($P<0.001$) was found between the maximal speed and total distance attained in both tests (PRE and POST).

It is concluded that FIET, which is more specific to the activity carried out by the futsal players, is able to assess satisfactorily aerobic fitness in futsal athletes. Moveover, the FIET was shown as acceptable tool to follow the training adaptations produced in the players. At least, FIET performance appears a more sensitive measure for variations in futsal performance than SRT and can thus be used to detect level differences between players.

References.

Ahamidi S., Collomp K., Caillaund C., Préfaut C. (1992). Maximal and functional aerobic capacity as assessed by two graduated field methods in comparison to laboratory exercise testing in moderately trained subjects. Int. J. Sport Med. 3: 243-248.

Barbero, J.C., Andrín, G. and Méndez-Villanueva, A. (2005) Futsal-specific endurance assessment of competitive players. Journal of Sports Sciences, 23, 11-12, 1279-1281.

Léger L., Lambert J. (1982). A maximal multistage 20-meter shuttle run test to predict VO2 max. Eur. J. Appl. Physiol. 49:1-12.

PEDALLING CADENCE DOES NOT INFLUENCE TIME TO FATIGUE OF PHYSICALLY ACTIVE MALES IN A PROGRESSIVE MAXIMAL RAMP TEST

Ansley, L., Noakes, T.

Kingston University, United Kingdom

Introduction

Recent technological advances have resulted in the widespread adoption of electrically-braked cycle ergometers for exercise testing. These developments have facilitated the use of a continuously increasing, or ramp, workload protocol to measure work capacity; which was identified early on as the ideal protocol for testing maximal effort (Taylor, 1941). Furthermore, in contrast to the traditional ergometers, electrically-braked ergometers also allow for the workload to be applied independent of the pedalling frequency that the subject adopts. However, unlike prescribed-cadence tests in which the test is halted when the required cadence can no longer be maintained, during preferred-cadence tests cadence drops off towards the end of the test (Katch, 1973); potentially extending the duration of the test before fatigue is reached. This study attempts to determine whether the potential extension afforded to subjects during a preferred-cadence test results in a significantly improved maximal work output.

Methods

Nine physically active individuals performed in random order a maximal incremental ramp test (0.5 W.s-1) on four occasions at a fixed cadence of 60, 80 or 100 rpm and at their preferred cadence (PC). Cadence was measured throughout each trial and averaged over 10s. Testing order was randomised. Mean (+/-SE) cadence data for the 1st minute, 3rd minute and final minute are presented. A repeated measures ANOVA was performed with significance accepted at $p<0.05$.

Results

Peak power output was similar for all cadence conditions (60=371+/-10rpm; 80=376+/-11rpm; 100=372+/-12rpm; PC=383+/-11rpm) ($p=0.86$). The mean cadence during the PC condition (88+/-2.9rpm) was not significantly different from the mean cadence for the 80rpm condition (81+/-0.6rpm) ($p=0.38$). Cadence during the PC trial declined significantly over the final 60s compared with the 1st ($p=0.05$) and 3rd ($p=0.01$) minute.

Discussion

The main finding of this study was that during a progressive maximal ramp test, the peak power attained is similar regardless of the cadence that is employed. Interestingly, although the preferred cadence was similar to the 80rpm trial, the cadence in the PC trial dropped off progressively in the final minute while subjects were able to maintain their cadence during the 80rpm trial. This suggests that the drop-off in cadence was probably not due to selective fatiguing of fibres (Beelen et al, 1991) otherwise this would have also manifested in the 80rpm trial. It is difficult to explain how the decline in cadence appears to pre-empt the completion workload.

References

Beelen A et al (1991). Effect of fatigue on maximal power output at different contraction velocities in humans. J.Appl.Physiol. 71:2332-2337.

Katch VL et al (1973). The relationship between aerobic power and measured work-output on a progressive step incremental bicycle ergometer test. Med.Sci.Sports Exerc. 5:23-28.

Taylor C (1941). Studies in exercise physiology. Am.J.Physiol. 135:27-42.

INTERLIMB COORDINATION, STRENGTH, AND POWER PERFORMANCES FOLLOWING A SOCCER MATCH

Perroni, F. 1, Tessitore, A. 1+2, Pesce, C. 3, Cortis, C. 1, Lupo, C. 1, Capranica, L. 1

1+3 IUSM of Rome, 2 Vrije University of Brussels, Italy

Introduction

The deterioration of motor ability attributed to fatigue could affect the systems responsible for the planning and execution of motor behaviour and enhance the chances of injuries. Thus, the aim of this study was to verify differences in inter-limb coordination, force, and power performances following a soccer match.

Methods

Ten soccer players (age: 18 ± 1 yrs; body mass 73 ± 6 kg; Labasal 1.6 ± 0.4 mM) were administered handgrip, counter movement jump (CMJ), and inter-limb coordination (in-phase and anti-phase flexions and extensions of hand and foot at 120, and 180 bpm velocities, for 60 s maximum) tests before and after a friendly match. Heart rates (HR), blood lactate (La) and rate of perceived exertion (RPE) were used to evaluate the intensity of the match. Differences in pre-post handgrip, CMJ and inter-limb coordination performances were assessed (ANOVA, $p<.05$). For inter-limb coordination, also the factors coordination mode and velocity were considered (Capranica et al., 2004).

Results

At the end of the match, 3.4±1.4 mM peak La and 12.4±2.1 RPE were recorded. Performances were enhanced from the pre- to the post-match condition for CMJ (34.8 vs 37.8 cm), handgrip (462 vs 449 N), and inter-limb coordination both in-phase (120 bpm: 58.2 vs 60.0 s; 180 bpm: 47.6 vs 50.9 s) and anti-phase (120 bpm: 36.6 vs 42.4 s; 180 bpm: 16.8 vs 18.9 s), even though no significant difference emerged.

Conclusions

Although soccer matches put a heavy physiological and psychological burden on athletes (Mohr et al., 2005; Reilly and Rigby, 2002), players maintain or even enhance their ability to coordinate movements. Both central and/or peripheral factors might be responsible for this phenomenon. Probably, the positive effect of intense exercise on motor coordination reflects, at least in part, the facilitation of the peripheral motor processes involved in response execution.

References

Capranica et al. (2004) Gerontology, 50, 6, 399-406

Mohr et al., (2005) Journal of Sports Sciences, J Sports Sci 23, 593-9

Reilly and Rigby (2002), Science and Football IV, 226-229.

BODY CHARACTERISTICS OF WORLD CLASS SPORTS & FITNESS AEROBIC ATHLETES

Aerenhouts, D., Clarys, P., Deriemaeker, P., Taeymans, J., Duvigneaud, N., Vandenabeele, E., Clijsen, R., Duquet, W.

Vrije Universiteit Brussel, Belgium

Introduction

Sports (SA)– and Fitness Aerobics (FA) is a growing sport which is being more and more professionally practised in its different disciplines (solo, mixed pairs, teams in SA and step, group aerobics, funk in FA). Literature on the body characteristics of world class athletes in this sport is scarce.

Aims

The aim of this study was to determine the somatotype (ST) of world class athletes in SA and FA and to make a comparison between the different disciplines.

Methods

During the world Championships SA and FA (Ghent, May 2005) athletes were invited for anthropometry for the determination of ST, BMI and percentage of body fat (%BF). ST was calculated using the Heath-Carter method (J.L. Carter and B. H. Heath, 1990) and %BF was estimated by body-impedance (TANITA TBF 410). Descriptive (Mean ± S.D.) and statistical analysis were made with the SPSS 13.0 program using a Oneway ANOVA with LSD post hoc test ($p < 0.05$).

Results

In total 113 (aged 21.6 ± 5.2 yr) female and 23 (24.4 ± 5.1 yr) male athletes volunteered. Mean BMI was 21.2 ± 1.8 for the female and 24.2 ± 2.5 for the male subjects. %BF was 19.3 ± 4.8% and 12.7 ± 6.6% for female and male athletes respectively. As a whole, both female and male athletes can be described as endomorphic mesomorphs (3.5 ± 1.1; 3.9 ± 1.0; 2.8 ± 1.0 for female and 2.7 ± 1.4; 6.0 ± 1.2; 2.0 ± 1.0 for male athletes). Only the women performing in funk could be described as mesomorphic endomorphs (4.4 ± 1.1; 3.5 ± 0.8; 2.8 ± 0.6). There were no significant differences for BMI and %BF between the different disciplines. Women performing solo were significantly smaller than their colleagues performing in group aerobics and step (160,0 ± 6,9 cm vs. 164,3 ± 6,2 cm and 166,7 ± 7,0 cm). Women performing in step were also significantly taller compared to the women of the mixed pairs (166,7 ± 7,0 cm vs. 159,6 ± 2,6 cm). Women performing in step and team were significantly heavier than those performing solo and in group aerobics (59,0 ± 7,5 kg and 58,8 ± 5,1 kg vs. 52,7 ± 5,3 kg and 55,2 ± 5,4 kg). For men, there were no interdisciplinary comparisons made due to the low number of subjects.

Conclusion

World-class athletes in SA and FA can be described as endomorphic mesomorphs. This is in contrast to other esthetical sports such as artistic gymnastics where the ectomorphic component is more and the endomorphic component is less present (J.L. Carter, 1982). Especially for the women performing in the funk discipline, the higher body weight resulted in a more endomorphic ST. This may be an indication for specific training demands in this discipline. In general, these results point to the importance of a certain muscularity especially for male but also for female athletes in SA and FA.

References.

J.L. Carter and B.H. Heath, Somatotyping development and applications, Cambridge University Press, 1990.

J.L. Carter, Physical Structure of Olympic Athletes, Medicine and Sport, Vol.16, 1982.

CORRELATION BETWEEN STRENGTH, POWER AND INTER-LIMB COORDINATION IN SOCCER PLAYERS

Lupo, C. 1, Tessitore, A. 1+2, Cortis, C. 1, Perroni, F. 1, Pesce, C. 3, Capranica, L. 1

1, 3, IUSM of Rome; 2 Vrije University of Brussels, Belgium, Italy

Inter-limb coordination is related to age (Capranica et al., 2004) and activity level (Capranica et al., 2005). Although a relation with strength has been assumed, no data support this hypothesis.

Methods: To verify differences between soccer players and sedentary individuals in inter-limb coordination, force, and power performances in relation to age, 47 soccer players (20 children: 12 ± 1 yrs; 21 adults: 28 ± 5 yrs; 6 old: 66 ± 6 yrs) and 47 co-aged sedentary individuals were administered handgrip, counter movement jump (CMJ) and inter-limb coordination (flexions and extensions of hand and foot in the sagittal plane with1:1 frequency, in-phase and anti-phase modes at 80, 120, and 180 bpm velocities, for 60 s maximum) tests. A 3 (Age) x 2 (Activity) ANOVA was applied to handgrip and CMJ performances ($p < .05$). For inter-limb coordination an ANOVA for repeated measures was applied (between factors: Age and Activity; within factors: mode, and velocity). Correlation coefficients were calculated between variables.

Results: For CMJ and handgrip performances a main effect ($p < .01$) was found for age and activity, with soccer players always showing better performances. Significantly worst CMJ performances in older (soccer players: 16.7 ± 4.2 cm; sedentary: 5.9 ± 1.7 cm), intermediate in young (soccer players: 24.7 ± 2.4 cm; sedentary: 19.3 ± 4.8 cm), and best in adults (soccer players: 37.9 ± 4.8 cm; sedentary: 30.6 ± 5.2 cm) individuals were found. For handgrip, significantly better performances in adults (soccer players: 481 ± 65 N; sedentary: 455 ± 94 N), intermediate in old (soccer players: 429 ± 56 N; sedentary: 320 ± 115 N), and worst in young (soccer players: 224 ± 43 N; sedentary: 218 ± 54 N) were found. For inter-limb coordination, main effects emerged for age, activity, mode, velocity, and the interactions velocity x activity x age, mode x velocity x activity, and mode x velocity x age. Soccer players always showed better performances, especially with increasing velocity and in the anti-phase mode. Low correlation was found between CMJ and inter-limb coordination tests for children (range: -.05; .36) and adults (range: .08; .29), while higher coefficients were found for older individuals (ranging from .47 to .87; in-phase mode: $p<.05$). Also the correlation between handgrip and inter-limb coordination tests was low for children (ranging from -.04 to .16) and adults (ranging from -.04 to -.27), while higher coefficients were found for older individuals (ranging from .52 to .60; 80 bpm in-phase mode: $p<.05$).

Conclusions: Soccer proved to be beneficial not only to develop strength, power, and synchronization capabilities in children and to reach higher levels of proficiency in adults, but also to maintain central and/or peripheral factors in older individuals. Data suggest that strength per se is not strictly related to coordination.

References

Capranica et al. (2004) Gerontology, 50, 6, 399-406

Capranica et al. (2005) Gerontology, 51, 5, 309-15.

ARCHITECTURAL CHARACTERISTICS OF GASTROCNEMIOUS MEDIALIS IN TRACK AND FIELD ATHLETES

Manou, V. 1, Tasopoulos, S. 2., Saraslanidis, P. 2., Kellis, S. 2

1 University of Thessaly, 2 Aristotle University of Thessaloniki, Greece

Introduction: Many researchers are investigating the relationships between muscle architectural characteristics and athletic performance. Abe et al. (2000), found that the relative fascicle length of vastus lateralis and gastrocnemious medialis and lateralis is significantly greater in elite sprinters than that observed in elite distance runners. Furthermore it was found that muscle architectural characteristics are related to joint angles (Maganaris et al. 1998; Narici et al. 1996). Purpose: The purpose of this study was to compare the architectural characteristics of relaxed gastrocnemious medialis in track and field athletes from different events at three ankle angles. Methods: Thirty four high-level Greek track and field athletes [10 throwers (TH), 8 sprinters (S), 8 long distance runners (DR) and 8 jumpers (J)] and 10 untrained individuals (C) volunteered to participate in this study. Muscle thickness (MT) and pennation angle (θp) of gastrocnemious medialis muscle were measured by B-mode ultrasonography, and fascicle length (FL) was estimated at -15 deg (dorsiflexion), 0 deg (neutral position) and 15 deg (plantarflexion) ankle angles (Abe et al. 2000; Kumagai et al. 2000). A One-way ANOVA was used to determine the effect of group and Tukey post hoc tests were used to locate the significantly different means. The level of significance was set at $p<.05$.

Results: Standing height and shank length were similar among all groups. Body mass was significantly greater in throwers than all the others participants. Pairwise comparisons between groups showed that there were significant differences ($p<.05$) in: a) MT at all three angles between C and TH, b) MT at -15 deg and 0 deg between C and J, c) MT at -15 deg between TH and DR, d) θp at -15 deg between TH and C and J, e) FL at all three angles between C and TH, S and J, f) FL at -15 deg between DR and TH and S, g) FL at 0 deg between DR and TH, S, J, h) relative FL at -15 deg between C and TH and S, i) relative FL at -15 deg between TH and DR and J, j) relative FL at 0 deg between C and TH, S, J, k) relative FL at 0 deg between DR and TH, S, J. Conclusion: TH, S and J indicated greater FL and relative FL than DR and C at -15 deg and 0 deg which is in agreement with the results of Abe et al. (2000). Furthermore the results of the present study confirmed the fact that the FL decreased and θp increased from dorsi to plantar angle flexion (Maganaris et al., 1998; Narici et al., 1996).

References

Abe et al. (2000). Medicine and Science in Sports & Exercise, 32: 1125-1129.

Kumagai et al. (2000). Journal of Applied Physiology, 88: 811-816.

Maganaris et al. (1998). Journal of Physiology, 512: 603-614.

Narici et at. (1996). Journal of Physiology, 496: 287-297.

OVERHEAD ATHLETES AND SPORTS PERFORMANCES ON THE FIELD

Forthomme, B., Crielaard, J.M., Croisier, J.L.

University of Liege, CHU Sart Tilman, Belgium

Throw, spike and serve actions represent complex skills that require many components of movement, technical and muscular qualities. Effectiveness of overhead tasks has been attributed to an energy transfer in a kinetic chain concept from the lower limb to the upper extremity, depending on flexibility, strength and coordination. The purpose of this study was to examine, among overhead athletes, the relationship between the isokinetic strength developed by the dominant shoulder and a specific performance on the field.

Sixty-eight highly skilled overhead athletes (from the highest Belgium national divisions or highest final placing) took part in the experiments: 21 tennis players, 19 volley-ball players, 17 badminton players, 11 javelin throwers. They performed an isokinetic assessment of the external (ER) and internal (IR) rotators of the dominant shoulder and a specific evaluation on the field following a standardized protocol. The isokinetic installation corresponded to the lying position, arm abducted at 90° in the frontal plane, through a constant range of motion (50° in internal rotation and 70° in external rotation). The isokinetic speeds selected were 60 deg/s, 240 deg/s and 400 deg/s in the concentric mode, and corresponded to 60 deg/s in the eccentric mode (3 to 5 maximal repetitions according to the mode of contraction and speed). Performances on the field corresponded to a determining action in each sport: serve in tennis, spike action in volleyball and badminton, and throw in javelin. The best performances were measured, among six attempts, using either a radar gun (ball speed, in km/h), a digital camera (shuttlecock speed, in km/h) or a string (javelin throw distance, in meters).

Based on the correlative analysis, maximum strength developed by the IR muscle group was significantly ($p < 0.05$) correlated with the javelin throw in all isokinetic conditions ($0.62 < r < 0.67$) and with the volleyball spike velocity in the concentric mode ($0.47 < r < 0.63$). The ER isokinetic performances were in relation with the javelin throw in the concentric mode at 240 deg/s ($r = 0.79$) and 400 deg/s ($r = 0.78$). The ER/IR ratios were negatively correlated with the volleyball spike velocity ($-0.52 < r < -0.62$) and positively with the tennis serve speed ($0.42 < r < 0.61$). The spike speed in badminton did not show any relation with the maximum strength developed isokinetically.

Even if overhead action is a multijoint action, these results highlighted some original correlations between analytic strength isokinetically developed by the dominant shoulder and field performance into high-level overhead athletes. These data could provide useful information for training management. For instance, strengthening the IR could seem to be relevant in volleyball performance optimization [1]. Nevertheless, we advise against entailing an agonist / antagonist imbalance which could possibly increase the risk of further shoulder injury.

[1] Forthomme B et al, Am J Sports Med, 33, 1513-1519, 2005.

COORDINATION ABILITIES OF SHOOTERS IN AGE 15 – 22 YEARS

Poliszczuk, D., Polishchuk, T.

The Jozef Pilsudski Academy of Physical Education in Warsaw, Poland, Poland

Movement precision in sport is one of the most fundamental features of movement potential of an athlete; consequently, development of methods for its control and evaluation plays a substantial role in shooting. Shooting imposes difficult requirements with regard to psychophysiology of persons willing to practice this sport discipline, particularly in relation to the aiming precision, which is a prerequisite for achieving proper sport results.

The aim of this study was an evaluation of coordination abilities in the scope of minor motor abilities and components of speed in youth practicing shooting as a sport.

The tests were carried out on 27 shooters (13 female shooters and 14 male shooters) aged 15 - 22 with training experience of 2 to 6 years. Results were obtained using the Vienna Test System. The analysis comprised the obtained parameters, medians of reaction time and time of simple movement, tapping-test, tremor and indices of linear tracking and aiming for the right and the left hand. The study involved an analysis of the level of coordination abilities, such as: differentiation, coupling and adaptation of movement with regard to minor motor abilities.

In the training process, abilities of aiming accuracy indicate a growth trend both for the right and left hands; nevertheless, the right hand is much more efficient than the left one. The better the result, the better the ability of high accuracy and sensitivity are, as well as the ability to effective tensioning and relaxation of muscles.

An analysis of the performed tests show that when commencing shooting training the shooters have similar values of coordination dexterity in both hands. However, with time, after continued training exercises changes occur that increase the difference between the dominating hand of the shooter and the other hand.

In the execution of Tests manifestations of asymmetry in movement of the upper extremities in shooters were observed. The tests showed that the 'better' hand dominates, i.e. the right one. This is connected with adaptation to the specific character of this sport discipline – shooting from one hand only, which is also visible in training, which to a large extent is unilateral in character. As may be seen, considerable differences occur between the right and left hands. This constitutes proof that the dominating hand has a much better coordination level. In the attempt of aiming and tremor, the difference between the right and the left hand amounts to 62.5%, and in the test of linear tracking 71% to the advantage of the right hand.

The occurring differences in the level of studied coordination abilities in persons of both sexes, and manifestations of asymmetry in movement of the upper extremities in execution of the Tests were subject to analysis. The structure of speed components were determined: reaction time, time of simple movement and frequency of movements of the tested subjects.

EMG AND PLANTAR PRESSURE APPROACH TO KINEMATIC ANALYSIS OF CARVING TURN IN SNOWBOARDING

Yamauchi, T., Takato, J., Okutsu, M., Yasuda, T., Kitamura, K.

Ishinomaki Senshu University, Japan

[Purpose] The majority of snowboard hobbyists today are youths and only a few are in middle age or older. However, with the prospect of the age range of snowboarders expanding to include children and the elderly in the near future, it is important to establish guidelines in order to ensure safety in snowboarding. In the present study, electromyographic (EMG) activity and plantar pressure were measured during the carving turn in order to determine the motion characteristics of the snowboarder. [Method] The experiment was carried out on the medium slope (50 m x 100 m) at Spring Valley Ski Course in Miyagi Prefecture, Japan. The subjects, consisting of two instructors from the Japanese Snowboarding Association, were asked to perform the long-turn carving turn while wearing soft boots. Surface EMG activity was measured using a portable measuring device at a frequency of 1 kHz. Measurements were taken for the vastus lateralis, tibias anterior, and the soleus. Plantar pressure was measured by inserting a load cell sandwiched between flat sheets of stainless steel and aluminum inserted into the space between the board and the binding, and using a portable strain recorder. Sensors were placed at the big toe and little toe sides of the toes and the heel, for a total of four measurement points. Video footage was recorded at the same time as EMG and load data using an ordinary digital video camera. [Results and Discussion] Vastus lateralis: Marked muscle activity was observed in the rear leg compared to the front leg during the uphill phase of the frontside and backside turns. Tibialis anterior: no consistent muscle activity patterns were observed. Soleus: Predominant muscle activity was observed in the uphill phase of the frontside turn. The load was placed on the toes during the frontside turn and on the heel during the backside turn. The little toe side of the heel in the rear leg carried a relatively small load in comparison to the other points during backside turn. Electromyographic analysis of the long-turn

carving turn shows that muscle activity was unevenly distributed between the front and rear legs during the downhill-uphill phases. The vastus lateralis of the rear leg indicated a larger EMG amplitude than that of the front leg, particularly in the uphill phase of the frontside and backside turns. Muscle activity of the soleus muscle correlated with the motion of the plantar flexion in the frontside turn, but the role of the tibialis anterior could not be ascertained in the present study and requires further investigation. The load cell measurements imply that the frontside turn can involve the internal rotation of the hip joint in the front leg, while the backside turn can involve the adduction of the hip joint in the back leg.

SPEED-STRENGTH EXERCISES IN PRACTICE OF SKILLED FENCER PREPARATION

Driukov, V., Mistuloa, T., Pavlenko, Y.

State Scientific-and-Research Institute of Physical Culture and Sports, Ukraine

High level of sports results in fencing mainly depends on the level of speed-strength fitness of athletes. Aim of work - to determine the optimum amount of weights utilized in special preparatory exercises for development of speed-strength capacities in skilled fencers.

16 skilled fencers served as the subjects of studies. 2 groups of athletes (8 in each group) performed special preparatory exercises aimed at the development of speed-strength capacities, during training sessions 5 days per week for the period of 4 weeks. 1st group used the weights in the range of 20% of maximum muscle strength, whereas the second one - in the range of 40%. Both programs were the same in physiological cost determined during preliminary studies according to total time of heart rate recovery during training session and mean value of heart rate during work.

Results. Multiple repetitions of training sessions for development of athlete's speed-strength capacities being different in the amount of utilized weights and equal in physiological cost have resulted in different increase of indices characterizing special work capacity of athletes. Utilization in special preparatory exercises of weights in the range of 20% of maximum strength has contributed to preferential development of dynamic strength, speed of single movement, maximum frequency of movements and speed endurance, whereas weights in the range of 40% of maximum strength have promoted to preferential development of maximum static strength The process of special work capacity development as a result of prolonged utilization of special preparatory exercises has been characterized by rather phases than linear character. Phase of fluctuations of increase in the range of initial level, phase of intensive increase, phase of stabilization in the range of achieved level. Besides, the following body adaptation changes have been observed: repeated utilization of training sessions with weights have been accompanied with decrease of heart rate response to suggested loads which is indicative of positive training effect; recovery processes during training sessions have occurred faster reaching the lowest indices by the end of studies; indices of latent time of muscle tension and relaxation during performance of special preparatory exercises have decreased in all measurements, however, the greatest reduction of latent time of tension has been noted as a consequence of usage of weights in the range of 20% of maximum strength, whereas that of latent time of relaxation - during usage of weights in the range of 40%; precision of coordination structure of movements in subjects during special preparatory exercises performed with weights in the range of 20% of maximum strength was higher than during utilization of weights in the range of 40%.

Conclusion. Obtained data may be used for development of speed-strength capacities in fencers during weekly (3-5 sessions) and monthly (10-12 sessions) cycles of training process.

DIFFERENT PHYSICAL, PHYSIOLOGICAL AND BIOMECHANICAL DETERMINANTS OF SWIMMING PERFORMANCE IN YOUNG SWIMMERS

Jürimäe, T., Lätt, E., Haljaste, K., Cicchella, A., Purge, P., Leppik, A., Jürimäe, J.

University of Tartu, Estonia

The performance in swimming has been related to different anthropometrical, physiological and biomechanical parameters in adults. Specifically, maximal performance in swimming depends on the amount of metabolic energy spent in transporting the body mass of the athlete over the unit of swimming distance and on the economy of locomotion. Very few studies have investigated the importance of different anthropometrical, physiological and technical parameters to determine swimming performance in children. To our knowledge, no studies have performed to investigate the energy cost of swimming (Cs) in prepubertal swimmers. In addition, the changes from prepuberty to puberty are important and include different anthropometrical, physiological and mechanical parameters. The purpose of this study was to examine the influence of Cs, anthropometrical/body composition and technical parameters on swimming performance in young swimmers. Twenty nine swimmers, 15 prepubertal (11.9±0.3 yrs; Tanner stages 1-2) and 14 pubertal (14.3±1.4 yrs; Tanner stages 3-4) boys participated in the study. Cs and stroking parameters were assessed over maximal 400 metre front crawl swimming in a 25 metre swimming pool. The backward extrapolation technique was used to evaluate peak oxygen consumption (VO2max). A stroke index (SI; m.2 s.-1cycles-1) was calculated by multiplying the swimming speed by the stroke length. VO2max results were compared with VO2max test in the laboratory (bicycle: 2.86±0.74 l.min-1 vs on-water: 2.53±0.50 l.min-1: R2=0.713; P=0.0001). Stepwise regression analyses revealed that SI (R2=0.898), on-water VO2max (R2=0.358) and arm span (R2=0.454) were the best predictors of swimming performance. In summary, the results of our study suggest that the backward extrapolation method for the assessment of VO2max after maximal 400 metre front crawl swimming in prepubertal and pubertal swimmers is a valid method and may be of value in the training and testing programmes for competitive young swimmers. The evaluation of Cs in young swimmers allows the estimation of energy expenditure during swimming training and could be used to evaluate the training load taking into account both aerobic and anaerobic pathways of energy production. The SI, arm span and VO2max appear to be the major determinants of front crawl swimming performance in young swimmers.

Poster presentation (PP)

PP2-03 Health and Fitness 1-5 - "Exhibition Hall"

THE INFLUENCE OF EXPERIENCE OF WEARING HIGH HEELED SHOES ON POSTURAL CONTROL

de Melo, F., Crisóstomo, R., Cabri, J.

Faculdade de Motricidade Humana, Portugal

The use of high heeled shoes is related to degenerative muscle and joint alteration (Kerrigan et al. 1988), as well as to different biomechanical parameters (step length and width, center of mass position) (Snow et al., 1994).

The risk of falls is known to increase in women, usually wearing high-heeled shoes, who change to flat-heeled shoes (Chang et al., 1994). However, there is not enough knowledge concerning the area of contact between the heel and the ground, in tasks needing balance and postural control.

The purpose of this study was to understand the influence of daily life experience in wearing different shoe formats on postural control tasks.

Thirty-six women aged 21 to 53 years old, were divided into three groups: 13 experienced in flat shoes (EFH group), 12 experienced in wide high-heeled shoes (EWH group), and 11 experienced in thin high-heeled shoes (ETH group). The protocol used included: Limits of Stability, Walk and Weight Bearing tests. We compared the directional control, reaction time, and postural sway in both anterior-posterior and lateral directions during standing and walking. All tests were performed using a Balance Master System (Neurocom Inc, USA) and the data (reaction time, movement amplitude and speed of the center of gravity) were acquired from the system test reports.

The results show that forward movements are safer in flat heels. In wide heels the EFH group have more problems moving forward and sideways. For the EWH and ETH groups, the more experienced they are, the worse sideway postural control in flat heel is present. Reaction time and sway amplitude are related with the time spent wearing wide high heeled shoes. (the more the time, the greatest the reaction time and sway amplitude). The ETH group reduced anterior-posterior displacements when wearing wide high-heeled shoes.

We may conclude in our study that with experience the risk of falling at gait ending increases (higher velocity and end sway) when wearing heels different in comparison to those one is used to. Using flat-heeled shoes, gait steps are wider in order to compensate an increase of the reaction time in the lateral direction. In conclusion, it may be stated that implementing specific training programmes may be improve the performance of lateral movements, especially in women wearing high heels. Furthermore, the use of sports footwear with higher heels may also be recommended as a means to prevent foot and ankle injuries in this habitual population.

REFERENCES

Chang MW, Wong E, Richards T (1994). Footwear and falls: A case involving New Cowboy Boots. Archieves of Physical Medicine and Rehabilittion 75: 1266-1268

Kerrigan DC, Tood MK, Riley PO (1988). Knee osteoarthritis and high-heeled shoes. Lancet 351 (9113): 1399-1401

Snow RE, Williams KR (1994). High heeled-shoes: Their effect on Center of mass position, posture, three-dimensional kinematics, rearfoot motion, and ground reaction forces. Archieves of Physical Medicine and Rehabilitation; 75: 568-576.

PHYSICAL ACTIVITY OF THE FEMALE STUDENTS OF THE UNIVERSITY OF THE THIRD AGE (U3A) AT WROCLAW UNIVERSITY AND SELECTED PARAMETERS OF THE BODY COMPOSITION

Ignasiak, Z., Żurek, G., Dąbrowska, G., Wnuk, W.

University School of Physical Education, U3A at the Wroclaw University, Poland

Introduction. The progress in many fields of science and improving medical care result in the growing number of elderly people. At the same time, it is important that living in their Third Age seniors enjoy full physical fitness. Hence the emphasis in scientific literature, on the significance of physical activity of the Third Age people.

The aim of the work was to measure the amount of physical activity of seniors – students at the U3A in Wroclaw according to BMI.

Material and methods. 116 people were researched all together, of whom the results of 101 women (= 75,6 old) were used. The body height and weight was measured, and on this base BMI was counted. With the help of an apparatus for measuring the body composition (FUTREX) a percentage content of the fatty tissue and the lean body mass (LBM) was determined. An interview was conducted to obtain the information concerning the level of the physical activity of subjects, i.e. inquiring about the frequency, intensity, and duration of their weekly physical exercise. The subjects were divided into two groups: one constituted by people whose BMI was lower than 25 and the other constituted by women of BMI higher than this value.

Results. The average values in both aforementioned groups differ significantly in all the somatic features compared as well as in body composition, however, no difference was observed in the level of physical activity. Subsequently, the measures of somatic development were correlated (Spearman correlation) with the level of physical activity.

The results show a stronger negative relationship between the amount of the fatty tissue and the declared level of physical activity in the group of higher BMI. In the group of subjects whose BMI was lower, the positive relationship was found between the lean body mass and the level of physical activity.

POSSIBILITIES OF THE EVALUATION OF THE QUALITATIVE STATUS OF MUSCLE TISSUE BY A MOLECULAR MODEL OF BODY COMPOSITION

Skorocká-Seflová, I., Bunc, V., Mahrová, A., Hráský, P., Balás, J., Cingálek, R.

Charles University Prague, Faculty of Physical Education and Sport, Czech Republic

Introduction: The monitoring of the body composition changes; particularly the monitoring of the percentage of body fat and lean body mass has become a frequent component of not only the clinical assessment of the health condition, but also of training practices. Besides the basic parameters of the body composition we can measure - by using the multi-frequency bioimpedance equipment - the extracellular mass (ECM) and the body cell mass (BCM). The proportion between ECM and BCM is clinically routinely used as one of the most sensitive indexes of the nutritional state, indicating e.g. malnutrition (Talluri et al., 1999). In our study we monitored the changes of ECM, BCM and its ratio in healthy men who attended regularly physical activities.

Methods: This study was carried out on 1938 healthy male' participants (age 5-60 years, mean age 22.0 ± 9.05 years, body mass 23.0 - 96.3 kg, mean values 72.3 ± 12.7 kg, body height 1.24 – 1.97 cm, mean values 178.6 ± 9.8 cm). They attended regularly physical activities at least 3 times in a week. We divided the participants into 7 age groups (Infants I. – 6 – 11 years, n = 30; Infants II. – 11 – 15 years, n = 149; Juveniles – 15 – 18 years, n = 572; Adults – till 30 years, n = 962; Matures I. - till 45 years, n = 197; Matures II. - till 60 years, n = 28). In the groups we estimated ECM, BCM and its ratio, body fat, lean body mass and total body water derived from whole–body bioimpedance measurement at different frequencies – 1, 5, 50 and 100 kHz (B.I.A. 2000M, Data Input, Germany).

Results: In the groups of participants we measured these results: Infants I. – BCM 15.7 ± 3.2, ECM 15.2 ± 3.2, ECM/BCM 0.97 ± 0.09; Infants II. –, BCM 27.5 ± 6.5, ECM 23.0 ± 4.3, ECM/BCM 0.85 ± 0.11; Juveniles – BCM 34.9 ± 4.6, ECM 26.3 ± 3.2, ECM/BCM 0.76 ± 0.09; Adults – BCM 38.5 ± 4.8, ECM 27.5 ± 3.4, ECM/BCM 0.72 ± 0.09; Matures I. - BCM 38.2 ± 6.5, ECM 27.9 ± 4.6, ECM/BCM 0.73 ± 0.08; Matures II. - BCM 33.7 ± 6.0, ECM 28.1 ± 4.7, ECM/BCM 0.82 ± 0.11.

Discussion and Conclusion: The results of the ECM/BCM ratio show in all age categories lower values in the physical actives than in the normal population (B.I.A. 2000M).

We observed the lowering of values ECM/BCM from the infants to adults. The lowest values of ECM/BCM were measured in the categories adults and mature I. These changes are significantly different ($p<0.01$) and are accompanied by characteristic changes of ECM.

References:

BUNC, V. et al. In Vivo Body Composition Studies, 2000; S203-204.

TALLURI, T. et al. Ann NY Acad Sci. 1999; S94-8.

EVALUATION OF SENIOR SPORT OFFERS IN SWITZERLAND: A PILOT STUDY

Wanner, M., Martin, B., Wyss, T., Schneider, A.

Swiss Federal Office of Sports, Switzerland

Background: In Switzerland several different organisations offer a wide range of physical activity and sport courses for seniors. These are well known in the Swiss population. However, the variety of sport offers for seniors has not yet been systematically evaluated.

Objective: In this pilot study the feasibility of evaluating senior sport offers was investigated and preliminary data were collected on the participant's profile.

Methods: In structures volunteering for this study, seven open-end courses (gymnastic clubs, N=112, no refusals), two 10-week courses (aqua gymnastics, N=17, response rate 85%) and one 1-week course (different sports, N=71, response rate 92%) participated in the questionnaire survey. Data were obtained on course satisfaction, expectations, level of physical activity and characteristics of the participants. Different aspects of overall course satisfaction were assessed such as organisation, competence of the instructor, atmosphere among the participants, motivation to be physically active outside the course.

Results: The mean age was 67.2 years in the open-end courses, 57.0 years in the 10-week courses and 68.2 years in the 1-week course. The proportion of women was 96.1%, 100% and 66.2% in the open-end courses, the 10-week courses and the 1-week course, respectively. 48.4% of participants in the open-end courses and 60.5% of participants in the 1-week course were sufficiently active according to the physical activity recommendations in Switzerland compared to 35.9% in the general Swiss population (1). None of the participants were classified as completely inactive, compared to 19.4% in the general Swiss population (1).

In the three types of courses, between 73.2% and 100% of the participants were very satisfied with the course, 99% were at least rather satisfied. The proportion of individuals at least rather satisfied ranged from 88% to 100% for organisation, competence, atmosphere and motivation. In both the 10-week courses and the 1-week course, the participant's expectations were met or exceeded (as assessed in the beginning and at the end of the course).

Conclusions: A questionnaire survey appears to be a feasible and well accepted method to obtain data from participants of senior sport offers in Switzerland. Preliminary data suggest that very active elderly people are currently reached by senior sport courses. The results have to be confirmed in larger samples. It remains a challenge to reach other segments of the senior population while maintaining the excellent satisfaction of participants.

1. Stamm H, Lamprecht M. Structural and cultural factors influencing physical activity in Switzerland. Journal of Public Health 2005;13(4):203-211.

RELATIONSHIP BETWEEN MEASURES OF BODY FATNESS AND AEROBIC POWER IN CHILDREN

Stavrinou, P., Theos, A., Papaspyrou, A., Bogdanis, G.C., Maridaki, M.

University of Athens, Greece

Introduction

Child obesity is associated with several risk factors for chronic diseases, particularly when obesity is combined with inactivity. The purpose of the present study was to examine the relationship between obesity estimated by body mass index (BMI), percent body fat (%BF) and aerobic fitness.

Methods

Seventy seven children (38 boys and 39 girls, age: 11.3 ± 0.8 years, height: 147 ± 1 cm, weight: 43.3 ± 1.2 kg, mean±SE) were tested in this study. Aerobic power (VO2max) was estimated from a 1000 m running test (Klissouras, 1973), while %BF was estimated according to the equations of Slaughter et al. (1988). The running test was performed twice and the best time was recorded. Body mass index (BMI; weight/height2) was converted to percentiles (adjusted for sex and age) according to the LMS method (Cole et al., 2000). Values between the 85th and the 95th percentile were taken to indicate risk of overweight, while values greater than 95th percentile were considered to indicate obesity.

Results

There was no significant difference between boys and girls in height (147 ± 1 vs. 148 ± 1 cm), body mass (45.0 ± 1.7 vs. 41.7 ± 1.6 kg) and VO2max relative to body mass (51.2 ± 1.4 vs. 48.9 ± 1.3 ml/kg/min). BMI and %BF were also higher in boys compared to girls (20.6 ± 0.5 vs. 18.8 ± 0.5 kg/m², $p<0.05$ and 23.3 ± 1.4 vs. 19.5 ± 1.1 %, $p<0.05$ respectively). The percentage of the children being at risk of overweight was 10% for the boys and 5% for the girls. The %BF was negatively correlated with VO2max ($r = -0.40$, $p<0.01$, $n=77$), and positively correlated with BMI ($r = 0.83$, $p<0.01$).

Discussion

The results of this study suggest that BMI is a reliable indicator and can be used as a measure of fatness in children. Furthermore the negative relationship between %BF and VO2max indicates that child obesity may be accompanied by decreased aerobic fitness.

References

Cole, T.J., Bellizzi, M.C., Flegal, K.M., Dietz, W.H. (2000). Establishing a standard definition for child overweight and obesity worldwide: international survey. Br. Med. J., 320: 1240-1243.

Klissouras, V. (1973) J. Sports Med., 13: 100-107.

Slaughter et al. (1988) Hum. Biol., 60: 709-723.

EFFECT OF NUTRITION, PSYCHOLOGY, AND DAILY LIFESTYLE ON ATHLETIC PERFORMANCE

Michiko, M., Haruo, S.

Nara Woman's University, Japan

The best assessments for improving of athletic performance, is to include that the results of psychology, dietetics and medicine.

This study was intended to clarify factor that contribute to conditioning and performance for athletes.

Methods

The subjects were soccer players (89 boys, 15-17years old) in Japanese high school. The athletic level is national convention participation school for 2004 years.

The measurement: nutritional states are carbohydrate, protein, V.B1, V.B2, niacin, Ca, iron. Psychological conditions are depression, conclusion, angry, tension and vigor (POMS-test). And life states are appetite, fatigue, and physical condition. In addition, the performance evaluations of the subjects from coaches were checked for the test reliability. A multivariate analysis was used as statistics (spss 11.0 J for Windows).

Results and discussion

1) The subjects categorized a regular player and an irregular player. The results based on discriminant analysis to examine a difference of a performance.

Results were extracted in order of protein, carbohydrates, calcium, V.B2, niacin, V. B1, depression, as nutrition factors.

Protein and carbohydrate are nutrient of an energy source of supply. Calcium is the nutrient, which is necessary for contraction of the muscle of exercise. And V.B1, V.B2 and niacin are the nutrient which are important for energy metabolism1) .

Depression is regarded as an important factor related to psychological self-control, and it is thought that a psychology skill to maintain mental stability is important for the better athletic performance2).

2) As results of statistically analysis of depression by using multiple regression, depression measure was the positive correlation with physical condition and negative correlation with carbohydrate statistically showed. It was thought that feelings and a change of emotion influenced athletic performances. As carbohydrate was energy source of exercise, an intake of carbohydrates promoted secretion of a hormone, it reduces tension and anxiety3).

In this study, the importance of carbohydrate intake was accepted as to reduce, in which depression was dependent variable.

3) The performance scores evaluated by coaches were statistically different with high-depressed group and low-depressed group. That is high-depressed group was showed some feelings of heavy body movement and fatigue by coaches.

Reference

1)Yasuo kishino: Exercise・Sports and nourishment physiology, basic relations of a nutrient. Japan clinical sports medicine Vol.13,p2-7,1996.

2)McMair.D.M.,Lorr.M. and Droppleman.L.F：Profile of moos states manual.

San Diego.CA：education & Industrial Testing Serris.1971.

3)Kotani Yasunori: Emotion and a performance to examine from a brain. Science of physical education Vol.1.2006.

IMPROVING PHYSICAL ACTIVITY AMONG PATIENTS IN TREATMENT FOR PSYCHOGENIC OBESITY AND BINGE EATING DISORDER

Carraro, A., Schiavone, P., Fiorellini, A.

University of Padua and Casa di Cura Parco dei Tigli, Italy

Obesity is a chronic multifactorial condition in which excess body fat may expose the individual to serious health risk (e.g. diabetes mellitus, hypertension, heart disease, etc.) and to severe alteration of the psychosocial functioning and quality of life. Moreover it can be associated with disordered eating, as overeating or binge eating disorder, depression, low self-esteem and impulsivity. This coexistent psychopathology may worsen the treatment outcome and produce early relapse.

Basic treatment of overweight and obese patients requires a comprehensive approach involving diet, regular physical exercise and cognitive and behavioural changes, with an emphasis on long-term weight management rather than short-term excessive weight reduction. The intrinsic motivation is one of the most important factors supporting the compliance with patients in treatment, in particular, the motivation to physical activity and the change in the attitude of patients towards physical experience are determining elements of the weight control treatment success (Berger, 2004; Dietz, 2004).

In a clinical psychiatric setting, we have been running a program of adapted physical activity (APA) for overweight and obese in-patients with psychiatric symptomatology. We have developed a specific multidimensional program for these patients including an energy-restrict diet, individualized physical activity daily program, nutritional education, together with individual and group cognitive-behavioural psychotherapy. The chief aims of our obesity APA program are: ameliorate the physical conditions, improving the exercise capability, the readiness to the physical activity, self-esteem, and increasing social relationships.

Our sample consisted of 35 inpatients (5 male e 30 female) with a mean age of 37,5 years (SD=14,4). The most frequent psychiatric diagnosis were Binge eating disorders and Borderline PD. On the basis of the BMI estimate 5 patients presented an overweight, 9 were in obesity class I, 7 were in class II and 14 were in class III; the mean BMI was of 39.23 kg/m2 (SD=8.5). Results have been evaluated with several tools, including: bio-medical parameters, improving BMI, psychometric scales (SCL-90, University of Rhode Island Change Assessment Scale, Dieter's Temptations of Eating Inventory, Body Image Avoidance Questionnaire, SF-36, Borg scale), physical measurement, recording of fitness performance, and specific observation for physical activity patterns. The results obtained so far are compatible

with the recommendations of the international guidelines for the cure of obesity(NHI, 1988): the mean weight loss was 5.9 kg corresponding to 5.5% of the initial weight.
Our findings lead us to support that a specific interview to support the motivation and the regular participation to physical activity could be an important functional element within a multidimensional therapy program aimed at the treatment of obesity with psychiatric comorbidity.

SEDENTARY BEHAVIOUR, PHYSICAL ACTIVITY AND THE METABOLIC SYNDROME AMONG FLEMISH ADULTS

Philippaerts, R.M , Wijndaele, K., Duvigneaud, N., Matton, L., Thomis, M., Duquet, W., Lefevre, J.

Ghent University, Belgium

The metabolic syndrome (MS) is considered to be an important public health problem, but until now less studies investigated relationship between MS and physical (in)activity. Purpose: We examined the association between sedentary behavior, physical activity and the prevalence of MS in Flemish adults. Methods: This study involved 1570 Flemish adults aged 18 to 75, including three study cohorts of the Policy Research Centre Sport, Physical Activity and Health (902 men, 668 women). MS was defined according to the 2005 International Diabetes Federation Definition. The Flemish Physical Activity Computerized Questionnaire was used to assess time spent in moderate to vigorous leisure time physical activity (MVLPA) and watching television/video and computer games (SB). Cut offs for MVLPA were 0, <3, and ≥3 h/week. Cut offs for SB were <14, 14 to 21, and ≥21 h/week. Subjects performing at least 3 h/week of MVLPA (age-specific MET-values) or watching less than 14 h/week were considered as reference groups. Binary logistic regression was used to calculate odds ratios (OR) and 95% confidence intervals. Results: Age-adjusted analysis showed that men who did not engage in MVLPA had almost twice the odds of having MS [OR, 1.83; 95% CI, 1.13-2.97]. Multiple adjustments (age, cohort, education, smoking, alcohol, height, SB) revealed the same results [1.86; 95% CI, 1.13-3.04]. Men engaged in less than 3 h/week had no significant OR for age and multiple adjustment respectively. In women, the same age-adjusted association between MVLPA and MS was found with OR for the three groups respectively [1.0] (referent), [1.03; 95% CI 0.59-1.82], and [1.98; 95% CI 1.09-3.60]. OR after multiple adjustments were similar. In men, age-adjusted OR for SB were [1.0] (referent), [0.66; 95% CI 0.42-1.02], and [1.09; 95% CI 0.72-1.65]. Additional multiple adjustment minimally affected the OR. In women, age-adjusted OR were [1.0] (referent), [1.65; 95% CI 0.92-2.99] for 14 to 21 h/week, and [2.66; 95% CI 1.44-4.94] for ≥21 h/week. Multiple adjustment resulted in the following OR, [1.0] (referent), [1.61; 95% CI 0.87-2.95] for 14 to 21 h/week, and [2.17; 95% CI 1.13-4.17] for ≥21 h/week. Conclusion: MVLPA and SB are independently associated with the prevalence of MS. Efforts to lessen the amount of time spent on watching television or using computer, and promoting a more active lifestyle could result in a substantial decrease in the risk of having the metabolic syndrome.
The Policy Research Centre Sport, Physical Activity and Health is supported by the Flemish Government.

COMPARISON OF EXERCISE AND DIETARY INTERVENTION ON HEALTH MARKERS IN PHYSICALLY INACTIVE POST-MENOPAUSAL WOMEN

Kimura, Y., Ohki, K., Nakagawa, N., Sato, T.

Saga University, Japan

Introduction

According to the WHO Report 2002, cardiovascular diseases are the most common cause of death in postmenopausal women in the western countries. The hormonal and metabolic changes during and after the menopause have a negative impact on various cardiovascular risk factors, including the lipid metabolism, thus promoting the development of the metabolic syndrome. Nutrition and physical activity are among the most important self-care behaviors that contribute to health and quality of life. Strength training (ST) is a specific physical activity for the neuromuscular system, but health effects of ST in women, especially in aging women, are less well known. Therefore, this study was designed to evaluate the effects of an individualized, combined exercise and dietary intervention on health markers in physical inactive postmenopausal women.

Methods

35 postmenopausal women (age: 62.1±5.5 years) with body mass: 60.6±8.1 kg, BMI: 25.4±3.6 kg/m2, body fat %: 31.2±5.6 %, waist to hip ratio (WHR): 0.84±0.2, total cholesterol (TC): 238±29 mg/dl, HDL-C: 76±18 mg/dl, LDL-C: 125±45 mg/dl and blood pressure (BP): 130.9±19.1/90.4±10.5 mmHg were randomly divided in three groups: 1) ST and nutritional counseling (ST+N, n=12), 2) ST and no-nutritional counseling (ST+O, n=13) and 3) no-ST and no-nutritional counseling (CONN, n=10). Two-week instruction was given to guarantee sufficient energy and proper balance of nutrients. Moderate gymnastics and supervised progressive ST with loads of 45-75% of 1 RM were performed two times a week for 12 weeks. A bicycle ergometer test was performed to determine the physical performance (at 2 mmol/l lactate) and leg strength also measured. Bone health markers (osteocalcin: BGP, pyridinoline: PYR and deoxypyridinoline: DPD) also included. These measurements were examined at the beginning of the study, after six and after 12 weeks.

Results

Leg strength increased significantly ($p<0.01$) in ST+N and ST+O by 23.8±8.5%, 25.7±5.6%. Serum concentrations of TC decreased significantly ($p<0.01$) in ST+N and ST+O by 12.0±3.5%, 9.6±2.5%, HDL-C increased in ST+N and ST+O by 9.2±2.3%, 8.8±3.8%, and LDL-C decreased in ST+N and ST+O by 14.1±3.1%, 13.7±3.4%. In body composition variables, BMI decreased significantly ($p<0.05$) in only ST+O by 4.2±1.7 and body fat % decreased significantly ($p<0.05$) in ST+N and ST+O by 14.8±3.5%, 13.7±3.8%. Physical performance capacity (2.0 mmol/l lactate) was significantly ($p<0.01$) increased in ST+N and ST+O from 55±21 to 62±10 watts, from 58±18 to 67±21 watts. GBP/PYR increased significantly ($p<0.05$) in only ST+O from 0.31±0.09 to 0.34±0.07. CON had no significant influence on any parameters. The positive effects of a combined exercise and dietary intervention result in a significant and clinically considerable improvement of the total health markers.

Conclusion

In conclusion, ST favorably affected health markers, and nutritional counseling even contributed to these positive changes.

ASSOCIATIONS BETWEEN REGIONAL MUSCLE MASS, MUSCLE FUNCTION, AND BONE MINERAL DENSITY IN POST-MENOPAUSAL WOMEN

Sanada, K., Miyachi, M., McGrath, K.F., Tabata, I., Usui, C., Higuchi, M.

Institute for Biomedical Engineering, Japan

Although a number of studies have reported the relationship between muscle function (strength and/or power) and bone mineral density (BMD), there is little scientific information on the effect of increased regional skeletal muscle (SM) mass on these factors in postmenopausal women. The purpose of this study was to investigate the relationships between SM mass, muscle function and BMD in postmenopausal women, and to determine the predictors of regional BMD using SM mass, muscle function and a physical activity questionnaire. Healthy Japanese postmenopausal women (n=62) aged 48-76 yrs participated in the study. Leg extension power (LEP) and handgrip strength (HGS) were measured in all subjects. Muscle thickness (MTH) was determined by ultrasound spectroscopy, and total or regional SM mass (arm, trunk, and leg) was estimated based on the 9 sites of MTH. Total and regional lean soft tissue (LST), fat mass, BMD (total body, arms, legs, and lumbar spine) were measured using Dual-energy X-ray absorptiometry (DEXA). The NASA/JSC physical activity scale (PAR), a questionnaire method, was used to survey the subject's physical activity. Total LST was significantly correlated with the total or site-matched regional BMD (r=0.42-0.45, P<0.001), and the relationships between SM mass and the total or site-matched regional BMD (r=0.44-0.47, P<0.001) corresponding to LST. When MTHs were adjusted to the years since menopause, the anterior upper arm (r=0.50, P<0.001), abdominal (r=0.36, P<0.01) and posterior thigh MTH (r=0.31, P<0.05) were significantly correlated with the site-matched regional BMD. Both absolute HGS and normalized (for arm SM mass) values were significantly correlated with arm BMD. Absolute LEP (W) was significantly associated with the leg BMD. Lumbar spine BMD, but no other sites, was significantly correlated with PAR (r=0.44, P<0.001). Stepwise regression analysis on LEP and PAR for the prediction of lumber spine BMD (r = 0.59, SEE = 0.087, P < 0.001), and on total SM mass and normalized LEP (for leg SM mass) for the prediction of leg BMD (r = 0.59, SEE = 0.089, P < 0.001) produced significant findings. The associations between SM mass estimated by ultrasound and total or site-matched regional BMD were comparable to the lean soft tissue values measured by DEXA. LEP, PAR and SM mass are independent predictors of trunk and leg BMD in postmenopausal women.

EFFECT OF THE EXERCISE MODE ON THE OXYGEN UPTAKE KINETICS DURING HIGH INTENSITY EXERCISE IN CHILDREN

Machado, F., Guglielmo, L.G., Greco, C.C., Denadai, B.S.

Universidade Estadual Paulista - Unesp, Brazil

INTRODUCTION: The slow component (SC) of the oxygen uptake (VO2) is the additional oxygen cost presented in constant load exercises with intensities above the lactate threshold (LT). In adults, factors such as the aerobic training state and the exercise mode (running x cycling), can modify the SC. However, age effects on the SC are still conflicting. OBJECTIVE: To verify the effect of the exercise mode (treadmill running x exercise bike) over the time constant (Tau) and the SC of the VO2 in 11-12 year-old children who exercised in high intensity (75%r). METHOD: 20 looking healthy active boys (age = 11.48 ± 0.41 years old; body mass = 41.38 ± 10.45kg; height = 147.45 ± 6.56 cm), sexual maturation levels 1 and 2 (pubic hair) took part of this study. These children first took an incremental test on the running treadmill (RT) and on the exercise bike (EB) to determine the peak oxygen uptake (VO2peak) and the LT. To determine the VO2 kinetics two six minutes step-change were taken in each ergonometric in 75%r intensity [75%r = LT + 0.75 x (VO2peak – LT)]. RESULTS: The VO2peak (45.16 ± 5.98 x 42.93 ± 7.51 ml/kg/min) and the maximal heart rate (196.5 ± 6.98 x 187.3 ± 9.27 bpm) were slightly higher in the RT comparing to the EB, respectively. The VO2 expressed in relative values to the body mass (31.82 ± 10.09 x 25.19 ± 7.36 ml/kg/min) and the VO2peak (69.83 ± 16.63 x 58.96 ± 14.55%) and the heart rate (150.5 ± 17.75 x 131.3 ± 12.98 bpm) corresponding to the LT also were slightly higher in the RT comparing to the EB, respectively. The SC expressed in absolute values (165.79 ±139.93 x 95.86 ± 77.68 ml/min) and as the percentage contribution of the CL to the VO2 increment at the end of the exercise (12.0 ± 9.0 x 7.0 ± 5.0%) were slightly higher in the EB comparing to the RT, respectively. However no differences were observed related to Tau in both exercise mode (RT = 18.83 ± 4.36 x EB = 19.94 ± 7.57 sec). CONCLUSION: Just like what was observed in adults, the SC of the VO2 is dependent on the exercise mode (EB x RT) during high intensity exercise in children.

KEY-WORDS: slow component, children, running, cycling.

REFERENCES

Carter, H. et al. Oxygen uptake kinetics in treadmill running and cycle ergometry: a comparison. J Appl Physiol. 89: 899-907, 2000.

Casaburi, R. et al. Effect of endurance training on possible determinants of VO2 during heavy exercise. J Appl Physiol. 62: 199-207, 1987.

Cooper, D. M. et al. Kinetics of oxygen uptake and heart rate at onset of exercise in children. J Appl Physiol. 59 (1):211-7, 1985.

Fawkner, S. G. & Armstrong, N. Oxygen uptake kinetic response to exercise in children. Sports Med. 33 (9): 651-69, 2003.

Fawkner, S. G. Oxygen uptake kinetics in children (dissertation). Exeter: University of Exeter, 2002.

Gaesser, G. A. & Poole, D. C. The slow component of oxygen uptake kinetics in humans. Exerc Sport Sci Rev. 24:35-71, 1996.

THE EFFECT OF 8 WEEKS MAXIMAL AND SUB MAXIMAL (INTERVAL AND CONTINUOUS) EXERCISE ON HEMATOLOGICAL PARAMETERS IN FOOTBALL PLAYERS ON YOUNG MALE 16-19 AGED

Jahani, G., Tarverdizadeh, B., Azarbaijani, M.A.

Islamic Azad University,Branch of Abhar, Iran

Some study were to investigate the effect of maximal or sub maximal (interval or continuous) exercise on hematology parameter in athletic, whereas, there are no many study about the effect of compound exercise on blood parameters in athletic .therefore, the purposes of this study were to investigate the effect of 8 weeks maximal and sub maximal (interval and continuous) exercise on hematological parameters in football players on young male 16-19 aged.

Materials and methods

Experimental design: cross sectional study to investigate the response of hematological parameters to the 8 weeks compound exercises in football players.

Participants: Twenty four healthy, physically active, football players Fajre club in Tehran.

Young male aged 16-19 years. In sub maximal (continuous) exercise they were allowed to continue the program with 60-70% VO2max, heart rate reached 120-170/min.

In maximal (interval) exercise were instructed to intensity exercise until exhaustion with 80-90% VO2 max. Heart reached over 170/min.

Blood sample were withdrawn from antecubital vein in to the E.D.T.A tubes immediately after resting fasted in the morning. Then participants trained at least 45-90/min /day for 8 weeks and antecubital vein blood sample were obtained after 24 hours rest and fasted in the morning.

Results

Analyzing of the data showed:

1. There was a significant difference in R.B.C, Hb, HCT, W.B.C, M.C.H and M.C.V response of football players to compound exercise.

2. There was no a significant difference in M.C.H.C and P.L.T response of football players to compound exercises.

3. there was a increase 5.39% in R.B.C, 4.52% in H.b , 2.97% in H.C.T , 7.99% in W.B.C ,2.03% in M.C.H and 91% in M.C.V after 8 weeks compound (interval and continuous) exercise in young football players .this increase was a significant difference in blood parameters .

4. There was a increase 4.41% in P.L.T and 21% in M.C.H.C after 8 weeks compound (interval and continuous) exercise in young football players .this increase was no significant difference in blood parameters.

Conclusions

The aim this work was to investigate the resting levels responses of hematological parameters e.g. red blood cell (R.B.C),hemoglobin(H.B) , hematocrite (H.C.T),white blood cell(W.B.C), mean corpuscular volume (M.C.V), mean corpuscular hemoglobin (M.C.H) , mean corpuscular hemoglobin concentration (M.C.H.C)and platelets (P.L.T), ratio to 8 weeks compound exercise .

A number of studies have demonstrated considerable hematological parameters changes during and after exposure to different environmental, physiological conditions and acute exercise or endurance training.

BIOCHEMICAL AND ANTROPOMETRICS VARIABLES AND THEIR ASSOCIATION WITH THE BLOOD PRESSURE IN MEN

Brito, C.J., Lima, W.A., Glaner, M.F.

Catholic University of Brasilia, Brazil

Elevated levels of body lipids are linked to the increase of serics concentrations of cholesterol, which can rise the systolic blood pressure (BP) and, consequently, develop a cardiovascular disease (Bonora et al., 2003). This study aimed to verify the influence of biochemical and anthropometrics variables on the BP. Were measured 123 men, age 35.8+/-10.4 years, body mass 73.4+/-11.4kg and %fat 20.9+/-8.6. The anthropometrics variables used as predictors were waist circumference (WC) and topography of fat (%Garms, %Glegs and %Gtrunk - dual energy X-ray absortometric). WC was measured on 2.5cm above the umbilical scar. The biochemical variables used as predictors were glucose (G) and seric cholesterol (SC), very low density lipoprotein (VLDL), low density lipoprotein (LDL), high density lipoprotein (HDL) and triglycerides (TG). These variables were dosed after fast of 12 hours by the enzymatic method with semiautomatic spectrophotometer. The adopted statistical treatment was the multiple linear regression by the stepwise method ($p < .05$). The values of the measured variables were: WC = 87.5+/-10.6cm, %Garms = 12.5+/-6.7, %Glegs = 20.4+/-8.2, %Gtrunks = 23.5+/-10.2, SC = 168.9+/-35.4mg/dL, G = 93.6+/-12.0mg/dL, VLDL = 34.9+/-32.4mg/dL, LDL = 99.2+/-32.1mg/dL, HDL = 39.4+/-10.4mg/dL, TG = 152.4+/-89.3mg/dL, BP = 132.4+/-18.4mmHg. Among the variables used as predictors of the BP, the WC by itself influenced in 27.5% ($p < .0005$), WC and SC, together, in 31% ($p < .015$) and WC, SC and %Garms, together, in 34.6% ($p < .011$). While WC and SC influenced directly, the %Garms influenced inversely. The other predictors variables did not influence, in a significant way, the BP ($p > .05$). As the WC and the SC increase and the %Garms decreases, the subjects appraised present higher BP. Therefore, in conclusion: the measure of WC is a good indicative of BP; the excessive accumulation of fat on the trunk must be controlled, with the intention of avoiding risk factors associated with cardiovascular diseases, like the BP.

Bonora, E. et al. Diabetes Care 2003: 36(4): 1251-1257.

R.O.M. IMPROVING EXERCISES IN PHYSICALLY INDEPENDENT ELDERLY WOMEN: STRETCHING VS DYNAMIC FLEXIBILITY

Lanza, M., Fracca, I.

University of Verona, Faculty of Exercise and Motor Science, Italy, Italy

Introduction

Flexibility is one of the most important health related physical activity for Older People (ACSM, 1998) but there are no detailed guidelines about dose and types of exercises needed to improve Range of Motion (ROM) (Cotton, 1998). Researches show static stretching as the elective method for improving the ROM (Briant, 2003) but dynamic exercises, that includes bending, extension, rotation and circumduction of the joint, are frequently adopted. Aims of the research is to compare the efficacy of Static Stretching (SS) and Dynamic Flexibility Exercises (DFE) in ROM improving.

Methods

ROM changes with SS and DFE were measured in 66 Physically Independent Elderly Women (Age=66.3y; 56y - 81y; d.s.=5.34). Two days a week they attended a-one-hour physical activity session. It included 15 minutes of SS and DFE for flexibility. Others activities of the training were endurance, local muscular endurance, coordination and balance. Flexibility was evaluated through the Standing-Sit-and-Reach (SSR) and Back Scratch tests (BS). Subjects were divided in two groups (gr.A – gr.B), homogeneous for number, age and performance in flexibility test (gr.A:n.32; Age:66.4y, d.s.:5.10; SSR:-8.3; BS:-4.5cm. – gr.B:n.34; Age:66.2y, d.s.:5.6; SSR :-7.1; BS:-5.4 cm.). In the first three weeks ("Run In" Phase) the two groups carried out an equal activity. In the second four-week-phase (Improvement), in order to improve flexibility, gr.A adopted static stretching alone (gr.A-SS) while the gr.B used dynamic flexibility exercises (gr.B-DFE). In the third four-week-phase (Maintenance) the groups exchanged the methods (gr.A-DFE; gr.B-SS). In the final three-week-phase both the groups stopped activity (Detraining).

Results

Flexibility showed a meaningful improvement (SSR=2.09cm; BS=2.05cm; $p<0.001$) and no difference in the two groups. In "Detraining" flexibility showed a reduction (SSR=-0.83cm; BS= -0.83cm; $p<0.001$) and no difference in the two groups.

CAN INACTIVE YOUNG PEOPLE BE REACHED THROUGH AN INTERNET PROGRAMME TO PROMOTE PHYSICAL ACTIVITY?

Padlina, O., Jimmy, G., Martin, B.

Swiss Federal Office of Sports, Switzerland

Introduction

Feelok is an online health promotion programme for young people aged 12-18 (www.feelok.ch). It has been available since 2002 and includes sections on the following topics: smoking, cannabis, stress, self-confidence, alcohol, nutrition, and sexuality.

An additional section to promote physical activity among inactive youth was added in 2005 with support of the Swiss Federal Office of Sports.

The aim of the current study was to determine whether inactive young people could be reached through the internet medium and if they showed an interest in engaging in the programme.

Method

Three different sources were used to answer the above question.

1) When the section on physical activity had not been added to feelok yet, all visitors of the general feelok programme were asked how many times per week they engaged in sports outside school hours.

2) Once the section on physical activity was launched, a programme running in the background of feelok recorded user numbers and duration of visits to this section.

3) feelok also offers a physical activity test based on a 7-day recall questionnaire. The number of test participants classified as inactive was determined being those who accumulated less than 1500 kcal through physical activities during a week.

Results

1) The question on sports outside school hours was answered by 545 youths aged 10 to 19 (54% female, response rate 14.2%) during a 2 week time period. Twenty-five percent reported engaging in sports less than once a week.

2) The feelok physical activity promotion programme was visited 208 times for at least 3 minutes during a time period of 8 weeks. An average visit lasted 14 minutes.

3) Out of 378 youths aged 10 to 19 (64% females) who completed the physical activity test, 12% were classified as inactive.

Conclusion

Seeing that a quarter of visitors of the general feelok programme were rarely active in sports, it can be concluded that this kind of programme is a good starting point to reach the group of inactive youths. The number of 104 visits per month for the physical activity promotion programme is comparable to the use of partial modules for other health dimensions of feelok and shows that this programme attracted the interest of the young people. Among those who completed the physical activity test, 12% were classified as inactive which indicates that this group can be reached. However, more active recruitment measures may lead to a higher participation rate of the inactive.

NEW OPPORTUNITIES IN TOURISM, SPORT & LEISURE

Reverter, J., Barbany, J.R.

Zaragoza University, Barcelona University, Spain

The present crisis of the tourism industry can be considered as a logical consequence of its created core destination strategies which have been established in the period of mass tourism (1960-1990), and which lacked both a conceptual and a customer focus. Big socio-demographic shifts, health awareness and changes in consumer behaviour and values have become important determinants and critical factors of success for what might be termed "new tourism". The transformed tourist demand calls for new innovative products (Hinch & Higham, 2004)*. New tourism clusters in the field of sports and health will in consequence constitute the only way to package and offer a complete and holistic range of wellness services. The aim of this work is to make an integrated proposal of new opportunities in tourism, sport & leisure.

* Hinch, T. and Higham, J, (2004). Sport Tourism Development, Channel View, Clevedon.

BODY PUMP® INSTRUCTOR'S PEDAGOGICAL FEEDBACK – COMPARISON BETWEEN DIFFERENT EXPERIENCED LEVELS AND DIFFERENT ACADEMIC DEGREES

Simões, V., Franco, S.

Escola Superior de Desporto de Rio Maior, Portugal

Introduction

The propose of this study was to characterize the Body Pump® instructors pedagogical feedback and compare this behaviour type in instructors with different types of academics qualifications and with different levels of professional experience.

Two hypotheses were formulated:

There are significant differences among experienced and inexperienced Body Pump® instructors feedback.

There are significant differences among Body Pump® instructors feedback with superior degree and without superior degree in sport's area.

Methodology

The sample was constituted by 15 Body Pump® instructors: 10 experienced and 5 inexperienced; 5 licentiates and 10 non licentiates.

The feedback emitted by the instructors was observed through the record videos of the respective classes.

The pedagogical feedback observation systems (Piéron & Rodrigues, 1991, in Piéron, 1999; Sarmento et al. 1998; Schmidt & Lee, 1999) that were used had 7 dimensions with 24 categories. The recording tactic used was Event Recording.

Conclusions

In each dimension, the more frequently feedback types observed were: Verbal, Concurrent, Isolated, Positive Evaluation, to the Class (Inexperienced and Licensed Experienced) or Individual (Experienced Not Licensed), Positive Afectivity, and Feedback Followed by Observation.

It was verified that:

There aren't significant differences among Body Pump®'s Inexperienced instructors (inexperienced as Fitness instructors and Non Licentiates) and Body Pump®'s Experienced instructors (Non Licentiates), concerning the feedback type occurrence, except in the category Group, in that the Experienced instructors present larger frequency of feedbacks.

There are significant differences between the Non Licentiates Body Pump® instructors and the Licentiates (both Experienced), concerning the feedback type occurrence, in the following categories: Visual, Concurrent, Terminal Immediate, Isolated and Accumulated. Significant differences were not verified in the remaining categories. The Licentiates instructors emit more Visual, Immediate and Accumulated feedbacks and less Concurrent and Isolated, that the Non Licentiates.

References

Piéron, M. (1999). Para una Enseñanza Eficaz de las Actividades Físico-Deportivas. Barcelona: INDE Publicaciones.

Sarmento, P.; Leça de Veiga, A.; Rosado, A.; Rodrigues, J. & Ferreira, V. (1998). Pedagogia do Desporto. Instrumentos de Observação Sistemática da Educação Física e Desporto. Cruz Quebrada: Serviço de Edições da Faculdade de Motricidade Humana.

Schmidt, R. & Lee, T. (1999). Motor Control and Learning. Champaign, Il: Human Kinetics.

PARTICIPANTS' PERCEPTION AND PREFERENCE ABOUT BODY PUMP® INSTRUCTORS' PEDAGOGICAL FEEDBACK

Franco, S., Simões, V.

Escola Superior de Desporto de Rio Maior, Portugal

Introduction

The purpose of this study was to characterize and to compare participants' perception and preference about instructors' pedagogical feedback in the resistance training program Body Pump®.

Methodology

Sample subjects were 184 Body Pump® program participants.

A questionnaire about pedagogical behaviour was develop and validated, in the perception and preferences versions, based on 7 dimensions, and 24 categories, of pedagogical feedback behaviour observation systems (Piéron & Rodrigues, 1991, in Piéron, 1999; Sarmento et al., 1998; Schmidt & Lee, 1999). A five-point Likert-type scale was used to measure the 24 feedback categories, ranging from least frequent (1=Never) to most frequent (5=Always).

The minimum, maximum, mean and standard deviation was used in the descriptive analyses. Wilcoxon test was used to compare the participants' perception and preference.

Conclusion

In all dimensions, the feedback category that the participants percept and prefer as more frequent in Body Pump® instructors were the same.

When we compare the participants' perception and preference, concerning Body Pump® instructors' feedback, we found there were significant differences in 18 of the 24 categories.

In most of the feedback categories participants preferred that the Body Pump® instructors provide it more frequently, like in Franco et al (2004) study' about fitness instructors' profile, what can mean that the participants want to receive feedbacks more frequently.

References

Franco, S.; Cordeiro, V. & Cabeceiras, M. (2004). Perception and Preferences of Participants about Fitness Instructors' Profile – Comparison between Age Groups and Different Activities. Proceedings of the 9th Annual Congress of the European College of Sport Science. CD-rom. Clermont-Ferrand: ECSS.

Piéron, M. (1999). Para una Enseñanza Eficaz de las Actividades Físico-Deportivas. Barcelona: INDE Publicaciones.

Sarmento, P.; Leça de Veiga, A.; Rosado, A.; Rodrigues, J. & Ferreira, V. (1998). Pedagogia do Desporto. Instrumentos de Observação Sistemática da Educação Física e Desporto. Cruz Quebrada: Serviço de Edições da Faculdade de Motricidade Humana.

Schmidt, R. & Lee, T. (1999). Motor Control and Learning. Champaign, Il: Human Kinetics.

13 YEARS FOLLOW-UP OF PHYSICAL FITNESS IN FLEMISH NURSES AS MEASURED WITH THE EUROFIT TEST BATTERY

Zinzen, E., Watthy, C., Luyten, R., Vandevelde, P., Clarys, P.

Vrije Universiteit Brussel, Belgium

Introduction.

Low physical fitness is assumed to be one of the major factors contributing to an increased incidence of cardiovascular disease, diabetes mellitus, obesitas, musculoskeletal problems, …. There is evidence that increased physical activity increases physical fitness levels and decreases the risk for above mentioned diseases (Erikssen, 2001; Katzmarzyk et al., 2004). Burton et al. (2004) indicate in their European Guidelines for Prevention of Low Back Pain (LBP) that increasing physical fitness level is the most effective action in primary prevention for LBP. The nursing population is very sensitive for LBP.

The findings of Tsigilis et al. (2002) indicate that the Eurofit test (EUT) system yields reliable information for the determination of physical fitness.

Purpose.

The purpose of this study was to investigate – in a longitudinal way – the physical fitness level of nurses in a Flemish academic hospital. Do the scores on the EUT change over a period of 12 years, with no particular interventions in that field? Does back schooling, with an explicit accent on physical activity, improve the scores on the EUT after one year?

Methodology.

In 1992, 12 male and 25 female nurses of the academic hospital of the Vrije Universiteit Brussel volunteered to participate the EUT. In 2004, 158 males and 670 females volunteered. After one year of back school intervention (2005) 86 males and 483 female nurses still participated the study. The EUT consists out of 8 tests: Flamingo Balance (FLB), Plate tapping (PLT), Sit and Reach (SAR), Standing Broad Jump (SBJ), Sit Up (SUP), Bent Arm Hang (BAH), Handgrip (HGR) and a Shuttle Run (SHR).

Data were cleaned, checked for normal distribution, and the means were compared by a one-way ANOVA with the Scheffé post hoc test. Significance levels were set at 5%

Results.

The results of 1992 compared to 2004, for the male nurses, indicate a significant improvement in flexibility (SAR). The SHR on the other hand showed significant lower results. After one year with 3 sessions of back schooling only the SUP test improved significantly.

The female nurses in 2004 performed, in comparison with 1992, significantly worse for the FLB and the SHR and better for the SAR. After back schooling they scored significantly better on PLT, SUP, and BAH. Scores were significantly worse for FLB and SBJ after that year.

Discussion and conclusion.

The results after 12 years are – in exception for the worse SHR and the better SAR – not that different for male and female nurses considering the small sample size in 1992. It was noted by Zinzen et al.(1997) that the nurses scored on both items exceptionally in comparison with a reference group. The back school intervention had the most effect for the female nurses with the SUP improved for both sexes. With regard to prevention of low back problems, stronger abdominal muscles are considered as an important improvement.

EFFECTS OF TAI JI QUAN ON DYNAMIC POSTURAL STABILITY AND ANKLE JOINT MUSCULAR STRENGTH IN OLDER WOMAN

Guanglin, X., Kumagawa, D., Tanaka, S., Tsunoda, N.

Graduate school of Sports System, Kokushikan University, Japan., Japan

It is well known that condition body balance control with a one of the ability to maintain the postural equilibrium in human. Tai Ji Quan is a widely practiced one of the Chinese martial arts. The characteristics of Tai Ji Quan are slow and continuous movements with a lower centre of gravity. Generally, older people have decline lower limb muscle function due to aging. Several studies reported that Tai Ji Quan practice improved balance ability in older people. However, there are no findings for dynamic postural control ability effect of Tai Ji Quan practice on older people. Therefore, the purpose of this study was to clarify the effects of Tai Ji Quan on dynamic postural stability and ankle joint muscular strength in older woman.

The subjects were fifteen female long-term Tai Ji Quan practitioner group (TG) and fifteen healthy non-practical female as a control group (CG). Dynamic balance control ability with opened-eyes during 20 seconds was tested by dynamic balance test of the Stability System (Biodex, USA) in all the subjects. The subjects were tested under three standing conditions of normal standing with both legs (BS), right leg standing (RS) and left leg standing (LS). The indexes of dynamic postural stability were evaluated amount of sway in the overall directions (OSI), anterior/posterior directions (A/PSI) and medial/lateral directions (M/LSI). The lower index values are showing higher dynamic balance ability. The relative dynamic postural stabilize time of ratio (%) in the center of target (A-zone) of each condition was evaluated. And also, the force of isometric plantar flexion was measured by dynamometer (Biodex System 3, USA).

In OSI, TG was shown significantly lower value than CG ($p<0.01$). In all standing conditions. And also A/PSI and M/LSI was obtained same tendency. The relative ratio of stabilizes time at A-zone on TG showed significantly higher values in all standing conditions ($p<0.01$). Plantar forces on TG were significantly higher than CG in right and left ankle. In a single leg standing condition of TG, significant negative correlation coefficients were obtained between plantar force and OSI with right and left (RS：r = 0.635，LS: r = 0.692. $p<0.05$). However, it was not significant correlated between plantar force and OSI in CG. Significant correlation coefficient between plantar force and A/PSI (RS: r = 0.655，LS : r = 0.702), and M/LSI (RS : r = 0.578，LS : r = 0.542) were obtained in all the subjects. And also plantar force related to ratio of stabilize time at A-zone with right (TG: r = 0.630, CG: r = 0.798) and left ankles (TG: r = 0.557, CG: r = 0.631).

From these results, it was considered that Tai Ji Quan exercise may effect on muscle force of ankle and dynamic posture stabilizes ability in older woman.

OBESITY INTERVENTION WITH THE M.O.B.I.L.I.S. PROGRAMME

Laqué, M.K., Berg, A., Frey, I., König, D., Lagerstroem, D., Predel, H.-G.

Institute of Cardiology and Sports Medicine, Germany

Obesity is one of the greatest public health challenges of the 21st century. Sustainability in terms of body weight reduction as well as stabilisation are demonstrably achieved by a combination of diet and physical activity interventions. Hereby M.O.B.I.L.I.S. (multicentre organised movement oriented initiative for lifestyle modification in personal responsibility) aims at a lasting modification of the activity level towards a balanced lifestyle and a simultaneous improvement of health competency via a 12-month movement oriented therapy intervention. The documentation of the therapy progress as an evidence-based medicine is aspired for 4.000-5.000 adults with a BMI between 30 and 40 kg/m2. Meanwhile one year results exist for three model groups following a standardised concept.

40 adults (age: 47,4±11,6, weight: 107±16 kg, BMI: 35,2±2,9 kg/m2, waist circumference: 112±11 cm, hip circumference: 121±9 cm, overweight: 40,8±11,8 %, LDL-C: 140±34 mg/dl, HDL-C:54±13 mg/dl, TG: 139±52 mg/dl) took part in the one year programme. Trained interdisciplinary teams impart content from the areas of movement/sport, psychology/pedagogy, nutrition and medicine/health in 20 theoretical and 35 practical sessions. Hereby different phases and time segments are provided: a 6-week start phase, 18-week body weight reduction phase and 6-month stabilisation phase. In order to optimise the individual therapy a permanent information exchange takes place within the teams.

Of the 52 participants 40 completed the one year programme (drop out rate 23%). The reduction of bodyweight (-10,9 kg), of BMI (-3,6 kg/m2) and in particular of the waist circumference (-8,4 cm) point to a significant reduction of abdominal-visceral fat mass ($p<0,001$). Furthermore, the hip measurement was reduced (-9 cm) as well as overweight (-14,4 %) ($p<0,001$). The atherogenic and inflammatory risk factors acted accordingly: LDL-C -6,4 mg/dl, TG -18 mg/dl ($p<0,05$), HDL-C +8,2 mg/dl, hs-CRP -0,16 mg/dl ($p<0,01$). The parameters of heart circulation regulation and load capacity (watt/kg body weight, heart rate variability, heart frequency, BP systolic and BP diastolic at rest and during load) also improved with $p<0,001$.

A one year instruction programme comprising the basic module movement in combination with diet- as well as behaviour modification and medical supervision constitutes a highly effective therapy option for obese adults.

Complete teams (PE teachers/sport scientists, psychologists/pedagogues, dietetics specialists, MD) are educated by the leaders of the four M.O.B.I.L.I.S. competency areas at special M.O.B.I.L.I.S courses since December 2004 and subsequently they take charge of M.O.B.I.L.I.S groups. Currently 37 groups of 15 participants each are professionally supervised.

SELF REPORTS: A NEW POSSIBILITY TO REPORT ADVERSE EVENTS AMONG CONSUMERS OF ILLICIT HORMONE PHARMACEUTICALS INDICATES A SPECIFIC PATTERN OF DOPING ABUSE

Thurelius, A.M., Garevik, N., Rane, A.

Karolinska University Hospital, Sweden

Background:

The Anti Doping Hot-Line works to prevent, discover, reduce, counteract and eliminate the misuse of doping and its consequences in Sweden. The most common reported adverse events (AE) of illicit hormone pharmaceuticals- mostly anabolic androgenic steroids (AAS), are: acne, plasma lipids alterations, hypertension, psychiatric and behavioural disorders, potency disorders, testicle atrophy and gynecomastia in males, and to some degree reduced fertility. Other AE include masculinization in women. In 2004 an interactive website was created with a possibility for the consumers to report AE. We investigated the different characterizations with respect to age among consumers of AAS, closely related substances and dietary supplements containing for example ephedrine.

Objective:

To understand the pattern of the abuse of illicit hormone pharmaceuticals and related compounds and develop preventive strategies to identify and describe physiological, social and psychiatric adverse events.

Methods:

An anonymous self-report questionnaire on the Anti Doping Hotlines website with questions concerning AE, substances misused and effects on quality of life. The form was filled in by a total of 97 anonymous consumers to the Anti Doping Hotline (including 10 (9.7%) females at age 19-32, 44 (42.7%) males at age 16-23, 43 (41%) males at age 24-44). The two different male groups were compared and analyzed with unpaired t-tests.

Results:

The consumers of solely AAS was significantly higher among the males at age 16-23 ($p<0.001$), the consumers of mixed drugs (AAS and other related hormone pharmeuticals) was significantly higher among males at age 24-44 ($p<0.001$). Having a positive experience of the abuse was significantly higher among males at age 24-44 ($p<0.001$), in this group 12 individuals also reported no AE. Clenbuterol, a beta-2 adrenergic agonist, was only abused among the group of males at age 24-44. The most common AE among males in total were psychiatric symptoms as anxiety and aggressiveness. No significantly differences were found between the males concerning AE. The proportion of females was low (only 10).

Conclusion:

Our data verify a different pattern of the abuse of illicit hormone pharmaceuticals and related compounds with respect to age among males. Among the older males a mixed abuse with different hormone pharmaceuticals involved was more common. Some of these pharmaceuticals were consumed in the belief that they prevent AE. However, there were no significant difference concerning age and AE, (despite the amount of abusers reporting no AE at all and having only a positive experience in the older group). This might be a sign of no expected effect of these hormone pharmaceuticals. Clenbuterol did not exist as an abuse among the younger males, which could indicate that they are less advanced in their abuse. This oral presentation will include current figures and statistics from the Anti Doping Hot-Line.

THE PHYSICAL AND PSYCHOLOGICAL EFFECTS OF A LONG-TERM EXERCISE PROGRAM IN ELDERLY PEOPLE

Sasaki, H., Takahashi, M.

Asai Gakuen University, Japan

Introduction: As the population of elderly people continues to grow in advanced nations, there is interest not only longevity, but also in the quality of life (QOL). QOL is defined by the World Health Organzation (WHO) as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns (General Guidelines for Methodologies on Research and Evaluation of Traditional Medicine WHO, WHO MD; 2000). The QOL for elderly people has two aspects; physical health and mental health.

Exercise maintains and promotes physical and mental function. Exercise is also one of the main stated factors that influences the improvement of QOL. Furthermore, as the physical and psychological effects of these exercises have explained in recent years, exercises for elderly people have widely in the prevention of nursing care Furthermore, as the physical and psychological effects of these exercises have explained in recent years, exercises for elderly people have widely in the prevention of nursing care.

Objective: The purpose of this study was to examine the physical and psychological effects of long-term exercise in elderly people and assesses the program's effect on QOL.

Subject & Method: Subjects in this study were 23 elderly people with a mean age of 64.1±6.0. They participated in a senior fitness class for about 9 months. Physical and psychological measurements were taken.

Those measurements were performed about once every about four months. The physical measurements were anthropometric indexes. These were; height, body weight, body fat, systolic and diastolic pressure, chest girth, abdominal girth, hip girth, left and right thigh girth, left and right lower leg girth, and fitness tests including grip strength, sit-ups, sitting trunk flexion, foot-balance with eyes opened, 10m obstacle walking, up and down step test. The psychological measurement used a 30-item General Health Questionnaire (GHQ30) and QOL was measured at the same time by WHO/QOL26.

Result: In the physical measurements, left and right thigh girth, grip strength and 10m obstacle walking improved. GHQ30 and QOL26 did not significantly changed. In each factor on the GHQ30, the ratio of the person with a high score (3-5point) of insomnia was about 30 percent. It was higher than in the other factors.

Discussion: From these results, it was supposed that the physical indices changed earlier than the psychological index in elderly people. The psychological index did not significantly change, but from the ratio of the persons with the highest scores in the factor of the GHQ30, it was suggested that one in three or four persons experienced a sleeping disorder. Continuous measurement is necessary to assess the change of psychological index.

INJURIES IN GERMAN PROFESSIONAL FOOTBALL - EPIDEMIOLOGY AND PREVENTION

Henke, T., Schulz, D., Platen, P.

Ruhr-Universität Bochum, Germany

Problem: Although football is of high social importance, in professional football economical factors are dominating. The total turnover has increased to over 1 billion euro in the 1st national football league alone which means a decupling since 1990. It is therefore plausible that the clubs have to take care for their player's health not only from the ethical but also from an economical point of view. In this context, the question arises what injury prevention in professional football should focuse on. The study presented was funded by the insurance of the german professional athletes (VBG).

Methods: For statistical analysis the following datasets of the season 2004/2005 were surveyed:

- Personal, sports specific and sociodemographic data of the 1953 professional football players from the 1st, 2nd und 3rd german professional football leagues. These players present the population.
- Type, severity and costs of 5361 sports injuries sustained by the german football professional players.
- Mechanisms, situations and circumstances of 448 out of the 5361 injuries were recorded in a special survey.

Results: Each professional football player sustains an average of 2 injuries per season, one of these resulting in an absence from sports and the other causing only medical costs. There is no player who sustains not at least one injury per season. About 13.5% of the players are constantly sidelined due to injuries. The costs (medical costs and salaries paid for injured players) of the injuries in professional football summarise up to 90 Mio. per season. Knee injuries are by far the most serious injuries in german professional football. They cause costs of about to 33 Mio. per season, which is equivalent to 37% of all injury costs. Ankle injuries (14 Mio.) and injuries of the thigh (10 Mio.) also create high costs. Injuries of the lower extremities cause 2/3 of all injury costs. About 25% of the knee injuries are non-contact injuries.

Conclusions: The situation presented is not acceptable, neither from the sporting nor from the economic point of view. Many clubs face with financial problems which are likely to increase due to changes concerning the television broadcasting rights. And even performance enhancement and success in championships and cup competitions will only be possible, if the teams important players stay uninjured. Against this background this study provides information, about how the problem of injuries in professional football can be approached and which preventive measures may be successful especially concerning the serious problem of knee injuries. With respect to other studies and own experiences proprioceptive and coordinative exercises seem to be most promising in this area. But these measures will only be accepted in professional football, if they are adapted especially for elite football and if it is communicated that they are not primarily preventive but also performance-enhancing.

THE IMPACT OF PHYSICAL TRAINING ON SICK LEAVE, CARDIO-RESPIRATORY PHYSICAL FITNESS, LEISURE PHYSICAL ACTIVITY, LIFE SATISFACTION AND MUSCULOSKELETAL COMPLAINTS OF EMPLOYEES IN NURSING HOMES

Gundersen, K.T., Bratteberg, M.P.

North-Troendelag University College, Norway

Abstract

Title: The Impact of Physical training on Sick Leave, Cardio-Respiratory Physical Fitness, Leisure Physical Activity, Life satisfaction, Musculoskeletal Complaints of Employees in Swedish and Norwegian Nursing Homes

Magnhild Bratteberg1, Kjell Terje Gundersen1

North-Troendelag University College, Faculty of Education, Engineering and Nursing, Levanger, Norway

Employees working at nursing homes are mentally stressed because of duty on rotation basis. They are working physically hard and have a high level of sick leave (Ihlebæck&Læhrum, 2004). Physical fitness and physical training should be of great importance to avoid developing health complaints. However there is limited knowledge based on research about the effects of physical activity and exercise on employees in health and care sectors and (Goverud&Hvamstad, 1999; Roness&Matthisen, 2002).

The study focus on employees in three nursing homes in Sweden and Norway and the effects of an intervention program with physical exercise in a social and pleasant setting. Objectives are the effect on sick leave, self-reported cardio respiratory physical fitness, leisure time physical activity, life satisfaction (LISAT) and functional musculoskeletal complaints (MSQ).

The intervention project included physical training of employees partly during working hours at the nursing homes and partly after finishing work.

Questionnaires were used to collect data from pre- and post-tests. Differences between Swedish and Norwegian results were assessed by bivariate analyses and analyses of variance (ANCOVAs).

The effects of the program reflect significant differences on cardio respiratory physical fitness, subjective well being and functional musculoskeletal complaints.

Key-words: nursing homes, intervention, sick leave, leisure physical activity, physical fitness, well being, functional muscle complaints

PHYSICAL PERFORMANCE, FITNESS AND GENE POLYMORPHISMS

Dondukovskaya, R., Ahmetov, I., Topanova, A., Mozhayskaya, I.

St Petersburg Research Institute of Physical Culture, Russia

Severe disease and peak physical performance can be viewed as the two extremes of a continuum of human fitness. There are individuals who fall close to one extreme (i.e. unfit and obese individuals) or the other (elite athletes). Fitness participants are generally considered as people with body weight and health problems, who wish to be fitter and healthier. Strong evidence for genetic influences on health condition, anthropometric characteristics and athletic performance has accumulated over the last years. The knowledge of genotype data of young athletes as well as fitness participants is supposed to help in individualization of training processes and optimizing their diet to achieve better fitness level and to prevent metabolic diseases such as obesity, type II diabetes and cardiovascular diseases. The aim of the present study was to compare the frequencies of endurance-related alleles of PGC1A, PPARA, UCP2 and UCP3 genes between endurance-oriented female athletes and unfit women, participants of fitness club and to search the association between genotype data and several physiologic and anthropometric characteristics of unfit females.

One hundred and fifty four Russian endurance-oriented female athletes (cross-country skiers, road cyclists, biathletes, triathletes and rowers, BMI 21.8±0.2) and eight unfit women (participants of fitness club; BMI 27.1±2.3 kg/m2) were studied. PGC1A Gly/Ser, PPARA intron

7 G/C, UCP2 Ala/Val and UCP3 -55C/T polymorphisms were determined by PCR and restriction enzyme digestion. Several physiological tests were performed to assess aerobic and anaerobic characteristics of the unfit women.

Mean BMI was significantly higher in unfit women than in female athletes (P=0.02). We found that the frequencies of endurance-related alleles - G (PPARA) and Gly (PGC1A) were significantly higher in athletes than in unfit women (G: 86.7% vs 68.7%, P=0.045; Gly: 59.4% против 25.0%, P=0.01). Furthermore, in unfit women, BMI and fat mass was slightly bigger in SS PGC1A and CT UCP3 (associated with high risk of development of metabolic diseases) genotypes carriers, but these differences were non-significant. In considering physiological data, we found that PPARA GG homozygotes exhibited the highest value of endurance performance (111±13 W vs 84±10 W (heterozygotes), P<0.05; estimated by PWC-170 test), and UCP3 CC genotype carriers showed the best values of handgrip dynamometry (29.4±1.4 vs 23.3±2.6 (heterozygotes); P<0.01). In conclusion, PPARA, PGC1A and UCP3 gene variants were associated with physical performance and fitness level of female endurance-oriented athletes and unfit women.

PREDICTING BODY FAT FROM BODY MASS INDEX IN HEALTHY INDIVIDUALS

Stavropoulos-Kalinoglou, A., Metsios, G.S., Koutedakis, Y., Nevill, A.M., Douglas, K.M., Jamurtas, A.Z., Kitas, G.D.

Univesity of Wolverhampton, United Kingdom

Excess body fat (BF) is a prominent health hazard significantly contributing to the development of cardiovascular disease (CVD). Assessments for body fatness include the calculation of body mass index (BMI - in kg/m2) and more accurate estimations of relative adiposity (i.e. BF percentage).

However, as BMI does not distinguish between lean-body mass and fat mass, in a way that people of similar stature and weight, but unequal muscle content, will have the same BMI but different BF levels, several authors have questioned its validity. Age and gender are among the factors that can affect the proportion of lean to fat mass. Assessments of BF percentage, even though more accurate than BMI, require specialised personnel and expensive equipment. Thus, the aim of this study was to develop an accurate and practical method to predict fat content in healthy individuals.

A total of 82 (39 males, 43 females) healthy, middle-aged (mean age: 46; sd: 12.3) individuals volunteered for the study. Their BMI (kg/m2) and BF percentage (using the "Tanita BC-418 MA Segmental Body Composition Analyser"; Tanita Corporation, Tokyo, Japan) were assessed. Mean (sd) BMI was 25.5 (4.5) [males: 25.7 (3); females: 25.4 (5.5)] and mean (sd) BF, 25.9 (9.5) [males: 19.2 (5.2); females 32.1 (8.2)].

According to BMI, 50% of our participants were classified as normal-weight, whereas, according to BF 62%. Age was significantly correlated with both BMI (r=0.234, p<0.05) and BF (r=0.337, p<0.01). One-way ANOVA revealed significant differences between genders for BF (p<0.01) but not for BMI (p>0.05). Linear regression analysis produced a predictive equation for BF (R2=0.769, p<0.01), deriving from BMI, age and gender (BF= 1.059 x BMI + 0.108 x Age + Gender - 0.719; where gender is: male= -11.294, female= 0).

In our sample, BMI over-predicted fat content. Both BMI and BF were increased with age but only BF differed among genders. Our data are supported by the current literature on the subject, as the validity of BMI is being questioned, especially in females who, normally, exhibit increased levels of body fat compared to males. Since BF percentage is a more accurate estimate of fat content, given that cut-off-points are age and gender specific, the equation presented herein can be used to more accurately predict fat content in healthy individuals.

THE EFFECT OF AGING ON THE REGENERATIVE CAPACITY OF SKELETAL MUSCLE

Ponsot, E., Lexell, J., Kadi, F.

Department of Clinical Medicine, Sweden

Introduction

It is well known that aging is associated with a progressive loss of skeletal muscle mass due to the atrophy of individual muscle fibres. This is accompanied by a decrease in the capacity to generate force and power, leading to a progressive weakness. However, it remains a matter of debate whether there is an age-related decrease in the capacity of skeletal muscle to repair minor or lethal injuries that occur at the level of muscle fibres in response to daily physical activity. The regenerative potential of skeletal muscle is partly dependent upon the regenerative history represented by the telomere length. The aim of the study was to determine the effects of aging on muscle DNA telomere length on muscle biopsies obtained from healthy active elderly women and men.

Methods

Fourteen healthy active elderly women and men (age range, 70-83 years) were compared to 15 healthy young women and men (age range, 20-32 years). All individuals participated regularly in recreational sports such as aerobics, jogging, cycling, and ball games. Muscle biopsies were obtained from the tibialis anterior muscle of the dominant leg. Total DNA extraction is achieved by incubation in proteinase K digestion buffer. The genomic DNA is then digested with a restriction enzyme to generate a smear of DNA fragments containing telomeres with different lengths of the TTAGGG repeat sequence. Telomeres were detected using southern blot analysis. The telomeres are detected by hybridization to a 32P-labelled (TTAGGG)4 probe, followed by exposure to x-ray film. The signals are analysed using Scion software and average and minimal telomere lengths were determined.

Results

The signal obtained provides a distribution profile of telomeric lengths of all myonuclei and satellite cells present in the tissue. Average telomere length indicates the most frequent DNA telomeric lengths of the tissue whereas the minimal telomere length indicates the shortest DNA telomeric lengths found in the tissue. The elderly group had a mean telomere length of 10.7 ± 1 kbp and a minimal length of 4.7 ± 0.6 kbp. In young, the mean length was 10.7 ± 0.9 kbp and the minimal was 5 ± 0.6 kbp. There were no significant differences in both mean and minimal telomeric length between young and elderly.

Conclusion

Contrary to what is described in-vitro and in-vivo in several tissues, it seems that healthy elderly and young men and women have similar skeletal muscle telomeric length. This result implies that we have to further improve our knowledge on the mechanisms allowing the stabilisation of telomere length in human skeletal muscle.

CLASSIFICATION OF PHYSICAL ACTIVITY BY HEART RATE AND ACCELEROMTERY DATA, RECORDED SIMULTANEOUSLY

Mäder, U., Ruch, N., Rumo, M., Martin, B.W.

Federal Office of Sports, Switzerland

INTRODUCTION: The extraordinary importance of habitual physical activity and exercise for disease prevention and health promotion is widely recognized. However, physical activity remains difficult to be measured accurately and the available measurement techniques have inherent limitations. The simultaneous use of heart-rate monitoring and accelerometry may be useful to overcome some limitations of those two methods, commonly used separately. The purpose of this study was to elicit, whether physical activities might be classified by heart rate and accelerometry data.

METHOD: Heart rate and accelerometry (biaxial) data were collected simultaneously by a chest mounted device (ikcal, Teltronic AG, Biberist, Switzerland) every 10 sec during walking (flat, uphill, downhill at 3 different velocities), during biking and arm cranking with two intensities each, sitting and standing. 6 of the volunteers were women (30.5 ± 11.6 y, BMI = 22.8 ± 5.0, 10 were men (37.2 y, BMI = 26.6 ± 3.3). Data of walking at 3 velocities on the flat and sitting were used to normalise all measured values before scanning for activity specific data patterns and defining 8 activity classes (walking (W), uphill (UH), downhill (DH), leg activity (LA), arm activity (AA), inactivity (IA), and not assigned (NA)). The established data patterns were used to classify measured activities among 12 subjects (6 females, 41.5 ± 14 y, BMI = 21.4 ± 2.6; 6 males, 39.3 ± 16.3 y, BMI = 22.3 ± 1.0) during 30 min of walking (treadmill, flat), biking (ergometer), stepping, and playing (joggling, diabolo, hit a target). Before the measurement, volunteers performed the calibration procedure described above.

RESULTS: During 30 min of walking 42.3 ± 37.0 % were classified correctly. Other classes were significantly less often selected ($p < 0.05$), except DH (16.7 ± 27.7 %) and NA (28.0 ± 28.6 %). 48.7 ± 29.7 % during 30 min biking were assigned to LA. The other classes were less represented ($p < 0.05$), except AA (30.6 ± 20.7 %). During 30 min of stepping 30.7 ± 37.7 % and 25.1 ± 31.7 % were recognised as UH and DH, respectively. 30.3 ± 25.3 % were NA. Only IA was significantly less represented than DH (0.3 ± 0.7 %, $p < 0.05$) during stepping. The 30 min of playing consisted of 39.7 ± 16.7 % min NA, 30.7 ± 17.0 % LA, 9.3 ± 11 % AA, 8.0 ± 8.7 % IA, 6.7 ± 22.3 % UH, and 6.3 ± 7.0 % W.

DISCUSSION: The results indicate, that values, averaged over 10 sec, for hear rate and accelerometry might be used to classify physical activity. The simple algorithms used for the classification process in this study have been applied to minimise the required computing level for a wearable device that record physical activity. However, it would be desirable to improve the validity of the classification process so it can be used in advanced research on physical activity behaviour.

TRACKING PHYSICAL FITNESS OF PRIMARY SCHOOL CHILDREN AT VIANA DO CASTELO, PORTUGAL

Rodrigues, L., Bezerra, P., Saraiva, L.

Instituto Politécnico Viana do Castelo & LIBEC/Un. Minho, Portugal

There is little knowledge regarding children's physical fitness behavior during primary school years (1st to 4th grade). To understand this phenomenon better there is a need to track for individual trajectories across repeated measures of time.

To investigate physical fitness trajectories and stability we took a sample of 358 children (184 girls, 174 boys) which we followed for three consecutive years (mean ages 7.5, 8.5, and 9.5 years-of-age) in the "Estudo Morfofuncional da Crianca Vianense", Portugal. Physical fitness was assessed by seven different tests: 60 sec sit-ups (SU), flexed arm hang (FAH), standing long jump (SLJ), 50 meters dash (50M), 10 meters shuttle run (SHR), 20 meters pacer run (PR), and sit-and-reach (SR). Repeated measures ANOVA tests were used to inquire into the behavior of each fitness variable along the three time waves. Results showed a general positive effect of AGE for SU, 50M, SHR, and PR for both genders; a negative effect for SR on boys only; and no effect for FAH. A structural equation modeling approach was then used to look for the whole multidimensional trait of physical fitness across time. Two autoregressive models were used, with all tests loading on a general physical fitness factor, repeated across three time waves with autocorrelated errors, to fit both gender data. The models presented a good fit to the data (NFI,CFI, GFI and RMSEA were respectively .96, .98, .86, .07, and .96, .99, .88, .05 for girls and boys). Structural coefficients for stability between the three moments were very high (beta21=.96 for girls and boys; beta32=.95 for girls and .94 for boys), explaining 93% and 90% of the variance of the girls trajectories, and 92% to 88% for boys. Disattenuated autocorrelation coefficients between the three latent physical fitness factors ranged from .96 to .91 for girls; and from .96 to .90 for boys.

These results showed that (a) almost all PF components were improving each year, meaning that children were getting fitter from 8 to 10 years-of-age; (b) PF as a whole was very stable across these pre-puberty years, although stability coefficients were decreasing more rapidly on boys than girls. A thorough explanation of the results asks for a contextual interpretation. A high tracking of individual PF was probably expected given the proximity of the evaluation moments (one year apart). But, from a developmental and educational perspective, primary school years should account for a major increment on organized physical activity and motor stimulation (in and out of school).This fact intuitively lead us to think that different trajectories should diverge between children (depending on the stimulation) and, if so, stability would diminish.

EFFECT OF PHYSICAL AND MENTAL FACTORS BY COMBINED TRAINING IN MIDDLE-AGED WOMEN WITH DIFFERENCES OF TRAIT ANXIETY

Maeda, Y., Yokoyama, N., Kuno, S.

University of Tsukuba, Japan

 Trait Anxiety is mentioned as an individual personality showing the tendency to perceive and react to the situation of giving a threat. Many studies have reported that the exercise brings not only physical effects but mental effects. However there are few studies in Japan about physical and mental effects by exercise with differences of trait anxiety. The purpose of this study was to investigate the physical and mental effects by combined training in middle-aged women with differences of trait anxiety.

 Participants were 28 middle-aged women(57.0±4.4 years).Training session was 10 weeks period, twice per a week at training room in university and 3 times per a week at home, resistance training and aerobic training. The investigation about trait anxiety was conducted with State-Trait Anxiety Inventory JYZ(STAI) in pre-post training session. There were measured Body Weight(BW), Body Mass Index(BMI),Waist-Hip Ratio(WHR), Body Fat Ratio(BFR) by Bioelectrical Impedance(BI) methods, the cross-sectional area(CSA) of thigh group and psoas major by magnetic resonance imaging(MRI), the estimated VO2max by submaximal exercise test , serum high-density lipoprotein cholesterol(HDLC), low-density lipoprotein cholesterol(LDLC), total cholesterol(TC), and triglycerides(TG) as physical factors, and General Health Questionnaire28(GHQ28) as mental factors in pre-post training session. Moreover there were measured the number of training and walking steps per a week in training session. Then participants were classified into two groups, Low Group(LG) having 20～39 score and High Group(HG) having 40～62 score, from the result of trait anxiety by STAI.

 There were no significant differences of physical factors, the number of the training and walking steps of training session by both groups in pre training session. As for GHQ28 about mental factors, the low rank scale was classified into four elements, Somatic Symptoms, Anxiety and Insomnia, Social Dysfunction and Severe Depression. There was significant higher score about Social Dysfunction in HG than LG (p＜0.05), although there were no significant differences about other elements in pre training session. As physical factors, the interaction was accepted by HDLC and TG in the comparison between LG and HG (p＜0.05), and TG was more significant decrease in post training session than pre it (p＜0.05). As mental factors the interaction was accepted by Social Dysfunction of GHQ28 in the comparison between LG and HG (p＜ 0.05) and there was the significant decrease of it's score in post training session than pre it. Moreover the interaction was accepted by trait anxiety in the comparison between LG and HG (p＜0.05), and it was more significant decrease in post training session than pre it (p＜0.001).These results suggest that the training session in this study improves not only trait anxiety but activities in society and serum lipid levels as for lifestyle-related disease in middle-aged women with differences of trait anxiety.

EFFECTS OF SAME INTENSITY WALKING AND WEIGHT TRAINING ON THE PHYSICAL FITMESS OF KOREA MIDDLE-AGE WOMEN

Choi, D.H., Choi, H.N., So, W.Y.

Sogang University, Korea, South

The purpose of this study was to finding out 2 type training which is walking and weight training with the same intensity have an effect on body composition, cardiorespiratory function, physical fitness and blood profiles. Subjects of this study were 42 women who had never exercise experience, started exercised at fitness center for inhabitants. They divided by three group(Walking, WT, and Control group). Fitness test were performed at pre, post 8weeks such as VO2max test with Bruce protocol, muscular strength, flexibility, muscular enduranc, power, agility and balance. The results are as follows: First, there was a statistic significant difference on the systolic blood pressure(p=.000) and normal heart rate(p=.008) while diastolic blood pressure(p=.07) tended to be decreased. Secondly, as for fitness test, there was no statistic significant diffence of cardiorespiratory endurance, flexibility, muscular endurance, power, agility and balance among groups, whereas muscular strength showed significant difference(p=.033). Third, as for blood profiles, there was no statistic significant difference of triglyceride among groups, whereas glucose(p=.019). total cholesterol(p=.045) showed significant difference. In conclusion, same intensity exercise for 8 weeks improved cardiorespiratory function and blood profiles such as blood pressure, heart rate, glucose and total cholesterol.

STUDENT'S PERCEPTIONS OF SCHOOLBAG LOADING AND PAIN SYMPTOMS IN GREEK ELEMENTARY SCHOOL STUDENTS

Emmanoulidou, M., Arampatzi, F., Kellis, E.

Aristotle University of Thessaloniki, Greece

Introduction

The prevalence of non-specific back pain increases dramatically during adolescence from less than 10% in pre-ten-year olds up to 50% in 15-16-year olds (Sheir-Neiss et al. 2003). There is a widespread concern that heavy schoolbags carried by students may be associated with some potential health problems, including muscular aches, back strain, altered posture and eventual up and low back pain (Whittfield et al. 2005). The purpose of the study was to investigate the prevalence of pain symptoms (PS) in upper body and the student's subjective perception (SSP) of the schoolbag load in elementary Greek school. Furthermore, we examined whether PS have an association with SSP of the schoolbag load and the percentage of body weight (% of BW) represented by school bags.

Methods

A total of 183 (105 boys, 84 girls) students aged between 6 and 11 years old (M=8.7, SD=±1.6) volunteered to participate in this study. The body weight of students was measured, as was the weight of their schoolbags. Information about the prevalence of PS caused by carrying schoolbags and the SSP of the schoolbag load was obtained from a self-administrered questionnaire (Negrini et al 2001, Whittfield et al 2005). Pearson correlation statistical method was used to establish if PS have an association with SSP of the schoolbag load and % of BW of schoolbags.

Results

The mean schoolbag weight for students was 5.3 ±1.08 kg (range from 3 to 8.5) and the % of BW represented by school bags was 15.10% (range for 6.49% to 28.29%). Sixty-one percent of students experienced MS whilst carrying a schoolbag. The prevalence of symptoms according to location were as follows: neck (14.7%), shoulders (33.9%), upper back (25.2%), lower back (8.6%), elbow (3.4%). Females reported the highest prevalence of symptoms (neck 26.9%, shoulders 44.2%, upper back 28.8%, lower back 17.3%) than males (4.8%, 27%, 22.3%, 1.6%, respectively) (p<.01). The student's subjective perception of heavy schoolbag was observed by 47% of students and fatigue experience whilst carrying a schoolbag by 32.8%. PS were correlated with fatigue whilst carrying a schoolbag (r=.534), the feeling that the schoolbag was heavy (r=484) and % of BW (r=.499) (p<.001).

Discussion/Conclusion

The student's subjective perception of the schoolbag load and the % of their BW were found to be associated with PS in the upper body. Students with PS were more likely to be females. Future work is required to confirm these results. Reduction of the schoolbag load borne by students is recommended.

Reference

Negrini S., Carabalona R. 2002 Spine 27: 187-195

Sheir-Neiss G., Kruse R., Rahman T. 2003 Spine 28: 922-930

Whittfield K., Legg S., Hedderley D. 2005 Applied Ergonomics 36:193-198,

This study is supported by an EC and Greek Ministry of Education (EPEAEK II) grant under the "Pythagoras II" program.

SCHOOLBAG WEIGHT IN 385 PRIMARY AND SECONDARY EDUCATION STUDENTS EXCEEDS SAFETY LIMITS

Emmanoulidou, M., Kouvelioti, V., Kellis, E.

Aristotle University of Thessaloniki, Greece

Introduction: Carrying schoolbags constitutes a daily activity for children aged from 6 to 18 years old. In recent years there has been a widespread concern over the role of school bags in the occurrence of back pain during childhood and adolescence (Puckree et al. 2004). Previous studies in USA (Goodgold, et al 2004), Italy (Negrini et al. 1999) and N. Zealand (Whittfield et al. 2001) showed that the school bags weight represented 17.2%, 22% and 11.7%, of the body weight of the students respectively. The purpose of the study was to determine the weight of the school bags, and the percentage of body weight (% of BW) represented by school bags.

Methods

A total of 385 (210 boys, 175 girls) students between the ages of 6 and 14 years (M=9.7, SD=±2.2) from a city in Northern Greece, volunteered to participate in this study. Body weight was measured to an accuracy of 0.5 kg using electronic scales and the same scales were used to determinate the weight of the school bags. Data were collected on an unscheduled day so that students could not alter their schoolbag weight.

Results

The mean body weight of elementary students was 37.28 ±11.0 kg and for high school students was 55.15 ±11.9 kg. The mean schoolbag weight for all student was 5.18 ±1.2 kg (range for 2.5 to 9). This value for elementary students was 5.6±1.1 kg and for high school students 5±1.4 kg. Percentage of BW by grade was as follows: elementary school: 1st=15.5%, 2nd=16.6%, 3rd=14.1%, 4th=14.3%, 5th =14.4%, 6th =12.4%, and high school: 1st =11.7%, 2nd =9.3%, 3rd =9%. Forty-seven percent of elementary students carried schoolbags that weighed from10% to 15% of their BW and thirty-nine percent more than 15% (ranging from 15% to 28.8 %) of their BW. Concerning high school, thirty-three percent of students carried schoolbags that weighed from 10% to 15% of their BW and thirteen percent more than 15% (ranging from 15% to 21.21%) of their BW. The most commonly reported type of schoolbags for the whole sample was back bags without a frame (92.6%).

Discussion/Conclusion

Schoolbags loads represent a significant percentantage of BW of this sample and younger students carried proportionally heavier loads. Similar findings have also been obtained in the previous studies. The National Back Pain Association suggest that ideally a schoolbags should weigh no more than 10% of a student's BW and this weight should be supported on both shoulders in a backpack style schoolbag.

Reference

Goodgold S., et al. 2004 Pediatric Physical Therapy 14: 122-131

National Back Pain Association 1997 NBPA School Bag Survey '97- Findings and Recommedation. Talkbck, Teddington

Negrini S., Carabalona R., Sibilla P. 1999 The Lancet 354: 1974

Puckree T., Silall S. P., Lin J. 2004 Disability and Rehabilitation 26: 54-59

Whittfield K., Legg S., Hedderley D. 2001 Ergonomics 44:819-824

This study is supported by an EC and Greek Ministry of Education (EPEAEK II) grant under the "Pythagoras II" program.

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE: SHORT OR LONG VERSION?

Delgado-Guerra, S., Serrano-Sanchez, J.A., Olmedillas, H., Guadalupe, A., Perez-Gomez, J., Vicente-Rodríguez, G., Bernales, O., Navarro, E., Calbet, J.A., Dorado, C.

University of Las Palmas de Gran Canaria, Spain

Introduction

The long version was designed to assess physical activity undertaken across a comprehensive set of domains: leisure time physical activity, domestic and gardening (yard) activities, work-related physical activity, and transport-related physical activity. The items in the shorter version are walking, moderate-intensity and vigorous-intensity activities. The purpose of the present study was to determine the validity by direct comparison of the measurements obtained by the administration of the IPAQ with a direct assessment of the main components of physical fitness and body composition.

Methods

A sample of 168 males (age= 31±6.9 yr; mean ± SD) were studied. Data collected with IPAQ were total METs per week in all domains and levels of physical activity as Low, Moderate or High active. Body composition and percent body fat (%Fat) were measured by DXA. The maximal leg extension isometric force in the squat position with knees bent at 90º and the mean power, peak power, and height jumped during vertical squat and countermovement jumps were assessed with a force plate. Additionally, 30-m and 300-m running tests were used to determine maximal running speed and to estimate the anaerobic capacity. Maximal aerobic power was estimated using the 20 m shuttle-run test.

Results

Thirty-six, 83 and 49 subjects were classified as Low, Moderate and High levels of physical activity with the short IPAQ, respectively. The corresponding numbers for the long IPAQ were 31, 91, 46, respectively. Weekly energy expenditure was related to several variables. However, no significant correlation was obtained between the three IPAQ physical activity categories and the physical fitness variables. Total domestic and garden MET-minutes/week derived from the long IPAQ correlated negatively with several physical fitness variables: body mass index, thorax and waist circumference, and %Fat (r= -0.35-0.16, $p<0.01$). Total leisure-time MET-minutes/week was correlated with waist, hip circumference, and %Fat (r=-0.36-0.34, $p<0.01$). Total moderate and vigorous MET-minutes/week correlated with maximal aerobic power (r=-0.15-0.16), and %Fat with Total vigorous MET-minutes/week (r=-0.23, $p<0.01$). In the short form, walking and moderate MET-minutes/week was related to waist and hip circumference, and maximal aerobic power (r=-0.22-0.31, $p<0.01$). The %Fat correlated also with walking, moderate, and vigorous MET-minutes/week (r=-0.19-0.21, $p<0.01$).

Conclusions

Correlations between physical fitness and body composition in one side and the estimation of weekly energy expenditure are low implying a scarce validity of the IPAQ as a tool to asses either physical fitness in males. However, the total energy expended during leisure time, assessed by the long version of the IPAQ appears have higher validity than other outcome variables assessing physical activity in this version of the IPAQ.

Acknowledgements:

The study was supported by Ministerio de Ciencia y Tecnología (BFI2003-09638), the Canary Islands Police Academy, and Universidad de Las Palmas de Gran Canaria. Spain.

SURVEY ON BODY COMPOSITION, PHYSIOLOGICAL AND ANTHROPOMETRICAL PROFILE OF IRANIAN ELITE INDOOR SOCCER(FUTSAL) PLAYERS

Parnow, A., Salehi, S., Ghrakhanlou, R., Rastegar, M., Agha Alinejad, H.,Tofighi, A., Eneyattabar, M.

Tarbiat Modares University, Iran

The purpose of this study was to describe the body composition, physiological and anthropometrical profile of Iranian elite indoor soccer players and the relationship between some of measured parameters. A number of 44 indoor soccer players(25.7± 4.37 age), including members of Iranian national team attended in Asian Indoor soccer Games (Makauo, 2004) and indoor soccer players present in Iranian premier- league of indoor soccer, were tested. For body composition profile, height, weight, body fat percentage, BMI, and for anthropometrical profile thigh circumference and length, calf circumference and length, sitting height and lower body length were measured. Physiological profile was composed of aerobic (20m shuttle run test) and anaerobic (sarjent jump) power, speed (10 &20m run), agility (Illinois), and flexibility (sit & reach). There was a significant reverse relation between aerobic and anaerobic power($r = -0.307$, $P<0.05$) of subjects. Similarly, aerobic power was reversely related to body fat percentage($r = -0.301$, $P<0.05$), indicating that increased body fat percentage will result in disturbance of aerobic performance. The changes in body fat percentage were directly related to those of anaerobic power($r = 0.516$, $P<0.001$), indicating that body fat percentage shouldn't be considered as a limiting factor for aerobic power. A significant direct relationship of agility with 10m($r = 0.391$, $P<0.001$). Speed, but not with 20m($r = 0.139$, $P>0.05$), is reported. There was also a reverse, but statistically insignificant, relationship of BMI with 10m($r = -0.045$, $P>0.05$). As well as 20m Speed($r = -0.26$, $P>0.0$). BMI was also reversely related to agility ($r = -0.081$, $P>0.05$). Findings showed that Iranian elite indoor soccer players were round the average in terms of height as well as weight.

Key words: Indoor soccer, Aerobic Power, Anaerobic power, Speed, Agility, Flexibility, BMI, Body Fat Percentage, Anthropometrical, Body Composition.

SAFETY MEASURES IN GOLF --THE ACTUAL SITUATION CONCERNING ACCIDENTS (INJURIES AND DAMAGES) AS REVEALED BY A QUESTIONNAIRE SURVEY OF GOLF COURSES A POSSIBLE MEASURES TO PREVENT THEM--

Yoshihara, S., Aoyama, H., Miura, M., Miura, K., Noguchi, K., Akita, K., Nishida, K., Katoh, Z., Nakashima, Y., Yamamoto, T., Ree Kyoug, O.K., Ogura, M.

St. Marianna University, Japan

[Objective] We have identified the actual situation concerning accidents and emergency medical services in golf course in the last time through questionnaire surveys we sent to more than 2,200 Japanese golf courses during the 20 years. This time, in order to survey the safety situation in Kanto district golf courses, we distributed questionnaires to 780 golf courses in Kanto district, Japan.

[Method] The survey period was one year, between April 2003 and March 2004. Six questions posed were as follows: 1) Frequency of ambulances dispatched to the golf courses in a year (subdivided into the number of emergency calls per month), 2) Main reasons for calling an ambulance, 3) Established cooperative arrangement with neighboring hospitals (general and private hospitals), 4) Distance to recommended hospital departments, and travel time, 5) Emergency medical care available at the golf course and crisis control system (designated person in charge, emergency training, qualified first aid persons, emergency equipment, fixtures, etc.), 6),Annual incidence or accidents among golfers (surgical accidents, deaths, etc).

[Results] 1) Ambulance calls: Out of 781golf courses, 198 replied. The response rate was 25.3%. With respect to the month, there were 3 requests in January (2.7%), 4 in February (3.7%), 16 in March (14.9%), 9 in April (8.4%), 22 in May (20.5%), 16 in June (14.9%), 26 in July (24.2%), 39 in August (36.4%), 11 in September (10.2%), 20 in October (18.6%), 18 in November (16.8%), and 10 in December (9.3%),respectively. These results indicated that ambulance calls were most frequent in July and August in all regions. 2) Emergency medical care system: Concerning emergency medical care procedures at golf courses, 65 golf courses (32.8%) said that "cooperative arrangements with a given medical institution are in place", while 133 courses (67.1%) replied that they had "no fixed cooperative arrangements". About half of the golf courses did not have an established system for cooperating with a given medical institution in case of an emergency. Looking at practical emergency care procedures in the case of an emergency on the golf courses, 118 golf courses (59.5%), the majority, had a designated member of staff who would be expected to take charge. 80 courses (40.4%) held training courses for their staff in emergency care, but 134 courses (67.6%), the majority, provided no emergency training. 3) Accidents to golfers: Accidents to golfers involving golf balls and clubs had been experienced at 86 golf courses (43.3%) and had not experienced at 112 (56.5%). The total number of accidents was 170. 107golf courses (54%) had experienced accidents due to falls and slips, while 91 (45.9%) had not. The total number of accidents was 233. There were 11 accidents resulting in death at 13 golf courses last year. Since the golf courses had been in operation, there had been 104 fatal accidents in total, 2 of them due to being struck by a thunderbolt (at 3 different courses).

FEMALE ATHLETE TRIAD IN DIFFERENT BRASILIAN SPORT MODALITY

Oliveira, F.P., Perini, T.A., Oliveira, G.L., Ornellas, J.

Federal University of Rio de Janeiro, Brazil

INTRODUCÇÃO: The American College of Sports Science (1992) published in a consensus conference that eating disease and partial syndromes had been understood as the Female Athlete Triad component. This syndrome is characterized for the coexistence of eating disease, premature amenorrhea and osteoporosis in woman athlete. It occurs with higher frequency in athletes who participate in sports that emphasize leanness.

OBJECTIVE: To examine the prevalence of the Female Athlete Triad in some Brazilian sports modalities.

METHODS: A transversal and descriptive study with 101 female athletes (age between 15 and 20 years) was developed. Sporting modalities: Rhythmic gymnastics (n=29; 15,0 ±2,8 years); Endurance runners (n=17; 15,0 ±1,8 years); Rowers (n=16; 19,0 ±2,7 years); Synchronized swimmers-juniors athletes (n=19, 15,6 ±0,8 years); Synchronized swimmers-seniors athletes (n=8; 19,0 ±1,ános) and University athletes (n=12; 20,4 ±1,6 years). For effect of comparison with the athletes 32 no-athletes had been evaluated (15,0 ±1,6 years). Four questionnaires had been used: 1°-Anamnese; 2°-Eating Attitudes Test, 3°-Bulimic Investigatory Test Edinburgh and 4°-Body Shape Ques-

tionnaire. The anthropometric measurements were done in all of the volunteers according to standardization of the International Society for Advancement in Kinanthropometry - ISAK. The data analyses were done in the Statistical for Windows 6.0.

RESULTS: The athlete's body fat were in healthy level and proper for the athletic performance. Synchronized swimmers-juniors (15,8%); Rowers: (12,5%) and Rhythmic gymnastics (6,9%) presented expressive total of athletes classified "at risk" to develop Eating Disorders (positive result in the 03 adopted questionnaires). It was observed that the occurrence of bone injuries, in the last two, years was expressive; however, only two athletes of rower had osteoporosis diagnosis. The frequency of dysmenorrhoea and oligomenorrhoea was accented in the Synchronized Swimmers-juniors (36.8% and 57.9%) and Endurance runners (29.4% and 41.2%). Secondary Amenorrhoea had greater frequency in Synchronized Swimmers-juniors (10.5%) and Synchronized Swimmers-seniors (12.5%).

CONCLUSIONS: It was verified more prevalence of inadequate alimentary practices and pathological attitudes (weight-control) associated with the dissatisfaction with the body image in sports which leanness or a specific weight was important. Only one athlete presents the Female Athlete Triad and four athletes are at risk of present it.

Keys words: Exercise, Eating disease, Amenorrhea, Osteoporosis.

References: Sundgot-Borgen J.(2004) Clinical Journal of Sport Medicine,14(1):25-32; Drinkwater B (2000). Women in sport. Australia: Blackwell science; American College of Sport Medicine.(1997),1(5):I-IV.

THE ACCUMULATION OF PERSONAL BARRIERS REDUCES WHILE THE ACCUMULATION OF SOCIAL SUPPORT INCREASES THE LIKELIHOOD FOR A PHYSICALLY ACTIVE BEHAVIOUR

Serrano-Sanchez, J.A., Sanchis-Moysi, J., Dorado-García, C., Ara-Royo, I., Vicente-Rodríguez, G., Calbet, J.A.

University of Las Palmas, Spain

Background. Personal barriers (PB) and social support (SS) influence physical activity (PA). Different types of PB (for example, lack of time) and SS (for example, having a friend to exercise) have been associated with PA (1-2). However, the effect of the accumulation of PB and SS on PA are less known. Methods. A representative sample of the general population of Gran Canaria composed by 3000 adults (18-75 years-old) was interviewed at home. Participants were asked about their PA using the Minnesota Leisure Time Physical Activity Questionnaire. Thirteen types of PB; 4 types of SS and a set of personal characteristics were measured. Two groups of PA according to public recommendations were established (sufficiently vs. insufficiently active). In addition, participants were classified in two groups as active (≥ 1 day/week) vs. inactive (< 1 day/week). PB were grouped in two categories: strong barrier (when the answer was: "often" or "very often") and weak barrier (when the answer was "sometimes" or "rarely" or "never"). Similarly, SS was grouped in two categories, existence of SS (when the answer was: "agree" or "strongly agree") and absence of SS (when the answer was: "disagree" or "strongly disagree"). The number of strong PB and the number of SS answers was obtained for each participant. Logistic regression with PA as dependent variable adjusted by age, gender, education, occupational activity, health status and BMI was applied. Results. Most PB predicted better inactivity than insufficient PA. Nine strong PB were associated with inactive status (p<0.001), with adjusted ORs ranging from 3.57 (95% CI. 2.50,5.08) for "I do not like exercise" to 1.49 (95% CI. 1.22,1.81) for "I do not have time". The accumulation of three strong PB enhanced the predictive value (OR= 4.66 for being inactive; OR= 3.57 for being insufficiently active). The four SS were associated similarly with both status of PA (active and sufficiently active). The adjusted OR for active status ranging from 1.92 (95% CI. 1.58,2.33) for "I have a friend to exercise" to 1.56 (95% CI. 1.29,1.88) for "I have a relative to exercise". The accumulation of three or more SS were more strongly associated with PA (OR= 2.37 to be active; OR= 2.20 to be sufficiently active) than each SS individually. Conclusions. To enhance the amount of PA of the population is convenient to reduce the number of personal barriers and increase the number of social support. The accumulation of personal barriers reduces while the accumulation of social support positive answers increases the likelihood for an active behaviour. The number of barrier or social support positive answers appears to be more important than any particular barrier or social support.

References

1. I. De Bourdeaudhuij, P. J. Teixeira, G. Cardon, B. Deforche, Public Health Nutrition 8, 886 (Oct, 2005).

2. R. C. Brownson, E. A. Baker, R. A. Housemann, L. K. Brennan, S. J. Bacak, American Journal of Public Health 91, 1995 (2001).

PAST SPORTS EXPERIENCES DETERMINE EXERCISE HABITS IN JAPANESE YOUTH: EXAMINATION OF "FROM WHEN" AND "HOW MUCH"

Suzuki, K., Nishijima, T.

University of East Asia, Japan

Introduction: Lifestyle-related diseases and a decline in youth physical fitness are widely acknowledged as serious problems in Japan. Previous studies demonstrated that exercise habits improve physical fitness. Suzuki & Nishijima (2006) took one further step and demonstrated that past sports experiences affected current exercise habits. However, it is not clear exactly what sports experiences are necessary to establish exercise habits in youth. The purpose of this study was to seek the criteria related to past sports experiences for establishing exercise habits in Japanese youth.

Methods: The subjects were 2,725 (male: 58.0%) high school students in Japan. Survey items included current exercise habits (frequency, duration), and past sports experiences (number of sports events: NSE, commencing time of sports: CTS, time spent per event: TS/E). An exercise habit was defined as implementation of exercise three or more days/wk and one or more hrs/day, according to the recommended level of physical activity for youth in previous studies. Classification and regression trees (CART) and logistic regression (LR) analysis were performed between exercise habits (yes or no) as an independent variable and past sports experiences as dependent variables. For checking replicability of these solutions, the data were randomly split into sample A and B halves.

Results and Discussion: 46.9% of the subjects was included in the exercise habit group. From the result of CART analysis for sample A, a classification tree with misclassification cost of 0.35 was produced. The rule of the highest ratio of exercise habit group (72.9%) was NSE > 2 events, & TS/E > 6.9 hrs. When variable importance index of NSE was considered to be 100, the relative value of TS/E was 50.4. From the result of CART analysis for sample B, a classification tree with misclassification cost of 0.34 was produced. The rule of the highest ratio of exercise habit group (76.3%) was NSE > 2 events, & TS/E > 8.3 hrs. Variable importance index of TS/E was 43.7. Split variables, split sequences, and magnitude relations of variable importance in CART analyses indicated the same results (NSE > TS/E > CTS) between the samples. The results of LR analysis using each sample indicated that only two variables, NSE and TS/E, were statistically significant in both samples (P < 0.01). Odds ratios of NSE and TS/E were 1.78 and 1.10 among sample A, 1.65 and 1.07 among sample B. The results showed that magnitude relation of odds ratio was equal (NSE > TS/E) between the samples. Magnitudes of variable importance and odds ratio

also indicated equal relations. Therefore, replicability of the results of CART and LR analysis by this data was confirmed. It was concluded that a requirement for establishing exercise habits in youth was as follows: 1) NSE > 2 events, and 2) TS/E > 6.9-8.3 hr before the end of high school.

References: Suzuki, K., & Nishijima, T. (2006). School Health.

THE RELATIONSHIP BETWEEN PHYSICAL FITNESS, PHYSICAL ACTIVITY AND JOB SATISFACTION IN MALE AND FEMALE OFFICE WORKERS

Hunter, A., Dibsall, K., Manson, N.

University of Stirling, United Kingdom

Introduction

It has been previously shown that there is a relationship between work performance and physical activity and cardiorespiratory fitness (Pronk et al., 2004). However in this study cardiorespiratory fitness was estimated from a self reported questionnaire and job performance was self rated by the participants. Both of these variables can be limited by misinterpretation and validity to the actual values. Accordingly, we examined employee Job Satisfaction Index (JDI)(Faragher et al., 2005), Scottish Physical Activity Questionnaire (SPAQ) (Lowther et al., 1999) and a selection of physiological fitness tests to see if these relationships exist.

Methods

102 healthy, moderately active, office workers (68 females and 34 males) with a mean age of 40 + 11.2 (range 20 - 66) participated in a selection of physical health and fitness tests and questionnaires. The health and fitness tests included resting heart rate and blood pressure, anthropometry, submaximal predicted VO2max, maximum number of sit ups achieved in 1 minute, sit and reach test, vertical jump and grip strength. The questionnaires involved completing both the standardised JDI and SPAQ.

Results

A significant relationship ($p<0.05$) was only shown for the males when correlating JDI with VO2max (job satisfaction r2 0.15, job in general r2 0.18, relationship with co-workers r2 0.23) and blood pressure (r2 -0.23). No significant relationships were shown when correlating the JDI with the other fitness tests. All participants showed significant ($p<0.05$) relationships when correlating VO2max with both age (males r2 0.33 females r2 0.12) and blood pressure (male r2 -0.14 female r2 -0.11), but none was shown between SPAQ and any other variable.

Discussion/conclusion

This study suggests that in male office workers there is a positive relationship between job satisfaction and aerobic capacity and a negative relationship with blood pressure, neither of which was observed in the females. Also, there is no relationship between aerobic capacity and self reported physical activity for both genders. Future studies should examine the differences in gender for these relationships and the validity of SPAQ to aerobic capacity.

References

Faragher, E. B., Cass, M., & Cooper, C. L. (2005). The relationship between job satisfaction and health: a meta-analysis. Occup.Environ.Med. 62, 105-112.

Lowther, M., Mutrie, N., Loughlan, C., & McFarlane, C. (1999). Development of a Scottish physical activity questionnaire: a tool for use in physical activity interventions. Br.J.Sports Med. 33, 244-249.

Pronk, N. P., Martinson, B., Kessler, R. C., Beck, A. L., Simon, G. E., & Wang, P. (2004). The association between work performance and physical activity, cardiorespiratory fitness, and obesity. J.Occup.Environ.Med. 46, 19-25.

STANDARDIZATION OF ANTHROPOMETRICS INDEXES AND THE AMOUNT OF PHYSICAL ACTIVITY AND STUDY THEIR RELATIONSHIP WITH CORONARY HEART RISK-FACTORS AMONG TEHRANIAN MEN AGING FROM 30 TO 55

Tofighi, A., Agha Ali Nejad, H., Salehi, S.

Tarbiat Modares University, Iran

Standardization of Anthropometrics Indexes and the amount of Physical Activity and study their relationship with Coronary Heart Risk-Factors among Tehranian men aging from 30to55.

Asghar Tofighi; Tarbiat Modares University(IRI)

Hamid Agha Alinejad; Tarbiat Modares University(IRI)

Saadat Salehi; Islamic Azad University of Arak(IRI)

This research was carried out to standardize the Anthropometrics Indexes including WHR, BMI, WC, Body Fat Percentage and the amount of Physical Activity and to study their relationship with Coronary Heart Risk-Factors which includes densities of Tchol,TG,Low Density Cholesterol Lipo-Protein ,Ratio Of LDL-C/HDL-C or Risk Factor and the Density of High Density Cholesterol Lipo-Protein among tehranian men aging from 30to55.The subjects involved in this study were 450 men from Tehran . In order to evaluate the relationship between anthropometrics indexes and coronary heart risk-factors , we took 46 blood samples of this research population Based on the results of this research the subjects norms was as following:

WHR: (0.95±0.57), WC: (93.77±10.22 cm), BMI :(25.8±3.65 kg/m2), PHYSICAL ACTIVITY (7.29±1.5). Moreover significant relationships between these factors were found: [WHR and TG ($r=0.536, p<0.01$)] , [WHR and Chloe ($r=0.49, p<0.01$)] ,

[WHR and HDL-C ($r= -0.541, p<0.01$)] , [WHR and RF ($r= 0.532, p<0.01$)]. Data analysis showed that there were significant relationships between these factors:

[BMI and TG ($r= 0.389, p<0.01$)] , [BMI and Chloe ($r= 0.37, p<0.05$)] ,

[BMI and HDL-C ($r= -0.415, p<0.01$)] , [BMI and RF ($r= 0.394, p<0.01$)] .

[%BF and TG ($r= 0.48, p<0.01$)] , [%BF and Chloe ($r= 0.4, p<0.01$)] ,

[%BF and HDL-C ($r=- 0.464, p<0.01$)] , [%BF and RF ($r= 0.45, p<0.01$)] .

[PHYSICAL ACTIVITY and HDL-C($r=0.58, p<0.01$)] ,

[PHYSICAL ACTIVITY and LDL-C($r=-0.429, p<0.01$)] ,

[PHYSICAL ACTIVITY and RF ($r= -0.526, p<0.01$)] .

We can conclude based on the results of the study that asWHR,BMI,WC,BODY FAT PERCENTAGE and a decrease in PHYSICAL ACTIVITY increase, the probability of subjects catching coronary heart diseases increases too.

Keywords: WHR, BMI, WC, Body Fat Percentage, the amount of Physical Activity, Coronary Heart Risk-Factors.

MOTOR COMPETENCE AND LEISURE TIME PHYSICAL ACTIVITY IN AN INTERNET BASED INTERVENTION

Loftesnes, J.M., Motterud, G., Veka, B., Myklebust, M.B.

Sogn og Fjordane University College, Sogndal, Norway

Introduction

An internet based intervention promoting physical activity was carried out involving 923 Norwegian school classes. The goal of the intervention was; participants should be as active as possible during a three week period in a nation wide competition. The pupils had to do a virtual walk around Norway. 10 minutes of physical activity was converted to 2 km on the map. Our goal was to detect whether inactive and little active children could benefit from this net-based campaign carried out by Trivsel.net (The Norwegian Olympic Committee and Confederation of Sports).

Methods

The subjects, 69 in all, aged 11.2 ±1.2 years old (Mean ±SD), were tested on the Movement Assessment Battery for Children, age band 4 (Henderson & Sugden, 1992). This assessment consists of 8 sub-tests in three groups. Permission was given by parents, children and the school, and the study took place in quiet settings so that the children could be anonymous. A questionnaire, consisting of five questions was administered: 1. To what extent it was fun to participate?, 2. To what degree do you feel you have been more physically active?, 3. Would you like to participate again?, 4. What kind of organised activity do you participate in and how many times in a week?, and 5. What kind of unorganised activity do you participate in and how many times during a week?

Results

There was a significant association between physical activity level in the Trivsel.net and motor competence (p= .047). Participants reported having had great fun, but only some of the very active children found it only a bit fun, while no subjects answered 'boring'. In total, 84 % answered that they were more active during the intervention period, with the remaining 16 % being in the very active group. Likewise, 87 % would like to participate again. However, the remaining 13 % belonged to the low active group. A strong Trivsel.net level of activity/organised leisure time activity association was present (Mann-Whitney U, p= .001). There was also a strong association between the physical activity level in Trivsel .net and unorganised leisure time activity (Mann-Witney U, p= .002).

Discussion

This study identified a close relationship between levels of physical activity and skilled performance, and confirmed that children with poor motor skill are less active both in organised activities and unorganised leisure time activities. The children in the low active group all confirmed the intervention as being great fun, and that they would like to participate in such an activity again. Since the children less motor skilled is the least active it seems that in order to get these inactive children in better physical shape, one must focus on teaching these children better motor skills.

Henderson, S. & Sudgen, D. (1992). The movement assessment battery for children. Kent: The psychological corporation.

ABDOMINAL SKELETAL MUSCLE AND ADIPOSE TISSUE CROSS-SECTIONAL AREA MEASURED BY MAGNETIC RESONANCE IMAGING IN OLDER FEMALE SWIMMER

Kazuya, Y., Kiyoshi, S., Chiyoko, U., Izumi, T., Mitsuru, H.

Nippon Sport Science University, Japan

Introduction

To protect against the increase of fat mass and loss of skeletal muscle (SM) mass with advancing age is important for older individuals to maintain a high level quality of life. Swimming reduces the mechanical stress on the joints because of lower impact in water. Therefore, many elderly females have participated in this exercise to advance their health and fitness. Although swimming improves cardiovascular fitness such as peak oxygen uptake (VO2peak), there is little evidence to support whether regular swimming exercise prevents the increase of fat mass or loss of skeletal muscle (SM) mass, especially the SM supporting abdominal region. The aim of this study was to investigate the abdominal SM and adipose tissue cross-sectional area (CSA) measured by magnetic resonance imaging in postmenopausal women who regularly perform swimming exercises.

Methods

A total of 73 older women participated in this study, and they were divided into two groups (42 Swimmers and 31 Untrained). Percentage of body fat was measured by air displacement plethysmograph using BOD POD System. The VO2peak during running was measured by incremental treadmill testing. The CSA of the abdominal profiles were measured by Magnetic Resonance Imaging (MRI). MRI images were segmented into the three components, i.e., SM, fat, and bone areas, and we divided the subcutaneous fat, visceral fat, flexor muscles and extensor muscles. Moreover their images were traced on the outline of the tissue, and their CSAs were analysed by NIH Image software (Ver 1.63).

Results

Swimmers had lower percentage of body fat and larger the VO2peak than untrained subjects (percentage of body fat; 27.4 ± 3.8 vs. 31.0 ± 5.0 %, VO2peak; 1.67 ± 0.21 vs. 1.46 ± 0.17 L/min in Swimmer and untraiend). There were significant differences with fat free mass (38.3 ± 3.3 vs. 35.4 ± 3.5 kg) and the CSA of the trunk SM (extensor muscle CSA; 43.2 ± 7.5 vs. 37.6 ± 4.8 cm2, flexor muscle CSA; 45.2 ± 8.5 vs. 41.5 ± 9.7 cm2) between swimmers and untrained subjects. There were no significant differences found regarding the waist circumference, (89.3 ± 6.9 vs. 90.5 ± 6.9 cm), subcutaneous fat CSA (117.1± 41.1 vs. 116.3 ± 40.1 cm2), and visceral fat CSA (46.4 ± 17.5 vs. 48.3 ± 17.6 cm2,) in this study.

Discussion/Conclusion

These results suggest that swimming exercise induce higher cardiovascular fitness in older women, and maintain the trunk muscle sizes in both the extensor and flexor muscles.

ASSOCIATION BETWEEN OVERWEIGHT, OBESITY AND LEVELS OF PHYSICAL ACTIVITY IN STUDENTS FROM JOÃO PESSOA, PARAÍBA – BRAZIL

Silva, F., Silva, K., Martins, C.

Catholic University of Brasília, Federal University of Santa Catarina, Faculty of Sports- Porto , Brazil

Introduction: Overweight and lack of physical activity have been promoting great impact in public health, an increasing problem in different populations. The diagnosis of risk factors contributes to an effective intervention. The aim of the present study was to associate overweight, obesity and physical activity levels of students from João Pessoa - Brazil. Method: The sample comprised 1091 children (573 boys and 518 girls), aged 9-12 years (10±0,1 year) of public and private schools from João Pessoa. All students answered a questionnaire about leisure time physical activities; distance and means of transport used to go to school and intensity and frequency of their physical activities practice. BMI was calculated from the ratio of weight / height2 and determined overweight and obesity according to criteria proposed by Glues et al. (2000). The scores obtained in the activities determined the levels of physical activity according to quartis. Statistical descriptive analysis, binary logistic and multivariate regression were made to observe associations isolated and/or combined among the variables. Results: Data showed 14,5% (n=155) of overweight; 3,6% (n=38) of obesity; 25% (n=263) of physical inactivity and 47,4% (n=501) indicated viewing TV in leisure time. No differences were observed between sexes nor association of overweight and obesity with quartis of physical activity. However, it tends to increase four times for those that spend more time dedicated to TV or leisure activities instead of those who practice sports or help in domestic tasks. Children of private schools presented risk for overweight and obesity three times larger than children of public schools. Conclusion: Overweight showed significant association with low activities and school segment. Intervention strategies for reduce risk for obesity should be stimulated at school.

EFFECTS OF THE TRAINING FREQUENCY UNDER A HAYPOBARIC HYPOXIA ON CARDIOVASCULAR FUNCTIONS

Ogita, F., Nishiwaki, M., Kawakami, R., Wagatsuma, A., Tamaki, H., Tanaka, T., Saito, K.

National Institute of fitness and Sports, Japan

Introduction

It has been well accepted that both exercise and hypoxia can be a great stimulus to increase vascular endotherial growth factor (VEGF), which is an important mediator of angiogenesis (Hoppeler 1999, Richardson et al. 1999). The developed capillary network by angiogenesis would elicit a favorable cardiovascular adaptation to satisfy the elevated tissue demands and to reduce peripheral resistance. Also this skeletal muscle adaptation to exercise would be influenced by training frequency. Therefore, the present study aimed to examine the effects of the training frequency under a hypobaric hypoxic condition on cardiovascular functions.

Methods

Twelve healthy adults (26±7 yrs) were assigned to two groups matching for physical fitness level. Both groups had aquatic exercise training in the hypobaric condition corresponded to 2000m above sea level, and were exposed to the condition for 2.5 hours/session. The exercise training was done in swimming pool located in a chamber where atmospheric pressure could be regulated. Also the training was performed at the intensity of around 50%VO2max level for 30 minutes/training session, 3 (3DG) or 4 (4DG) days/week, for 4 weeks. Before and after the training period, VO2max and cardiovascular responses such as heart rate (HR), stroke volume (SV), cardiac output (CO), and systolic (SBP), diastolic (DBP) and mean blood pressure (MBP) during cycling exercise at the intensity of 50%VO2max were determined.

Results

After the 4 weeks of training, VO2max did not change significantly in both groups. In cardiovascular responses during the exercise at 50%VO2max, no significant changes were observed in 3DG, except for MBP. On the other hand, a significant increase was observed in SV (pre: 115±19, post: 132±25 ml) and CO (pre: 14.7±2.8, post: 16.3±2.5 l?min-1) in 4DG ($P<0.05$). Furthermore, DBP (pre: 68±8, post: 55±4 mmHg) and MBP (pre: 98.4±5.2, post: 91.9±4.4 mmHg) in 4DG were significantly decreased ($P<0.05$).

Discussion/Conclusion

The findings of this study and our previous studies suggest that the exercise training in hypobaric hypoxic condition would induce the favorable cardiovascular changes which increases easily SV and CO reducing total peripheral resistance and that to obtain such cardiovascular adaptations in young healthy adults, it is required to do exercise training more than 4 days a week.

Reference

Hoppeler H (1999) Vascular growth in hypoxic skeletal muscle. Adv Exp Med Biol 474: 277-286

Richardson RS, et al (1999) Human VEGF gene expression in skeletal muscle: effect of acute normoxic hypoxic exercise. Am J Physiol Heart Circ Physiol 277:H2247-H2552

Acknowledgement

This study is partly supported by a Grant-in-Aid for Scientific Research from the Japan Society for the promotion of the Science (project No 16500446) and by a grant -aid for scientific research from National Institute of Fitness and Sports in Kanoya (President's discretionary Budget 2005).

Poster presentation (PP)

PP2-04 Sports Medicine 1-3 - "Exhibition Hall"

THE SQUAT: ISO-INERTIAL RESISTANCE EXERCISE PROMOTES GREATER QUADRICEPS MUSCLE USE THAN THE BARBELL EXERCISE

Norrbrand, L., Tous Fajardo, J., Tesch, P.

Karolinska Institutet, Sweden

Knee extensor and adductor muscle use in the Squat exercise carried out with either iso-inertial resistance or barbell, was assessed by means of functional Magnetic Resonance Imaging (MRI). Thus, exercise-induced contrast shifts of images were determined in an effort to grade and compare individual muscle use (1) in the Squat employing these two loading modes. On two separate days, five trained men

(age; 33±2 yrs, height; 179±10 cm, body mass; 88±17kg, barbell half-squat 10RM; 146±18 kg) performed the Squat (5 sets of 10 reps @ 10RM) using either free weights (barbell half-squat; BS) or an exercise device (2), which uses the inertia of rotating flywheels (flywheel squat; FS) to provide resistance. MRI spin-echo scans (double echo sequence, proton density with TR/TE: 1500/30 msec, T2 weighted with TR/TE: 1500/60 msec) of the thighs were performed prior to and immediately after completing any exercise session. From each stack of images of both limbs, five images were analyzed by measuring signal intensity (SI) and calculating T2 of mm. rectus femoris (RF), vastus lateralis (VL), vastus medialis (VM), vastus intermedius (VI), adductor magnus (AdM), biceps femoris (BF) and gracilis (Gr). SI and T2 of subcutaneous fat, bone and bone marrow were also analyzed to assure reliable measurements across scans. A two-way repeated measures ANOVA was employed to compare measurements. T2 of all individual quadriceps muscles and AdM was enhanced after both exercises ($p<0.05$). T2 of Gr and BF, subcutaneous fat, bone and bone marrow was unchanged ($p>0.05$). T2, averaged across the four quadriceps muscles, showed greater ($p<0.05$) use with FS compared with BS. Among individual muscles, RF showed greater ($p<0.05$) use with FS. Though both exercise modes provoked enhanced T2 of quadriceps and AdM muscles, it appeared the overall response was more marked for FS compared with BS. In contrast to weight training, iso-inertial resistance allows for the execution of maximal, voluntary concentric actions through the entire range of motion and across repetitions of a full set. This may explain the greater response shown after FS and suggest that quadriceps muscle use in the Squat exercise, employing iso-inertial resistance, is boosted compared with traditional barbell resistance exercise. Hence, this technology could serve as an alternative for athletes who are concerned about performing the classical barbell Squat with near maximal loads.

1. Meyer, R. A. and B. M. Prior. Functional magnetic resonance imaging of muscle. Exerc Sport Sci Rev. 28:89- 92, 2000.

2. Berg, H. E. and P. A. Tesch. Force and power characteristics of a resistive exercise device for use in space. Acta Astronaut. 42:219-230, 1998.

THE TREATMENT OF SHOULDER PAIN: CURRENT TRENDS IN CHIROPRACTIC MANAGEMENT

Pribicevic, M., Pollard, H.

Macquarie University, Australia

Background: Shoulder pain is a common problem encountered in clinical practice and represents a very challenging area for the therapist due to its structure and strong biomechanical and anatomical relationship with adjacent areas. The chiropractic literature contains no standardized approach to the management of shoulder pain, and is supported by low-grade evidence based upon published case reports. The common denominator of chiropractic management is the use of a multi modal treatment approach incorporating soft tissue therapy, electrotherapeutics, manipulation and exercises. Other accepted and standard forms of conservative treatment for shoulder disorders include the use of oral non-steroidal anti-inflammatory drugs, corticosteroids oral and injections, manipulation under anaesthesia, and physiotherapy approaches including exercise, mobilization, taping and electrotherapeutics. Aim: To describe the clinical management of shoulder pain as described in the literature. Methodology: Included recent publications derived from medline, cinahl, ovid and science direct databases. Also included were searches from the Cochrane Musculoskeletal Group trials register and Cochrane Controlled Trials Register. Manual searches of relevant textbook and journal bibliographies were utilized with a main focus on recent chiropractic and physiotherapy publications, 1985-present. Results: The papers presented in this review largely utilised a multimodal approach. All subjects demonstrated a positive outcome in terms of reduction of pain , improvement in range of motion, and the normalisation of orthopaedic tests after a course of treatment, with the restoration of normal daily and sporting activities. Conclusion: The chiropractic literature supports a multimodal management approach of shoulder disorders based upon low-grade case report publications. No quality research has been undertaken within the profession to substantiate a particular approach in the form of a controlled trial.

A RANDOMIZED CONTROLLED CLINICAL TRIAL OF MANUAL THERAPY TREATMENT FOR SHOULDER PAIN

Pribicevic, M., Pollard, H.

Macquarie University, Australia

A RANDOMIZED CONTROLLED CLINICAL TRIAL OF MANUAL THERAPY TREATMENT FOR SHOULDER PAIN Pribicevic M, Pollard HP Macquarie Injury Management Group, Macquarie University, NSW 2109, Australia Background: Shoulder pain has a high prevalence in clinical practise, with very little research being dedicated to this complex clinical entity from a manual therapy perspective. Aim: The purpose of this study is to describe a clinical trial and treatment rendered on a randomised pool of subjects utilising 2 different manual therapy treatment methods. Methodology: Forty-two subjects participated in the trial, who were individually randomised into 3 different groups: a control group (n=12), a manipulation group (n=15), and a multimodal treatment group (n=15). Each subject after randomisation and the initial assessment was treated for a total of 8 visits over a 4-week period. Reassessment of subjects occurred at the end of the 4-week treatment. The treatments rendered included: A detuned ultrasound set at a zero setting for the control group, manipulation of the cervical or thoracic spines, and or gleno-humeral joint for the manipulation group, and a multimodal approach combining soft tissue methods, manipulation of the cervical, thoracic spines, or glenohumeral joint and rehabilitation exercises. The outcome measures for the trial included: patient perception of pain, VAS, and key orthopaedic tests (Hawkins, Neer's, and Jobe's and painful arc).Results: The data was statistically analysed with descriptive statistical and inferential methods using a standard significance level (alpha) of 0.05. Both treatment groups showed a marked reduction in mean pain levels pre and post treatment for both pain outcome measures. The multi modal group demonstrated a change from pre-treatment levels of pain for both outcome measures of 6.7/6.2 respectively to post treatment levels at 1.8/1.36. The manipulation group for both outcome measures demonstrated changes from the pre treatment levels of 5.2/4.8 to post treatment levels of 2.8/2.2. The control group showed no statistically detectable change with t-test analysis. For both pain outcome measures the demonstrated pre treatment values were 5.1/4.3 with post treatment levels being 4.8/3.7. The subjects randomised to the multimodal treatment group demonstrated a greater mean pain level change for both outcome measures. Conclusion: This report of preliminary findings demonstrates the potential benefit of a multimodal manipulation protocol and "straight" manipulation protocol in managing pain syndromes associated with dysfunction of synovial structures of the shoulder and or shoulder girdle.

GENDER DIFFERENCES IN SENSORY AND MOTOR THRESHOLDS DURING ELECTRICAL STIMULATION OF THE QUADRICEPS FEMORIS MUSCLE

Maffiuletti, N.A., Herrero, A., Jubeau, M., Bizzini, M., Dvorak, J.

Schulthess Clinic, Switzerland

Electrical stimulation (ES) therapy is largely used in rehabilitation-orthopaedic medicine (Snyder-Mackler et al. 1995) and in sports medicine (Lake 1992), with the general objectives to (1) minimize the effects of prolonged disuse on skeletal muscle structure and function, and (2) improve neuromuscular function parameters (e.g., as a resistance training and/or as a recovery modality). One hypothesis for the well known gender differences in body composition is that males and females respond to ES differently, and would therefore require different current intensities to optimize treatment effectiveness. Aim of the present study was to examine gender differences in sensory and motor thresholds during ES of the quadriceps femoris muscle at both high (75 Hz) and low (10 Hz) frequency modulation.

Forty healthy subjects (20 males and 20 females) were stimulated via surface electrodes placed over the vastus lateralis muscle and a portable ES unit. The two experimental frequencies (10 and 75 Hz) were randomly presented. Stimulation intensity (in mA) was increased progressively and the following thresholds were determined: sensory (ST), i.e., initial perception of stimulus sensation; motor (MT), i.e., minimal visible muscle contraction; maximal motor (MMT), i.e., full knee extension. Then, maximal voluntary contraction (MVC) torque of the quadriceps muscle was measured, and the subject was stimulated to evoke 10% of the MVC torque (10%T). Skinfold thickness was measured under the stimulating electrode and quadriceps cross-sectional area was estimated according to Housh et al. (1995). A two-way ANOVA (gender, frequency) was performed.

A significant frequency effect was consistently found; ES thresholds were significantly lower at 75 Hz compared with 10 Hz ($p < 0.001$). ST and 10%T were significantly lower in females than in males (ST: 3.1 vs. 5.4 mA, $p < 0.001$; 10%T: 46.8 vs. 57.0 mA, $p = 0.01$), while MT was significantly higher in females as compared to males (13.5 vs. 11.3 mA, $p = 0.042$). Interestingly, ST was significantly correlated to both skinfold thickness ($r = -0.71$, $p < 0.001$), and cross-sectional area ($r = 0.65$, $p < 0.001$). Significantly higher pain scores (VAS) were found in the female group and at low frequency (data not presented).

It is concluded that, during surface ES of the quadriceps femoris muscle, females need different doses of current to activate both sensory and motor nerve fibers as compared to their male counterparts. Gender differences in skin nerve fiber density (Goransson et al. 2004, Mowlavi et al. 2005), subcutaneous fat layer and quadriceps muscle mass mainly account for these results. Our findings are valuable in terms of the gender-specific response to acute and chronic application of ES.

Goransson LG et al., Neurology 62:774-7, 2004

Housh DJ et al., Med Sci Sports Exerc 27:784-91, 1995

Lake DA, Sports Med 13:320-36, 1992

Mowlavi A et al., Plast Reconstr Surg 116:1407-10, 2005

Snyder-Mackler L et al., J Bone Joint Surg Am 77:1166-73, 1995.

ASSESSMENT OF CARDIORESPIRATORY FITNESS BY A CYCLE ERGOMETER TEST AND THE REFERENCE VALUES FOR A GENERAL POPULATION OF FINNISH ADOLESCENTS

Tammelin, T., Remes, J., Oksa, J., Näyhä, S., Zitting, P., Kujala, V.

Finnish Institute of Occupational Health , Finland

Poor cardiorespiratory fitness is associated with increased risk of several cardiovascular and metabolic diseases. The weakened results of repeated fitness tests performed in Finnish schools and defence forces indicate that the level of cardiorespiratory fitness has declined among young Finnish people. However, cardiorespiratory fitness has not been evaluated in health surveys of young people in Finland and the reference values of maximal oxygen uptake for large unselected population of adolescents have not been available. This study evaluated the accuracy of a submaximal cycle ergometer test to assess cardiorespiratory fitness in adolescents and provided population based reference values. In a health study of Northern Finland birth cohort 1986, cardiorespiratory fitness of 5375 boys and girls aged 15 to 16 years was measured by a submaximal cycle ergometer test by using a two-stage exercise protocol designed for this survey. A total of 4903 subjects performed two work stages, and maximal workload and peak oxygen consumption (VO2peak) were calculated on the basis of heart rate responses by extrapolation method (WHO). An additional 472 subjects were able to finish only one work stage. For them, VO2peak was calculated by Åstrand nomogram (ÅN). To evaluate the accuracy of submaximal testing, a validation sample of 90 subjects performed both a submaximal test and a maximal cycle ergometer test with direct measurement of VO2peak. The WHO method proved to estimate VO2peak with a reasonable accuracy. The ÅN method overestimated VO2peak considerably, and therefore a new single-stage regression method (SSR) was applied to calculate VO2peak on the basis of heart rate and perceived exertion rate during single work stage. The reference values of cardiorespiratory fitness were provided for methods WHO and SSR for a general population of Finnish boys and girls aged 15 to 16 years. Mean VO2peak was 49 ml/kg/min in males (N=2635) and 35 ml/kg/min females (N=2268) by method WHO. The developed test protocol and the reference values provided will be an aid in the population surveys measuring cardiorespiratory fitness among the youth. The methodology and the reference values presented would also be useful in fitness testing and in any efforts to enhance physical activity, cardiorespiratory fitness and health among young people.

EFFECTS OF BATHING AND POST-EXERCISE BATHING ON AUTONOMIC CARDIOVASCULAR REGULATION IN MIDDLE-AGED AND OLDER MEN

Matsui, T., Miyachi, M., Kawano, H., Nishimura, M., Amaoka, H., Senoo, N., Kosaka, T., Ono, K., Onodera, S.

Nihon Fukushi University, Japan

It has been reported that baroreflex sensitivity during head-out water immersion in middle-aged and older people is weaker than that in young people. Due to this reduction, middle-aged and older individuals have an inadequate ability to regulate increased central blood volume caused by immersion. Therefore, middle-aged and older people show greater fluctuations in blood pressure, and are at higher risk for cardiovascular events than young people. Especially when bathing in water at 40 degrees C or higher, central blood volume is affected by both immersion and warmth, and the risk of event might be greater. Speedy and adequate autonomic cardiovascular regulation is needed during bathing in hot water. Users of Kurhouse (hot spring spa with sports facilities) perform exercise, then get into a bath shortly there after. In this situation, effects of exercise are added to the effects of bathing in hot water. However, there have been few studies of the effects of post-exercise bathing.

We investigated the characteristics of autonomic cardiovascular regulation in response to bathing and post-exercise bathing (40 degrees C, 20min) in healthy middle-aged and older men (MO, 55 +/- 10 years, range: 40-71 years) compared with young men (Y, 22 +/- 3 years). During bathing, heart rate (HR) of MO and Y were similarly increased, and were parallel to the decreases of heart rate variability (logHF, vagal modulation) and spontaneous cardiac baroreflex sensitivity (logSBRS). Systolic blood pressure (SBP) in MO temporarily increased at the beginning of bathing, then significantly decreased in the last phase of bathing similar to that in Y. The MO also showed a significant decrease in SBP and diastolic blood pressure (DBP) at the beginning of the recovery phase after post-exercise bathing. In both group, stroke volume (SV) and cardiac output (CO) significantly increased, and total peripheral resistance (TPR) significantly decreased in both bathing trials. But the TPR of MO was greater, and extension of the carotid artery diameter (systolic – diastolic) was smaller than that of Y. Based on these results, it was suggested that bathing attenuates spontaneous cardiac baroreflex sensitivity, and affects the regulation of fluctuation in blood pressure response in MO. Further, greater attenuation of sensitivity observed during post-exercise bathing in MO seemed to affect blood pressure regulation during the recovery phase after leaving the bath.

CASE STUDY, POTENTIAL 'PIT FALLS' IMAGING HAMSTRING INJURY

Rogers, R., Allen, G., Witvrow, E.

University of Wolverhampton , United Kingdom

Hamstring injuries are among the most common muscle injuries in athletes. Recurrence rates for hamstring strains also tend to be high despite concentrated rehabilitation efforts. The high rate of re-injury and of persistent complaints after return to athletic activities can pose difficult problems for Sports Medicine Clinicians as well as Trainers. The factors dealing with the main causes of the injury are numerous, and no unanimous conclusion has been drawn. Several biomechanical and morphological aetiologies have been proposed, with a multifactorial basis to hamstring injury most likely. The imaging basis of strain to the hamstring muscle relies on demonstrating the features of myofibrillar disruption. Currently MRI and Ultrasound imaging are employed as the mainstay of radiological assessment. Evaluating the location, extent and severity of hamstring injury can provide supplemental information to the clinical assessment and may potentially assist in defining the prognosis and guide rehabilitation. Such information is also crucial in the professional sporting context, given the pressure to return rapidly to competition. Often however imaging does not correlate with clinical impressions. This presentation will provide four case studies where clinical and functional assessments did not correlate with imaging. In addition we will discuss some of the potential "pit falls" in relying solely on imaging studies for prognosis and return to play.

THE EPIDEMIOLOGY OF GOLF-RELATED INJURIES IN AUSTRALIAN AMATEUR GOLFERS: A MULTIVARIATE ANALYSIS

McHardy, A., Pollard, H., Luo, K.

Macqaurie University, Australia

Introduction: Golf is a popular sport played worldwide by people of all ages and skill levels. Part of the appeal of golf is that there are no gender, skill or age limits to participation. Golf participation rates vary across all age ranges and are high in the older age groups. This is partly due to the fact that: older persons have more leisure time to pursue activities and golf is a low impact sport with a general aerobic component, which makes it a perfect recommendation for practitioners wanting their patients to exercise. Although they are uncommon, injuries do occur whilst playing golf. Considering the popularity of golf, both in participation and spectator rates, it is surprising that there have been only a small number of small studies on golf injury. Indeed, most studies on injury rates in golfers were produced ten to twenty-five years ago1,2,3.

Objective: To perform an epidemiologic study of amateur golfers to determine the golf-related injury rates in amateur golfers across Australia. To determine the common injury mechanisms in golf and to determine if factors such as age, gender, warm up and conditioning habits, equipment and skill level affect injury rates.

Method: a one-year retrospective design was used to study golf injuries associated with golfers of randomly selected Australian golf clubs. Risk factors of golf-related injury (age, gender, warm up and conditioning habits, equipment and skill level) were further examined together by univariate and multivariate analysis using logistic regression.

Results: there were 1634 golfers included in the present study. Of them, 288 reported having had one or more golf-related injuries in the previous year. The most common injury location was the lower back (25.3%), followed by the elbow (15.3%) and the shoulder (9.4%). The most common injury mechanism occurred due to the golf swing (44.8%). Significant difference between injured and non-injured golfers was identified when assessing age, warm-up status and conditioning habits, and participation in other sports / activities. Equipment use such as type of golf club shaft used, and type of shoes used were found not to be statistically significant.

Conclusion: the most injured site identified in this study was the low back, the elbow and the shoulder respectively. Age, warm-up status and conditioning habits, and participation in other sports / activities were identified as risk factors associated with injury. This study provides timely and new information on the location and factors associated with injury in amateur golffers in Australia.

References

1. Batt ME. A survey of golf injuries in amateur golfers. Br J Sports Med 1992 26;1:63-5.

2. McCarroll JR, Gioe TJ. Professional golfers and the price they pay. Phys Sports Med 1982 10;7:64-70.

3. McCarroll, Retting AC, Shelbourne KD. Injuries in the amateur golfer. Phys Sports Med 1990 18;3:122-26.

ONE-YEAR PROSPECTIVE STUDY ON GOLF INJURIES IN AUSTRALIAN AMATEUR GOLFERS

McHardy, A., Pollard, H., Luo, K.

Macqaurie University, Australia

Introduction: Golf is a popular activity, particularly in the older population as it provides an opportunity for those with available time to exercise in the outdoors playing a game they enjoy. From a health perspective golf, as a form of exercise, is popular as it provides a low level of physical exertion over an extended period, without the physical contact and high intensity of many other sports. Despite this ,popularity only one previous study has prospectively investigated golf injuries, a study that was conducted on low back injuries in beginner golfers by Burdorf and co-workers1. All other golf injury epidemiology studies have been retrospective in nature, raising the possibility of recall bias in their findings. Additionally, due to a lack of prospective studies, the true incidence rate of golf injuries has been unable to be accurately determined.

Objectives: To undertake a detailed, epidemiological study of golf injuries sustained by golfers in order to define their incidence, nature, severity, and causes.

Methods: A one-year prospective design was used to study golf injuries associated with 588 golfers at 8 Australian golf clubs. Golfers self-reported injuries sustained during golf participation and provided details of the location, onset, and mechanism (phase of the golf swing). Additionally, information was sought on any treatment sought for each injury was recorded.

Results: The overall incidence of injury was 15.8 injuries/100 golfers. Recurrent injuries were most common, while injuries were more likely to occur over time. The lower back was the most common injury site (18.3%), closely followed by the elbow. Incorrect swing mechanics accounted for 46.2% of injuries, while in the golf swing injury was most likely to occur at impact (23.7%), followed by the follow through phase of the swing. When assessing for risk factors for injury, multivariate analysis produced significance in the amount of game play and time of last change of clubs ($P < 0.05$) Factors such as age, gender, handicap, practice habits and warm-up habits were not identified as risk factors for injury, despite earlier research of a retrospective nature that suggested the opposite (unpublished data)2.

Conclusions: On average, nearly 16% of golfers may expect to sustain a golf-related injury in the next 12 months and that injury would be most likely be sustained in the lower back region as a result of faulty swing mechanics. Based on statistical analysis, only the amount of game play and recent change of golf clubs seem to be significantly associated with risk of injury after adjusting for other risk factors ($P < 0.05$).

References

1. Burdorf A, Van Der Steenhoven GA, Tromp-Klaren EG. A one-year prospective study on back pain among novice golfers. Am J Sports Med 1996 Sep-Oct;24(5):659-64

2. Gosheger G, Liem D, Ludwig K, Greshake O, Winkelmann W. Injuries and overuse syndromes in golf. Am J Sports Med. 2003 May-Jun;31(3):438-43.

FORCE CONTROL DURING SUBMAXIMAL ISOMETRIC CONTRACTIONS OF THE KNEE EXTENSOR MUSCLES IN INDIVIDUALS WITH MENTAL RETARDATION

Periklis, V., Hadjixenofontos, M., Tsimaras, V., Charitonidis, K., Michailidis, C., Kotzamanidis, C.

Aristotle University of Thessaloniki, Greece

Relevant studies have shown that people suffering from mental retardation (MR) present diminished efficiency in motor performance (Agelopoulou et al 1999) regarding people without mental retardation(NMR). More over there is lack of information related with their variability during motor task execution (Latash & Corcos 1991) and specifically during strength effort. For this reason the purpose of this study was the comparison of the force variability between successive and increasing isometric contractions of the knee extensor muscles between people with mental and without mental retardation. The sample consisted by 10 adults, 5 subjects with MR (age: 24,3±2,5 and height: 168,4±5,9 cm) and 5 subjects without MR (age: 25,6 ± 1,3 and height:171,9 ± 2,6). They voluntarily participated in the experimental procedure and they did not have systematic athletic training. The levels of submaximal isometric contractions were fixed in the 6%, 12%, 24%, 36%, 48% and 60% (Smits-Engelsman, 2005), of maximal isometric contraction (MIC). The variability of force was estimated using two variables, standard deviation (SD) and coefficient of variance (CV). After MIC estimation the subjects performed 5 efforts in the 6%, 12%, 24%, 36%, 48% and 60% of the MIC. Simultaneously vastus lateralis, vastus medialis (agonist) and biceps femoris (antagonist) activity were recorded. The neuronal activation of the agonist muscle was normalised as the ratio of aEMG vs maximal value while antagonist activity as the ratio of antagonist activity vs the maximal activation of the same muscle acting as antagonist. For the measurements CYBEX NORM. dynamometer and the BTS EMG device were used. For the statistical analysis the level of significance was $p<0.05$. The obtained results indicated that there was not statistically significant differences in the level of agonist activation between groups while antagonist activity was higher in MR. The CV remained constant in all selected intensities in the NMR group while it was continuously increased in MR group. People with MR presented higher CV in all cases combared with NMR group. More over the antagonist activity increased in parallel with contraction intensity in both groups and in all cases was higher in people with MR. The individuals with NY present developmental delay, thus they have delay in the beginning of basic kinetic skills as the posture and gait. The above results can partial be explained by low perception in motor ability, decreased attention, hyper mobility, aggressiveness and negativism (Agelopoulou, 2004).

MORPHOLOGY OF TRICEPS BRACHIALIS MUSCLE IN ELITE TENNIS PLAYERS

Guadalupe-Grau, A., Bernales, O., Delgado-Guerra, S., Olmedillas, H., Dorado, C., Calbet, J.A., Sanchis-Moysi, J.

University of Las Palmas de Gran Canaria, Spain

INTRODUCTION: Tennis is an excellent exercise model to study muscle plasticity in response to chronic exercise. Tennis players submit their dominant-arm to a huge amount of physical activity compared to their contralateral arm. In consequence, the muscle mass is about 20% higher in the dominant compared to the non-dominant arm (Calbet et al. 1998). However, the effect of tennis participation on arm muscle morphology remains unknown. Moreover, only scarce data is available on triceps morphology in athletes (Mizuno et al. 1990; Parsons et al. 1993; Mygind, 1995; Terzis et al. 2006) and there is, in general, a paucity of data on the effects of exercise on arm muscles.

PURPOSE: The aim of this study was to assess the effect of tennis participation on the morphology of the triceps brachialis muscle of the dominant compared to the non-dominant arm.

METHODS: Four elite tennis players (23.0 ± 1.0 yr, mean ± SEM) accepted to participate in this study. Muscle biopsies were taken from lateral aspect of the triceps brachialis of both arms and processed for histochemical fiber typing and determination of fiber cross sectional areas. In addition, the muscle mass of the dominant and non-dominant arm was also determined using dual-energy x-ray absorptiometry (DXA). Side-to-side comparisons were carried out using a one-tailed Student's t-test.

RESULTS: The muscle mass of the dominant arm was 14% greater than that of the contralateral arm. Compared to the non-dominant the type 1, 2a and 2x muscle fiber were hypertrophied in the dominant arm by 36% (4018 ± 457 and 5472 ± 556 μm2), 31% (6185 ± 1015 and 8109 ± 1542 μm2) and 39% (5333 ± 1389 and 7430 ± 1370 μm2), respectively. The mean area of all muscle fibers was 33% higher in the dominant than in the non-dominant arm ($P<0.05$). The percentage of type 1, 2a and 2x fibers was similar in both arms, i.e., 29 ± 8 and 32 ± 7%, 39 ± 4 and 42 ± 2, and 21 ± 10 and 20 ± 6%, in the non-dominant and dominant arm, respectively.

CONCLUSION: Long term tennis participation is associated with marked hypertrophy of all fiber types in the lateral portion of the muscle triceps brachialis, without any significant effect in the fiber type distribution. The inter-arm difference in muscle mass was smaller than the difference in cross sectional area of the triceps brachialis, emphasizing the relative importance of this muscle in tennis players.

REFERENCES:
Calbet et al. (1998). Calcif Tissue Int 62: 491-6
Mygind,(1995). Scand J Med Sci Sports 5: 76-80
Mizuno et al. (1990). J Appl Physiol 68: 496-502
Parsons et al. (1993). Scand J Med Sci Sports 3: 89-98
Terzis et al. (2006). Scand J Med Sci Sports 16: 121-126
ACKNOWLEDGEMENTS
The study was funded by a grant from the Ministry of Science and Technology of Spain (Ministerio de Ciencia y Tecnología, BFI2003-09638).

INCREMENTAL TREADMILL TESTS TO DETERMINE ENERGY COST OF RUNNING

Fusi, S., Salvadego, D., di Prampero, P.E.
University of Udine, Italy

During incremental exercise tests, the intensity is increased by a constant amount at regular short intervals, so that the O2 consumption (VO2) keeps increasing without ever attaining a steady state. The energy cost of running (Cr = energy spent to transport the subject's body over one unit of distance) is traditionally determined from steady state VO2 at constant speed. We show here that Cr can be obtained also during incremental running as follows. Assume that the speed is increased by a constant amount ?v at regular intervals of duration T, while VO2 is measured on a breath by breath basis. Within each step below the anaerobic threshold VO2 increases exponentially towards the steady state:

$$VO2n,t = (VO2n,s - VO2n-1,T) (1 – e-(t/?)) + VO2n-1,T \quad 1)$$

where the values at time t within the nth step and at the end of the immediately preceding one are denoted by VO2n,t and VO2n-1,T and where VO2n,s is the steady state value, were T long enough to attain it. If VO2n,t is averaged over homologous times (a, b, c …) within each period, and neglecting the initial ones, the VO2 difference between the corresponding time values becomes constant and equal to the difference between the appropriate steady states:

$$VO2n,a - VO2n-1,a = VO2n,b - VO2n-1,b = \ldots\ldots = VO2n,s - VO2n-1,s \quad 2)$$

Thus, Cr is given by:

$$(VO2n,a - VO2n-1,a)/ ?v = (VO2n,b - VO2n-1,b)/ ?v = \ldots$$

$$\ldots = (VO2n,s - VO2n-1,s)/ ?v = Cr \quad 3)$$

We determined Cr above resting on 7 well trained runners as follows. After 4-5 minutes walking, the treadmill speed was increased by 0.5 km h-1 every 30 seconds. Single breath VO2 was measured and the averages from 0 to 10 (a), 10 to 20 (b) and 20 to 30 (c) seconds calculated for each period. Cr was obtained from the ratio of the difference between the VO2 averages for any two homologous times within subsequent periods to the corresponding speed difference (?v) (equation 3). Between the walking to running transition and the anaerobic threshold, Cr on the treadmill is independent of the speed. Therefore, and since ?v and the T (30 sec) were constant, the relationship between VO2 and speed (S) is described by straight lines of the form:

$$VO2a = A + BS; \quad VO2b = A' + BS; \quad VO2c = A'' + BS$$

The intercepts (A, A', A") depend on the time within the step over which VO2 was averaged, and the slope B = ? VO2a/ ?S = ? VO2b/ ?S = ? VO2c/ ?S yields the mean individual Cr above resting. On 7 subjects, the so obtained values of Cr (ml O2/ (kg m)) amounted to 0.182 ± 0.007 (n = 6) for a (0 to 10 sec) 0.175 ± 0.012 (n = 6) for b (10 to 20 sec) and to 0.175 ± 0.012 (n = 7) for c (20 to 30 sec). These values are essentially equal to those that can be expected from the ratio of VO2s to speed (0.185 ml O2/ (kg m)), so confirming the validity of the incremental approach for assessing the energy cost of running.

FREQUENCY OF DIABETES TYPE 2 AND CVD RISK FACTORS IN OBESE CHILDREN AND ADOLESCENTS

Matzenbacher dos Santos, J., Gaya, A.R., Cardoso, M., Mansilha, H., Mota, J.
Faculty of Sports- Porto University, Portugal

Background: The prevalence of obesity and overweight has dramatic increased in youth along with different diseases, which were specific of adult population, namely the diabetes type II [1-2]. Thus, the aims of this study were (1) to analyse the frequency of diabetes type II in at risk of obesity children, and (2) identify the association with cardiovascular disease factors.

Methods- 87 children and adolescents obese from Maria Pia Pediatric Hospital (Porto -Portugal) age: 12.1±2.4 years-old; weight: 75.2±21.7 kg; height: 156.3±12.8 cm; BMI: 30.7±3, Kg/m2 participated in the study. The calculation of Homeostasis Model Assessment (Homa), using plasmatic insulin and glucose value, were used to estimate insulin resistance [3]. Children's and adolescent's Homa over 2.24 were classified as risk to development diabetes type 2 [4].

Results: 68.4% of children and adolescent at risk of obesity were classified as a risk to development of diabetes type 2. Logistic regression showed that BMI, triglycerides and physical activity were predictors ($p<0.05$) of diabetes type II in obese youth. No significant results were found for waist circumference, HDL, LDL, systolic blood pressure, diastolic blood pressure and birth weight

Conclusions: BMI, triglyceride and physical activity was found to be associated with risk to development of diabetes type 2 in youth at risk of obesity.

References: 1. Gungor, N., et al., Youth type 2 diabetes: insulin resistance, beta-cell failure, or both? Diabetes Care, 2005. 28(3): p. 638-44; 2. Hale, D.E., Type 2 diabetes and diabetes risk factors in children and adolescents. Clin Cornerstone, 2004. 6(2): p. 17-30; 3. Wallace, T.M., J.C. Levy, and D.R. Matthews, Use and abuse of HOMA modeling. Diabetes Care, 2004. 27(6): p. 1487-95; 4. Gokcel, A., et al., Detection of insulin resistance in Turkish adults: a hospital-based study. Diabetes Obes Metab, 2003. 5(2): p. 126-30.

GLUCOSAMINE ADMINISTRATION IN ATHLETES: EFFECTS ON RECOVERY OF ACUTE KNEE INJURY

Ostojic, S., Arsicm, N., Prodanovic, S., Vukovic, J., Dikic, N.
Sports Academy, Serbia and Montenegro

The main aim of the present study was to examine the effects of four weeks of glucosamine administration on the functional ability and the degree of pain intensity in competitive male athletes after acute knee injury. Randomized, double-blind parallel trial of glucosamine

(1500 mg per day) or a placebo for 28 days. Hundred and six patients with acute sports injury of knee evaluated at the beginning of the study and at 7, 14, 21 and 28 days after starting treatment. Evaluation included pain intensity at rest and while walking with a visual analog scale, passive knee flexibility (flexion and extension) of the injured limb and degree of knee swelling. No statistical difference was found between glucosamine and placebo group in mean pain intensity scores for resting and walking, and degree of knee swelling at the 7-day, 14-day, 21-day and 28-day assessment ($p > 0.05$). There was no statistical difference found between passive knee flexibility at the 7-day, 14-day and 21-day assessment ($p > 0.05$). After 28 days of treatment the patients from glucosamine group demonstrated significant improvement in knee flexion and extension as compared to placebo group ($p < 0.05$). The findings of the present study indicate that administration with glucosamine does not significantly alter recovery after acute sports injury of knee. Yet, glucosamine supplementation appears to be suitable as a flexibility improvement strategy in athletes after 4 weeks of treatment.

RELATIONSHIP BETWEEN SOME ANTHROPOMETRIC CHARACTERISTICS AND FINAL RANK STANDING IN THE GREEK HANDBALL CHAMPIONSHIP

Bayios, I., Noutsos, K.

National & Kapodistrian University of Athens, Greece

Introduction. The success of top level handball players depends on many factors, including morphological, physiological, psychological, technical and tactical characteristics. The aim of this study was to investigate the relationship between selected anthropometric characteristics and the final team ranking in the Greek handball championship.

Methods. Female handball players (n=101) of the first Greek National League participated in the present study (age 23.2±5.3 yrs, training age 10.9 ±2.2 yrs, body mass 66.6±9.3 kg, body height 167.2±7.4 cm). Anthropometric measurements involved height, body mass, four skinfolds and selected measurements used for somatotype estimation. Fat mass (FM), fat free mass (FFM) and percent body fat (%BF) were calculated for all subjects from the sum of skinfolds, using a standard equation (Siri, 1956). Somatotype assessment was performed according to Heath & Carter's (1990) anthropometric technique and different component calculation was based in the equations proposed by Heyward & Stolarczyk (1996). Ranking was reported as the final points of the teams in the Greek handball championship during 2002-2003 competition season. Relationships between anthropometry and ranking were studied with Spearman correlation coefficient ($p<.05$).

Results. Body mass index was calculated 23.8 ±2.7 kg/m², percentage body fat 25.6±3.4, fat mass 17.2±4.1 kg, fat free mass 49.3±6.2 kg, endomorphy 4.0±1.0, mesomorphy 4.1±1.2, ectomorphy 1.8±1.0. The results showed significant correlation between final team ranking and chronological age ($r=0.478$, $p<.001$), training age ($r=0.382$, $p<0.001$), body height ($r=0.385$ $p<0.001$), fat free mass ($r=0.255$, $p<0.01$), mesomorphy ($r=-0.214$, $p<0.05$) and ectomorphy ($r=0.211$, $p<0.05$). No significant correlations were found between final team ranking and body weight, body mass index, endomorphy, percentage body fat, fat mass and somatotype attitudinal mean.

Discussion. It seems that both chronological and training age favorably affect team ranking. In addition, elevated body height and high fat mass were positively associated with final team ranking in these female handball players. Finally, team ranking also seems to be affected by somatotype (mesomorphy and ectomorphy) of the players as previously suggested (Carter & Heath, 1990).

References

Siri WE (1956). Adv Biol Med Phys 4:239-280.

Carter JEL, Heath HB. (1990). Somatotyping – development and application.

Heyward V, Stolarczyk L (1996). Applied body composition assessment.

ACTIVATION OF COAGULATION AFTER A DOWNHILL MARATHON RUN (TYROLEAN SPEED MARATHON)

Schobersberger, W., Greie, S., Fries, D., Mittermayr, M., Falkensammer, G., Griesmacher, A., Sumann, G.

University for Health Sciences, Medical Informatics and Technology, Hall/Tyrol, Austria, Austria

Introduction: Prolonged exercise can be associated with multiple changes in blood hemostasis. Eccentric muscle activation (e.g. downhill running) induces micro-traumata of skeletal muscle thus inducing an inflammatory response. Since in several diseases there is link between inflammation and coagulation we speculated that downhill running may activate the coagulation system.

Material and Methods: 13 volunteers (12 males, 1 female) participated at the Tyrolen Speed Marathon (42,195 km downhill race, 795 m vertical displacement; range of running time 3.12 hrs to 4.26 hrs). Blood from antecubital veins was collected 3 days (T1) and 3 hrs (T2) before the run, within 30 min after finishing (T3) and one day thereafter (T4). Measured parameters: Creatine kinase (CK), myoglobin, PT, aPTT, platelet count, thrombin-antithrombin-complex (TAT), prothrombin fragment F1+2 (F1+2), D-dimer, plasmin-alpha2-antiplasmin (PAP), Thrombelastography with RoTEM®: intrinsic pathway: InTEM-CT (clotting time), InTEM-CFT (clot formation time), InTEM-MCF (maximum clot firmness), InTEM-alpha (alpha angle). All parameters were corrected for plasma volume changes according to van Beaumont (1981). Statistics: Friedman ANOVA follwed by Wilcoxon test; level of significance $p < 0.05$.

Results: CK and myoglobin were elevated at T3 and were further increased at T4 (mean CK and myoglobin values at T4: 4879 U/L and 1409 ng/ml) We found a significant shortening in PT and aPTT and an increase in platelet count after the race. TAT, F1+2, D-dimer and PAP were significantly increased at T3; F1+2 and PAP remained elevated until T4. ROTEM analysis exhibited a shortening of InTEM-CT and InTEM-CFT after the marathon and an increase in InTEM-MCF and InTEM-alpha.

Conclusions: We could demonstrate that a 42km downhill marathon induces coagulation activation, as measured by specific parameters for coagulation and RoTEM. These changes were accompanied by pronounced increases in markers for micro-damage of skeletal muscle.

REDUCTION IN ECCENTRIC HAMSTRING STRENGTH AFTER A DOWNHILL MARATHON RUN (TYROLEAN SPEED MARATHON)

Greie, S., Koller, A., Hoertnagl, H., Sumann, G., Griesmacher, A., Falkensammer, G., Schobersberger, W.

University for Health Sciences, Medical Informatics and Technology, Hall, Austria, Austria

Introduction: Marathon running can be associated with some hazards, e.g. musculoskeletal injuries. It is a common suggestion stating that lower extremity fatigue is a risk factor in musculoskeletal injuries arising from participation in marathons, although little is known about muscle fatigue in marathon participants. We performed the present study to investigate the effects of a downhill marathon-specific fatigue on concentric and eccentric quadriceps and hamstring strength.

Material and Methods: We selected the Tyrolean Speed Marathon as model for a competition with a high eccentric muscle effort (42,195 m; downhill vertical distance 795 m). Peak concentric and eccentric quadriceps and hamstring torques of both legs were measured in 13 marathoners (12 males, 1 female; range of running time 3.12hrs to 4.26hrs) at an isokinetic testing speed of 60°s-1. These measures were obtained at rest (T1) and 12 hours after the marathon (T2). In addition, serum total creatinkinase (CK) and myoglobin (Myo) were analysed. Level of significance $p < 0.05$. Data are given as mean values ± 1SD.

Results: Whilst there was a significant decrease in eccentric hamstring strength ([left leg] T1: 145.3±31.7 Nm, T2: 120.1±33.1 Nm, $p = 0.012$; [right leg] T1: 133.8±22.2 Nm, T2: 119.7±25.1 Nm, $p = 0.024$), there was no significant decline in concentric ([left leg] T1: 150.8±30.1 Nm, T2: 133.7±43.5 Nm, $p = 0.064$; [right leg] T1: 148.3±40.8 Nm, T2: 130.8±49.5 Nm, $p = 0.083$) and eccentric ([left leg] T1: 194.1±40.2 Nm, T2: 174.8±67.9 Nm, $p = 0.124$; [right leg] T1: 193.6±43.1 Nm, T2: 179.8±63.8 Nm, $p = 0.148$) quadriceps strengths, and concentric hamsting strength ([left leg] T1: 110.7±27.0 Nm, T2: 104.2±30.8 Nm, $p = 0.176$; [right leg] T1: 109.3±26.9 Nm; T2: 102.7±29.9 Nm, $p = 0.102$). CK and Myo were increased at T2 by + 3781 U/l and by 967 ng/ml, respectively.

Conclusions: Downhill marathon running was shown to induce a significant deterioration in eccentric hamstring strength which was associated with pronounced increases in total creatinkinase and myoglobin.

THE EFFECT OF EXERCISE PLUS METFORMIN ON THE NON ALCOHOLIC FATTY LIVER DISEASE

Tock, L., Prado, W.L., Caranti, D.A., Piano, A., Cristofalo, D.M., Lederman, H., Siqueira, K.O., Stella, S.G., Tufik, S., Mello, M.T., Dâmaso, A.

São Paulo Federal University, Brazil

Despite the increasing prevalence of non-alcoholic fatty liver disease (NAFLD), its pathogenesis and clinical significance remain poorly defined and there is no better treatment. Although there is no accepted pharmacological treatment that can reverse fatty liver disease, all patients should be given a low fat diet, insulin resistance-lowering agents and encouraged to practice exercise. The purpose of this study was to assess the short-term (12 weeks) changes on the NAFLD prevalence and insulin resistance in obese adolescents. The inclusion criteria were severe primary obesity (IMC>30 wt/ht2), insulin resistance and/or NAFLD diagnostic. 21 obese adolescents were submitted a multidisciplinary lifestyle intervention (aerobic exercise and nutrition) plus metformin (500mg twice daily). The visceral/subcutaneous adiposity and NAFLD were measured at pre and post-intervention by ultrasonography. Fasting blood samples were collected to measured glucose and insulin. The differences between times were assessed by Test T for dependent samples. The metformin treatment associated to exercise and nutritional intervention promotes a significant decrease in the prevalence of the NAFLD (50% to 25%) and insulin resistance (90% to 76%), accompanied by a significant decrease in HOMA (5.01+1.63 to 4.45+4.06), visceral (3,99+1.01 to 3.46+1.53) and subcutaneous (3.22+0.60 to 2.97+0.87) adipose tissue. It's suggest that long-term therapy can be a better treatment to improve and prevent NAFLD and insulin resistance associated to obesity in adolescents.

NO SIGNIFICANT DIFFERENCES IN 24 HOUR ECG AND BLOOD PRESSURE RECORDINGS IN OVERTRAINED ATHLETES COMPARED TO CONTROL ATHLETES

Uusitalo, A., Vanninen, E.

Kuopio University Hospital, Helsinki University Central Hospital, Finland

Palpitation, arrhythmia's and blood pressure changes are symptomes and signs hypothesized to be related to excessive physical training and overtraining (Kuipers and Keizer 1988, Swanson 2006), and patho-physiology of those could be related to changes in autonomic function and/or inflammatory reasons (Lehmann et al. 1998, Swanson 2006). On the other hand, athletes may have several changes in their ECG related to athletes heart (Holly et al. 1998). There are no controlled studies of long-term ECG and blood pressure changes in overtrained athletes. Our aim was to study overtraining related changes in 24-hour ECG and blood pressure.

Methods Twelve otherwise healthy severely overtrained athletes (OA): age 25±7 (SD) yr; 6 women and 6 men; 9 endurance athletes and 3 ice hockey players; body mass index (BMI) 23±2 kg/m2; maximal oxygen consumption (V O2max) 49±9 ml/min/kg, and 11 control athletes (CA): 26±6 (20-39) yr; 6 women and 5 men; 10 endurance athletes and one sprinter; BMI 22±2 kg/m2; VO2max 55±6 ml/min/kg took part in the study. Overtrained athletes 1) had suffered from an unexplained decrement in physical performance and fatigue for several weeks to many months and continued to have equal symp-toms even after a recovery time of weeks to months, 2) had been examined to be otherwise healthy and 3) had a suitable training history for overtraining (increase in volume and/or intensity of training or training monotony). 24-hour ECG and blood pressure and resting ECG were recorded at the overtraining state (BL) and after one to two years of recovery (RE). Heart rate (HR), ventricular and supraventricular arrhythmia's, pauses over 2 seconds, takycardia (HR>120 bpm), bradycardia (HR<40 bpm), and PR-, QRS-, and QTc-times were studied from the ECG recordings. In addition, systolic, diastolic, and mean blood pressures during night and daytime were measured from 24-blood pressure recordings. Results There were group differences only in sleeping time at the RE ($p < 0.05$, mean±SD: OA 8.7 ±0.6 h, CA 7.5±1.1 h). Changes from BL to RE were found in QRS-time (from 94±11 ms to 92±12 ms, $p<0.05$) and sleeping time (from 7.7±1.4 h to 8.7±0.7 h, $p<0.05$) in the OA. However, some OA's had many supraventicular beats (mean 39, range 0-324) and pauses (21, 0-238) which CA's tended to have less (5, 0-12 and 5, 0-28, respectively). Blood pressures did not differ between the groups or did not change during the recovery. Conclusion Arrhythmia's, ECG changes and blood pressure changes did not significantly take place during overtraining state but this does not rule out individual changes in these parameters. Sleeping time reacts to overtraining state and recovery.

Granted by Finnish Ministry of Education, and Research Fund of Kuopio University Hospital.

References

Kuipers and Keizer. Sports Med 6; 79-92, 1988.

Swanson DR. Medical Hypotheses, Epub january, 2006.

Lehmann et al. Med Sci Sports Exerc 30; 1140-1145, 1998.

Holly et al. Sports Med 25; 139-148, 1998.

BODY COMPOSITION AND PERFORMANCE DURING THE COMPETITION: A STUDY ON ITALIAN ELITE SOCCER PLAYERS

Corradini, G., Bertoldo, F., Dalle Carbonare, L., De Vita, F., Lo Cascio, V., Giordani, G., Masiero, M., Ferrari, M.

University of Verona, Italy

The aim of this study was to examine body composition in elite soccer players and its relationship with physical performance. Twenty seven soccer players (age 25.8±4.2, height 180.8±4.9 cm; body mass 78.4±5.3 Kg), divided into four groups (goal keepers, defenders, centrals, forwards) were studied. All of them underwent dual energy X-ray absorptionmetry scans (DXA), expressing the results as the ratio between, body fat mass, body lean mass, body mineral content (kg) and height (cm2). Total meters covered during competition at a speed >23 km/hour (fast running, FR), 15-19 km/hour (running, R) and 8-15 km/hour (slow running SR) were calcutated by means of a computerized analysis of video recording (Digital.Stadio, Sics, Vicenza, Italy) of four matches of the first division Italian championship.

Total body fat resulted not dependent on the role, whereas body lean mass was higher in forwards (20,6±1,03) in respect to other categories (goal keepers (19,1±0,65), centrals (19,1±0,85), defenders (19,3±0,67)) (p=0.01). Body mineral content tended to be higher in forwards (1,08±0,086) and in goal keepers (1,09±0,03), than in centrals (1,03±0,09) and defenders (1,05±0,08), even though the difference was not statistically significant.

A significant positive relationship was found between total bone mineral content and FR (r=0.78, p<0.001), and between SR and body lean mass (r=0.79, p< 0.001). On the contrary, body lean mass was negatively associated with R (r=-0.45, p=0.02).

Our data suggest that in elite soccer players the type of physical exercise associated to the role influences the body composition, particularly total lean mass; in turn, body composition is associated with a different physical performance during competition.

EFFECTS OF TRAINING LOADS ON SERUM HORMONES IN PROFESSIONAL BASKETBALL PLAY

Slowinska-Lisowska, M., Jozkow, P., Medras, M.

University of Physical Education , Poland

Interpretation of various reports on hormonal changes accompanying training cycle is difficult. Due to differences in training load it is often impossible to compare obtained results (Lehmann 1993, Urhausen 1995).

There is little data on changes of endocrine parameters in elite sportsmen undergoing long-term and high-intensity training.

Our aim was to investigate serum concentrations of gonadal and adrenal steroids in three consecutive training mezocycles. Hormones (total testosterone, DHEA-S, cortisole), and SHBG level were evaluated before and after each of the mezocycles.

Twelve professional basketball players were recruited for the study. They were preparing for the play-off round of the national championship.

The first mezocycle comprised a significant increase of the training load. When compared with baseline values, total testosterone, DHEA-S and FAI decreased, while cortisole and SHBG did not change.

In the second mezocycle the exercise load was reduced. When compared with the first mezocycle, concentrations of total testosterone, cortisole and FAI increased, when DHEA-S and SHBG did not change.

In the third mezocycle training's load and intensity were increased. This time total testosterone, DHEA-S and cortisole decreased when compared with the second mezocycle.

Overall, after three months of training: total testosterone decreased by 35%, DHEA-S by 39% and FAI by 19% when compared with baseline values.

We conclude that professional training significantly affects endocrine status of elite athletes. Hormonal measurements may be of use in monitoring training's load.

References

Lehmann M., Knizia K., Gasmann U., Petersen K. G. Et all: Influence of 6 –week, 6 days per week, training on pituitary function in recreational athletes. Br. J.Sports Med. 1993 27 (3) 186-192

Urhausen A., Gabriel H., Kindermann W. (1995) Blood hormones as a marker of training stress and overtraining. Sports. Med. 20 : 251 – 276.

THE INFLUENCE OF RAPID WEIGHT REDUCTION ON IMMUNE RESPONSE IN MALE JUDO ATHLETES

Shimizu, K., Aizawa, K., Kimura, F., Suzuki, N., Mesaki, N., Kono, I.

Tsukuba University, Japan

Purpose: Judo athletes must reduce their body weight in a few weeks before competition. It is generally thought that athletes are susceptible to infectious disease, primary upper respiratory tract infection due to chronic immunesuppression. The purpose of this study was to examine the effects of rapid weight reduction on immune function in judo athletes. Methods: Seven male competitive college judo athletes (20.3 ± 0.4 years) from the University of Tsukuba, completed weight reduction program during 2 weeks before competition. They conducted dietary restriction, 30 min cycle ergometr exercise in the dry room, and sauna during 2 weeks. Saliva and blood samples were obtained at 40 (baseline; BL) and 3 (weight reduction; WR) days before, and at 1 and 3 days after the competition. Secretory immunoglobulin A (SIgA) concentration was measured by enzyme-linked immunosorbent assay (ELISA) and the SIgA secretion rate were calculated (SIgA concentration multiplied by saliva flow per minute). The number of T, Th (T-helper), Tc (T-cytotoxic), NK (Natural Killer), CD28+Th, CD28+Tc and CD14+TLR-4 (Toll-like-receptor-4) + cells were measured by flow cytometry. Results: Subjects exhibited significant decreases in body weight (2.8% average loss at WR) compared with BL ($p < 0.05$). At 3 days after the competition, their body weights returned to baseline-value. Percents of body fat were significantly lower at WR than that at BL ($p < 0.05$). SIgA secretion rates tended to decrease at WR, compared with BL ($p = 0.09$), and returned to BL at 3 days after the competition. This result suggested that rapid weight reduction had an adverse affect on mucosal immune function in judo athletes. The number of T cells significantly decreased at WR compared with BL ($p < 0.05$), and then returned to the baseline-value by 1 day after competition. Compared with BL, the number of Th, Tc, CD28+ Th and CD28+ Tc cells did not change significantly at WR. The number of NK cells did not show significant change. The number of CD14+TLR-4+ cells significantly decreased at WR, and then returned to baseline-value after the competition. These results suggested that rapid weight reduction decreased acquired and natural immunity in judo athletes. Conclusion: These results suggested that rapid weight reduction before the competition could decrease immune function, leading to decline of condition in judo athletes.

THE EFFECT OF FAR INFRARED IRRADIATION ON SKIN MICROCIRCULATION

Natsui, H., Nagai, S., Takemura, M., Ohshima, N., Kono, I.

Tokyo Women's College of Physical Education, Japan

The effects of far infrared have been known as increase of temperature and blood flow, or decrease of pain. Thermotherapy is indicated several times in sports rehabilitation, far infrared apparatus is compact and portable, so it will be used beside the sports field. In this study, we intended to evaluate the effect of far infrared irradiation on skin microcirculation using laser Doppler blood flow meter.

12 male adult (age 20 +/- 1) was used. 6 male was irradiated far infrared on their right upper back for 20 minutes (irradiation group), other 6 male was held switch-off apparatus 30 cm aloft (control group). Right upper back skin blood flow velocity and flow rate was measured during far infrared irradiation using laser Doppler flow meter (ADVANCE ALF21N, Tokyo). Skin temperature and comfort score was measured before and after irradiation using thermography (NEC San-ei TH9100, Tokyo) and visual analogue scale.

Skin temperature was increased 3.2 +/- 0.8 degrees centigrade on intra-irradiation area, and also increased 3.3 +/- 1.0 degrees centigrade on extra-irradiation area. Post irradiated skin blood flow velocity was increased 1.5 times compared with pre irradiation. Blood flow rate was also increased 2.3 times. Comfort score of irradiation group was higher than control group.

Far infrared has thermal effect on skin. Skin blood flow velocity and flow rate were increased by far infrared irradiation. Blood flow rate was calculated by blood flow velocity and blood flow mass. So, irradiation of far infrared might affect both increase of blood flow velocity and increase of blood flow mass.

A TWO-YEAR PROSPECTIVE STUDY OF SOCCER RELATED INJURIES IN THE CLUB ATLÉTICO BOCA JUNIORS PROFESSIONAL TEAM

Ortega Gallo, P., Garcia, L., Argemi, R., Batista, J., Liotta, G.

Club Atletico Boca Juniors, Argentina

Objectives: Soccer is known to be associated with a relatively high injury rate but there is no epidemiologic data in South American soccer where a different injury pattern was apparent.

Purpose: Analysis of injury incidence in the professional soccer team of the Club Atlético Boca Juniors over two competitive seasons.

Study Design: Prospective survey.

Methods: An injury report system was kept by the club's medical staff for all training sessions and matches.

Results: A total of 391 injuries per year were documented, with an average of 9.53 injuries per player per season. The mean (SD) number of days absent per injury producing some kind of training or match participation limitation was 9 (SD 15). Every week 10% of the team (4 players) was not able to train or play due to injury. The majority of injuries (87%) where slight or minor. A total of 1442 days and 354 matches were missed. Competition injuries represented 31% of those reported.

Conclusions: Professional soccer players are exposed to a high risk of injury, with 10% of our professional players unable to play every week due to injury. Injuries produce considerable economical and performance losses for a soccer team and probably long lasting consequences for the health and sport carrier of a soccer player. It was concluded that the majority of injuries were sustained during training in comparison to competitive matches. These results contrast when compared to findings within European soccer.

INCOMPLETE MUSCLE STRENGTH RECOVERY IN INJURED PROFESSIONAL FOOTBALL PLAYERS

Croisier, J.L., Ganteaume, S., Genty, M., Binet, J., Ferret, J.M.

University of Liege, CHU Sart Tilman, Belgium

Purpose: The injury risk in professional football is high and regularly entails absence from competitive participation for the wounded player. The decision as to when a player is considered fully rehabilitated after injury remains classically subjective. The recovery of normal strength and balance between agonist / antagonist muscles could potentially condition the performance on the field as well as the risk of relapse. The aim of the study was to assess the knee muscle strength performances in players who have returned to play after a major injury.

Methods: In total, 617 soccer players from professional teams in France, Belgium and Brazil were screened in that study. An injury report form was applied for determining the amount of players with a past history of major injury on the knee joint structures (bone, ligament, muscle, tendon). All players benefited from knee flexors and extensors isokinetic testing, following a standardized protocol consisting in concentric and eccentric exercises. A context of lingering muscle disorder was defined using statistically selected cutoffs for bilateral differences and Flexors / Quadriceps (Fl / Q) ratios (including a mixed Flexorseccentric/Quadricepsconcentric ratio).

Results: The isokinetic testing was performed in preseason and all involved players were considered at that moment as fit for training and matches by their respective medical staff. 413/617 players (67%) were identified as having sustained in the past a major injury on the predefined knee structures. Of these 413 players, 268 subjects still showed significant bilateral asymmetries and/or Fl/Q imbalances through the isokinetic assessment. These results mean that, after an injury, 65% of professional football players return to play in spite of serious muscle strength disorders.

Discussion and Conclusion: Our findings highlight the lack in standard return to play criteria as well as questionable options in professional football player treatment and rehabilitation after injury. Interestingly, a previous study dealing with hamstring strain [1] showed that persistence of muscle weakness and imbalance may give rise to recurrent muscle injuries. Furthermore, correction of preseason muscle imbalance allows for a significant reduction in the risk of subsequent muscle strain [2]. Therefore, we emphasize the role of an isokinetic intervention for muscle performance assessment before return to play after a major knee injury.

References

[1] Croisier et al., Am J Sports Med, 30, 199-203, 2002.

[2] Croisier et al., Br J Sports Med, 39, 379, 2005.

THE EFFECTS OF SERIAL FATIGUING TASKS AND ACUTE RECOVERY ON INDICES OF NEUROMUSCULAR AND SENSORIMOTOR PERFORMANCE OF THE KNEE FLEXORS IN FEMALES

Walters-Edwards, M., Minshull, C.M., Gleeson, N.P., Bailey, A., Nordvall, M., Rees, D.

Marymount University, United States

There is accumulating evidence of a link between fatigue and acute muscle strain injuries (Heiser, et al., 1984; Hawkins, et al., 2001). Females may be more influenced by fatigue and also show poorer proprioceptive capabilities compared to males (Huston and Wojtys, 1996). No previous research has investigated the effects of a fatigue intervention on neuromuscular and dynamic sensorimotor performance of the knee flexor musculature in females.

Maximal volitional peak force (PF) of the knee flexors and the error (constant; variable) arising from two types of sensorimotor performance (SMP) assessment were evaluated in females (n=20, 22.0 ± 2.8 years; 165.7 ± 0.04 m; 66 ± 6.5 kg [mean ± SD]). The SMP tasks involved the matching of a blind target force (50 % of PF) learned previously (SMP-TR [time-regulated force production at ~1000 N.s –1] and SMP-SR [self-regulated force production at ~200 N.s –1]). SMP response was reported as an over (+) or underestimation (-) of the target force. Assessments were undertaken prior to and immediately following two treatment conditions: (i) a control condition consisting of no exercise; (ii) a fatiguing intervention condition consisting of 4 bouts of 35 seconds maximal isometric exercise. Recovery measures were obtained at 1, 3 and 6 minutes. The SMP-TR and SMP-SR tasks were performed on separate days to minimise any the carry-over effects of fatigue. The fatigue intervention elicited a significant group mean decrease in peak volitional force of the knee flexors of up to 20.5%. This recovered to 94%-96% ± 2% (95% confidence limits) of pre-exercise values following 6-minutes of rest for both SMP-TR and SMP-SR assessment sessions, respectively ($p<0.05$).

Error of sensorimotor performance (constant error) was significantly increased (-2 ± 9% vs. 0 ± 12 % and -6 ± 11 % vs. -4 ± 12%) by the fatigue intervention during both SMP-TR and SMP-SR, respectively ($p< 0.002$) and remained at an increased level throughout recovery ($p<0.001$). Pre fatigue sensorimotor values were not re-established until 3 minutes following the final fatigue bout (94-96% of pre PFv values ± 2% [95% confidence limits]). Consistency of force response (variable error) was not significantly altered as a result of the fatigue intervention for both types of SMP. It is plausible that the disruption to the accuracy of force replication could be attributed to a failure of the force 're-scaling' mechanism during fatigue, where the under-shooting of the target force could be due to a failure by the afferent (muscle spindles) and efferent feedback systems.

The loss of proprioceptive performance of up to 6% (SMP-SR) and concomitant reduction in strength capability (20.5%) for up to 3 minutes following the cessation of the fatigue task suggests a substantial threat to dynamic joint stability during this period in females.

INCIDENCE OF EXERCISE-INDUCED HYPOXEMIA ON SUSCEPTIBILITY TO ACUTE MOUNTAIN SICKNESS IN SKI-MOUNTAINEERS

Durand, F., Bayonne, A., Ceugniet, F., Desplan, J.

Laboratoire Sport Santé Altitude, France

Introduction

Acute mountain sickness (AMS) occurs in those that go too high, too fast and is independent of endurance training. Ski-mountaineers could be affect by AMS all the more because it was exacerbated by exercise in the early hours of altitude exposure. In another way, it is commonly accepted that some endurance-trained athletes develop exercise-induced hypoxemia (EIH) at sea-level. Because many physiological events which were implicated in EIH have been well documented in the pathophysiology of AMS (Durand et al., 2000), we suggest that ski-mountaineers exhibiting EIH who exercise regularly at moderate altitude could be particularly susceptible to AMS as they exhibit EIH.

Methods

Nine male ski-mountaineering athletes (aged 34  1.8 yr) participated. They performed i) incremental exercise test to assess the maximal oxygen uptake (VO2max) and mesure EIH and ii) hypoxic test to assess the susceptibility to AMS (Rathat et al., 1992). Ventilation (VE), heart rate (HR), breathing frequency (f) and O2 saturation (SpO2) were measured and permitted us to calculate cardiac (CR) and ventilatory (VR) responses to exercise in hypoxia assessed by the following equations : CR = -HREH – HREN/SpEH-SpEN and VR = [VEEH-VEEN/SpEH-SpEN]/weigh (kg) x 100. Others parameters like resting desaturation (SpR = SpRN-SpRH), exercise desaturation (SpE = SpEN-SpEH) and f measured during exercise in hypoxia (fEH) were compared to normal values.

Results

All athletes exhibit EIH (SpO2 fall equals 13.1 ± 1.4%) which is significant from 40% VO2max. Negative correlation between the fall in SpO2 and SpE ($r=-0.84$, $p<0.05$) and fEH and VE measured at 40% VO2max during exercise test ($r=-0.7$, $p<0.05$) were observed. A tendency toward a significant correlation occured between the fall in SpO2 and RC ($r=0.6$, $p=0.08$). 5 ski-mountaineers were susceptible to AMS as at least two of the four parameters like CR, VR, SpR, SpE and fEH are out of normal values. These athletes report the greater degree of EIH. Nevertheless if all athletes had previously experienced altitude, no one had reported AMS.

Conclusion

At 40% VO2max which is the intensity of hypoxic test, EIH is explained by relative hypoventilation. This hypoventilation could influence the response to hypoxic test and particularly induce the increase in frEH. It is well known that moderate altitude increase arterial desaturation during exercise in athletes. Like this, greater is EIH exhibited by ski-mountaineers and greater is SpE. In conclusion, this study clearly suggest that EIH influence the responses to hypoxic test predicting susceptibility to AMS as no subjects had experienced AMS in previous altitude stage. EIH induced false positive response and ski-mountaineers which are athletes training and exercising in altitude have to interpret cautiously the results of hypoxic test.

References

Durand F, Prefaut C. Sci Sports 15 :154-161, 2000

Rathat C, Richalet JP, Herry JP et al. Int J Sports Med 13:1 S76-8, 1992.

ASSESMENT IN KINETIC REHABILITATION PROGRAMME OF ANKLE INSTABILITY AFTER AHILLIAN-CALCANEO-PLANTAR DISORDERS

Rusu, L., Vasilescu, M., Paun, E., Ortanescu, D., Ciocanescu, D., Dragomir, M., Diaconescu, D.

University of Craiova, Romania

Disorders of muscletendinos size like ahillian-calcaneo-plantar region(ACP), involve instability of ankle and this is the reason for that kinetic rehabilitation using kinetic method for rehabilitation is very important. The aim of this study is to present the efficency of kinetic rehabilitation programme that we used at a lot of athlets for recovery and return at soon at possibile to sport performance, after injuries of foot and ankle.

Material and method: We studied 15 subjects(volleybalist player), with mean age 20 years. The injuries of foot and ankle including disorders of muscletendinos jonction, disorders of Ahillian tendon, disorders of aponeurotique structure of foot. After all these disorders we observed ankle instability and perturbation of gait. Assesment of subjects including asseement of pain(scale of clinic pain assesment 0-4), and EVA score, specific evaluation like stability test, clinical assesment including palpation of region, stretching test, muscle force,jumping test(scale 0-2), mobility, flexibility, pain point, functional assesment use VISA scale(maxim score 100 with 8items) and echographic evaluation for assesment change of structure. Rehabilitation programme has the next goals: decrease pain and stifness, increase mobility and flexibility, increase muscle force, motor control, stability, coordination and balances during gait and jumping. For that we used kinetic method like FNP technique(Kabat, hold relax, passive and isometric stretching, proprioception training) and exercises in closed kinetic chain.The study has been made during one month, the number of kinetic programme during week was 5/week, 1hour.Return to sport training when the pain was out, stability and muscle force are normal.

Results: Before treatment at clinical assesment score was 1for 60% from subjects, 2for 40%. After rehabilitation programme score was 0 for 80% from subjects and 1 for 20%. Functional assesement has been 30points at the begining and after one month total score(in VISA scale) was 91 points for 30% from subjects, 96points for 60% from subjects and 100points for 10%.

Conclusions: Complet and seriously assesment before and during kinetic rehabilitation programme for ACP disorders help the athlets to return quikly at sport activity, because if we use objectiv scale for assesment clinical and functional aspects we can build an efficient programme for rehabilitation, how we seen in our study because after only one month our subjects can begin the training. Because our rehabilitation programme improvment stability and by proprioceptive method can involve an increase of muscle balance at ankle and foot.

References:

1.Lephart S: Reestablishing proprioception, kinesthesia, joint position sense, and neuromuscular control in rehabilitation, in Prentice WE (ed): Rehabilitation Techniques in Sports Medicine. St Louis, CV Mosby, 1994

2.Sheth P, Yu B, Laskowski E, et al: Ankle disk training influences reaction times of selected muscles in a simulated ankle sprain. Am J Sports Med 1997;25(4):538-543.

WAIST CIRCUMFERENCE AND GLUCOSE METABOLISM AMONG PEOPLE OVER 65 YEARS OLD

Martins, R., Neves, A.P., Teixeira-Veríssimo, M., Teixeira, A.M.

Faculty of Sport Sciences and Physical Education, University of Coimbra, Portugal

According to the International Diabetes Federation definition, central obesity based on waist circumference (WC), should be defined as a value higher or equal to 94 centimetres, for the European men and as a value higher or equal to 80 centimetres for women. This definition addresses the new importance of the waist circumference values, when compared to the waist-to-hip ratio (WHR) or even the body mass index (BMI). Overweight and obese individuals are more likely to be insulin resistant and at increased risk of cardiovascular disease. Questions remain as to whether waist circumference or body mass index most effectively identifies insulin-resistant individuals. The purpose of the present research was to analyse and establish a relationship: a) between waist circumference and glycosylated haemoglobin; b) between waist-to-hip ratio and glycosylated haemoglobin; c) between body mass index and glycosylated haemoglobin in a population over 65 years old.

Seventy women (77.53±7.99 years old) and forty four men (75.43±6.64 years old), aged between 65 and 95 years old participated in this study. Biochemical analyses were conducted based on fasting venous blood samples. Anthropometric indices were measured according to standard protocols. The inferential statistical analysis was performed using the bivariate Pearson's correlation.

Regarding the waist circumference only 14.9% of the women and 34,1% of the men studied had a value under 80cm and under 94cm respectively. According to these values, 85.1% of the women and 65.9% of the men were considered has having central obesity. When comparing the relationships between anthropometric indices and glycosylated haemoglobin it is possible to observe that the body mass index did not correlate with glycosylated haemoglobin, not only for the men's group but also for the women's group. The data also show a positive correlation between waist-to-hip ratio and glycosylated haemoglobin and also between waist circumference and glycosylated haemoglobin in the women's group. On the other hand, in the men's group no correlations were found for any of the variables analysed.

In this population the abdominal fatness, evaluated from waist circumference, correlated positively with glycosylated haemoglobin. The body mass index and waist-to-hip ratio did not attained significant correlation with the glucose metabolism variable. When subgroups were analysed, correlations for the waist-to-hip ratio and waist circumference were found in the women's group, but that did not occur for the men's group. Results suggest that central obesity, evaluated from waist circumference, could be a better indicator of the risk of raised glucose levels in over 65 years old population, than the BMI or WHR. The differences observed between women and men could be due to the higher central obesity prevalence observed in the female subjects.

PROOF OF LYMPHATIC VESSELS IN HUMAN VASTUS LATERALIS MUSCLE FROM MALE CYCLISTS

Gehlert, S., Weber, S., Bloch, W., Platen, P.

German Sports University Cologne, Germany

Proof of lymphatic vessels in human vastus lateralis muscle from Male Cyclists

Sebastian Gehlert, Sebastian Weber, Wilhelm Bloch, Petra Platen

Institute of Cardiology and Sports Medicine; German Sport University; Cologne; Germany

Introduction

Lymphatic system has to fulfil important tasks in human organism like Immune cell trafficking and fluid homeostasis. Lymphatic vessels consist of single layered and high permeable, thin endothelial cell walls. In human myocardium, lymphatic vessel density has already immunhistochemical been proved (1). Occurrence and density in human striated skeletal muscle however still has not been estimated. With regard to the mentioned functions of lymphatic vessels, a possible importance in dynamic exercise respectively occurrence in striated skeletal muscle could be assumed. Therefore it was purpose of the study to investigate, the structure and density of lymphatic vessels in human skeletal muscle of endurance athletes.

Methods

6 male amateur cyclists (Age 31 ± 4,55 years) participated in this study. Muscle biopsies were taken from musculus vastus lateralis and bioptic material has been stored in liquid nitrogen. 10µm cross-sectional slices were cut from the bioptate and immunhistochemical staining has been performed using lymphatic endothelial markers "FLT-4" and "LYVE-4" finally developed with the DAB-Method. Several fields were digitally image captured and positive stained structures were counted. Additionally fibre spectrum has been determined using ATPase staining at PH 9.4. Classification of fibre spectrum has been carried out, determining staining intensity for the different fibres.

Results

There were counted in mean 270 ± 168 muscle fibres containing of 39 ± 28 lymphatic structures between these fibres. This means a number of 13.6 ± 4.0 lymphatic vessels per 100 fibres. Participants had 45,03% ± 15,8% Typ I fibres, 40,6% ± 11,2% Type IIa and 14,3% ± 9,0% Type 2x fibres. Lymphatic structures appeared orientated preferentially along interstitial structures and between fibres. The found numbers of positive structures do not correlate with the measured maximum oxygen uptake or the calculated, maximum glycolytic capacity. Correlation between preferential percentage of fibre type I, IIA or IIb could not be found.

Conclusion

Lymphatic vessels can be proofed in a variable density in human skeletal muscle using appropriate antibodies. Occurrence of lymphatic vessels showed no clear preference to an special fibre type. In contrast to the known tasks lymphatic structures have to fulfil, a more precise statement of their function in human skeletal muscle under dynamic strength or endurance exercise and a possible load dependent development, would be desirable.

References

1. Geissler H J., Dashkevich A., Fischer U M.,Fries J WU., Régnier FK., Addicks K., Melhorn U., Bloch W, MD. First year changes of myocardial lymphatic endothelial markers in heart transplantation recipients. Eur J Cardiothorac Surg. 2006 Jan 23.

COMPARISON OF METHODS TO IDENTIFY THE ANAEROBIC THRESHOLD FOR TYPE 2 DIABETICS AND NON-DIABETIC SUBJECTS

Simões, H.G., Moreira, S.R., Hyane, W.C., Do Valle, G., Sotero, R.C., Lima, R.M., Cunha, R.R., Oliveira, R.J., Puga, G.M., Moffatt, R.J., Campbell, C.S.

Catholic University of Brasilia - Brasília DF Brazil and Florida State University - Talahassee FL US, Brazil

Methods to identify the anaerobic threshold (AT) on 10 type 2 diabetics (54.5 +9.5 yr; 30.1 +5.0 kg/m2) and 10 younger non-diabetic subjects (36.6 +12.8 yr; 23.9 +5.0 kg/m2) were compared during incremental test (IT) on cycle-ergometer. The over-proportional increase on the VE/VO2 and the blood lactate ([lac]) responses identified the workload (Watts-W) corresponding to ventilatory (VT) and lactate threshold (LT) respectively. The lower blood glucose ([gluc]) identified the individual glucose threshold (IGT). The VE/W and [lac]/W responses were modeled through a second grade polynomial function (PF) to identify exercise intensities above which an over-proportional increase in VE and [lac] did occur and were named VTVE/W and LT[lac]/W. Additionally, the acid-base balance as related to AT was analyzed. The LT (85.0 +32.1), VT (88.0 +31.7), IGT (86.0 +33.8), LTLac/W (82.0 +20.9) and VTVE/W (90.2 +22.2) identified on diabetics differed from the LT (139.0 +39.0), VT (133.0 +42.7), IGT (140.8 +36.4), LTLac/W (122.7 +44.3) and VTVE/W (133.0 +39.1) identified for non-diabetics ($p<0.001$). However, ANOVA evidenced no differences between methods to identify the AT within groups. After reaching the AT intensity during incremental test a blood pH was significantly decreased. We concluded that the [gluc] responses as well as the modeling of the VE/W and [lac]/W ratio through PF successfully identified the AT for type-2 diabetics and non-diabetics. Also, the studied protocols identified exercise intensities above which the acid-base balance is disrupted and the blood glucose may be increased.

Financial support: CNPq (475575/2004-0) and UCB/SIGEP.

VO2 KINETICS AND BRONCHIAL HYPER-RESPONSIVENESS IN PROFESSIONAL CYCLISTS

Medelli, J., Marefati, H., Campion, F., Lounana, J.

CHU Amiens, France, France

Introduction

The relation between oxygen consumption (VO2) and work rate (W) is classically considered to be linear (Astrand). Recently, the comparison of the VO2 measured during an incremental test with the extrapolated values from the VO2/W relation below the lactate threshold, can show an excessive VO2 in healthy subjects (Zoladz) or a reduced VO2 in professional cyclists (Lucia). A high prevalence (50%) of bronchial hyper-responsiveness has been observed in professional cyclists (Medelli). Clinical investigation, lung function testing at rest or during exercise and pharmaceutical tests are not always discriminatory enough for a diagnosis. Could the analysis of VO2 kinetics below and above VT provide additional information?

Method

37 professional cyclists (27±4.1 years, 179.7±6.8 cm, 71.2±6.8 kg, VO2max: 67.55±5.9 mL.kg-1.min-1, Wmax: 415±35Watts) were separated in two groups characterized by positive (BHR+, N=18) or negative (BHR-, N=19) bronchial hyper-responsiveness according to the following parameters: clinical investigation, lung function testing at rest and after exercise, and methacholine challenge. Subjects performed an incremental test (50W/3min) until exhaustion on a bike ergometer (Lode Excalibur). Physiological parameters were measured continuously (Jaeger Oxycon V) and recorded every 30s until test termination. The values of the last minute of each completed step were averaged and used for regression analysis below and above the ventilatory threshold with calculation of slopes and intercepts.

Results

Except age (29.2±3.4 vs. 25.3±3.9 for BHR- and BHR+; $P<0.05$), there was no significant difference between groups regarding anthropometrics, physiological and lung function testing data. However, during the incremental test the VO2 relation of the BHR+ group exhibited a breakpoint with a steeper VO2 /W slope above compared to below VT (0.497±0.031 vs. 0.561±0.051 respectively, $P<0.0001$) while

the VO2/W relation was linear in the BHR- group. The VO2/W slope above VT was significantly higher in BHR+ compared to BHR- (P<0.05). These results were unchanged when taking into account age effect.

Discussion

In this group of professional cyclists, lung function testing cannot always differentiate between subjects according to their BHR status. However, it appears that the VO2 kinetics during an incremental exercise test can be a discriminatory parameter contributing to the diagnosis of BHR. A possible factor for the excessive VO2 observed at workloads above VT in BHR+ may be the increased solicitation of respiratory muscles to compensate airways obstruction.

References

- Astrand PO, Rodahl K, 1986, p.301 Textbook of Work Physiology, McGraw Hill, New York.
- Zoladz JA, Rademaker AC, Sargeant AJ. J Physiol. 1995 Oct 1;488 (Pt 1):211-7.
- Lucia A, Hoyos J, Santalla A, Perez M, Chicharro JL. Med Sci Sports Exerc. 2002 Feb;34(2):320-5
- Medelli J, Lounana J, Messan F, Menuet JJ, Petitjean M, J Sports Med Phys Fitness (under press).

Poster presentation (PP)

PP2-05 Biomechanics 1-3 - "Exhibition Hall"

SIMULATIONS OF INDIVIDUAL SQUAT JUMPS ON COMPLIANT SURFACES

Tilp, M.

Karl-Franzens-University Graz, Austria

Jumps in sports are all executed on more or less compliant surfaces with different material behaviour. Sport surfaces behave elastic like a trampoline or may be quite rigid like asphalt. In the last decades a lot of outdoor sports on sand like beach volleyball or beach soccer became popular disciplines. In beach volleyball the jumping height is one of the performance determining factors and several, mostly empiric, works (Giatsis et al., 2004; Vetter/Nicol, 2004) have dealt with the different jumping or landing movements on sand compared to rigid surfaces. To get more knowledge about the influence of the surface on the jumping behaviour we simulated individual jumping movements on different compliant surfaces.

The employed 2D-model is described in detail by Sust (1997) and uses the individual properties of the muscle, nervous and anatomical system of an athlete to simulate squat jumps. With the help of the model and some movement measurements it is possible to determine the properties of an athlete and to simulate individual jumps under different movement conditions (Tilp et al., 2004). An augmented version of the model provides the option to simulate different surface properties to research the consequences on kinematic and kinetic quantities of the jumping movement like e.g. developed force, velocity, power or jumping height.

A compliant surface changes the working conditions for the muscle during the jumping movement compared to rigid surfaces. Therefore, the force development changes and jumping performance (maximal height) may decline (Giatsis et al., 2005). Simulations showed that there is another interesting effect. Due to the nonlinear relationship between the muscle properties and the jumping height, it is possible that athlete "A" jumps lower than athlete "B" on a rigid surface but higher from a surface with a specific compliance. Such findings may be explained by the adaptation of the muscle-nervous system to specific movement conditions (e.g. specific surfaces) and should be veryfied empirically.

A possible future application of such simulations could be the individual preparation of an athlete to a specific competition surface when the surface properties are known.

Literature

Giatsis, G., Kollias, I., Panoutsakopoulos, V., Papaiakovou, G. (2004). Biomechanical differences in elite beach-volleyball players in vertical squat jump on rigid and sand surfaces. Sports Biomechanics 3 (1), 145 – 158.

Sust, M., Schmalz, T. Linnenbecker, S. (1997). Relationship between distribution of muscle fibres and invariables of motion. Human Movement Science, 16, 533 – 546.

Tilp, M., Sust, M., Thaller, S. (2004). A biomechanical method to improve individual planning and controlling of training, Proceedings of the 28th American Society of Biomechanics (ASB) Annual Meeting 2004. Portland, 418-419.

Vetter K., Nicol, K. (2004). Zum Einfluss des Sanduntergrunds auf die Sprungleistung im Beach-Volleyball. Leistungssport 2/04. 57 – 62.

EVALUATION OF SPRINTING PERFORMANCE THROUGH CHARACTERISTICS OF VERTICAL JUMPING

Gouvali, M., Kourias, T., Zapartidis, I., Boudolos, K.

University of Athens, Greece

INTRODUCTION

The strength qualities of sprinters are frequently evaluated through jumping tests. Although various tests have been proposed in the literature, their validity in evaluating critical aspects of sprinting performance is not yet established due to the samples used or to the selected parameters. Therefore, the purpose of the study is to examine the relationship between sprinting performance and qualities measured by countermovement jumping (CMJ) or hopping in place.

METHOD: Sample consisted of 8 male sprinters (75.8±8.1kg, 179.4±8.7cm, 21.6±1.8yrs, 100m record: 10.85±0.3s). Two maximum 50m running efforts were performed from a block start and the best was selected for analysis. Times were recorded at 8, 10, 40 and 50m with 4 pairs of photocells (Brower Timing System) in order to compute velocity (V). Mean step frequency for 10 and 50m was calculated by data obtained with a VC (50Hz) and step length was computed as the quotient of the whole distance to the total number of steps. Subjects also executed 3 CMJ and 2 trials of hopping in place for 10s on a force plate (Kistler, Type 9861A). The vertical height of the CMJ was calculated by flight time, while for hopping trials, the frequency was calculated. Statistical analysis included Pearson correlations (p<0.05), as well as regression analysis.

RESULTS: Velocity between 40 and 50m was 9.89±0.42m∙s-1, while the velocity between 8 and 10m was 76.0±6.3% of the maximum. CMJ height was statistically correlated with velocity at 10 and 50m, as well as mean step length at 10m. Hopping frequency and height was correlated with velocity at 50m and mean step length at 10 and 50 m. CMJ height alone, was a good predictor of velocity at

10m (R2=0.734, p<0.05). Velocity at 50m could better be predicted by a combination of CMJ height and hopping frequency (R2=0.552, p<0.05).

DISCUSSION – CONCLUSION: Sprinting requires strength qualities to accelerate and elastic qualities to sustain maximum velocity. Thus, CMJ height, as a measure of explosive strength, proved to be a good indicator of the velocity at the initial acceleration phase (Bret et al., 2002), however, hopping frequency, as a measure of elasticity, is also necessary in predicting the ability to sustain maximum velocity (Berthoin, et al. 2001; Chelly & Denis, 2001). Consequently, sprinting performance is a result of different qualities, such as strength and elasticity, which should be evaluated through different jumping tests, specific for each one.

REFERENCES: Berthoin S., et al. (2001). J Strength Cond Res. 15, 75-80

Bret C., et al. (2002). J Sports Med Phys Fitness. 42, 274-281.

Chelly S.M. & Denis, C. (2001). Med Sci Sports Exerc. 33, 326-333.

Acknowledgement

Research partially supported by the Hellenic General Secretariat for Research and Technology and by the European Union.

FASCICLE BEHAVIOR OF THE SYNERGISTIC MUSCLE GROUP, MEDIAL GASTROCNEMIUS AND SOLEUS, DURING DIFFERENT INTENSITY DROP JUMPS

Sousa, F., Ichikawa, M., Vilas-Boas, J.P., Komi, P.V.

Neuromuscular Research Center, University of Jyväskylä, Finland; Faculty of Sports, University of Porto, Portugal, Portugal

The present study was designed to examine the fascicle behavior of the synergistic muscles, medial gastrocnemius (MG) and soleus (SOL), simultaneously during different intensity drop jumps (DJ). Eight subjects performed unilateral leg drop jumps on a sledge apparatus with maximal effort from four individually predetermined dropping heights: 50, 75, 100, and 120% of the optimal dropping height (DJ1, DJ2, DJ3 and DJ4, respectively). During the exercises, the reaction forces (Fz; parallel to the movement plane of the sledge seat), sledge displacement and velocity were measured simultaneously with the electromyographic (EMG) activity, and fascicle lengths (using ultrasonography) for the MG and SOL muscles. The results showed that muscle tendon unit (MTU) and tendinous tissues of both muscles were stretched prior to shortening during the contact phases. However, the fascicles behaved differently between the two muscles. The SOL fascicles were stretched prior to shortening during the ground contact, following MTU and TT behavior. With increasing dropping intensities, the lengthening amplitudes of the SOL fascicles decreased together with higher EMG activation. However, the MG fascicles behaved differently from its synergistic SOL muscle during DJs. During the lower drop height conditions (DJ1 and DJ2) they primarily shortened during the braking phase. Thereafter in the DJ3 and DJ4 conditions, the MG fascicles did not shorten during the braking phase although the EMG activity was still increasing during the preactivation and braking phases. Instead, they behaved isometrically or lengthened in this particular phase. These results suggest that the MG and SOL fascicles can behave differently during DJ, as well as that there may be a specific length change patterns of the MG and SOL fascicles with increasing prestretch intensity. Results provide evidence that the fascicle behavior is task dependent.

ANAEROBIC POWER PRODUCTION CHARACTERISTICS DURING BICYCLE EXERCISE AND MUSCLE SIZE IN THROWER, SPRINTER, MIDDLE AND LONG DISTANCE RUNNERS

Tanaka, S., Aoyama, T., Tsunoda, N.

Kokushikan University, Japan

Anaerobic power production capacity is important factor in any athletic activities. Its power output capacity affected by athletic training mode was reported previously. The purpose of this study was to observe the anaerobic power production capacity on bicycle exercise and effects of muscle size in track and field athletes.

The subjects were thirty-two collegiate athletes. These subjects were classified by athletic event (9 throwers; TG, 13 sprinters; SG, 10 middle and long distance runners; MLG). The maximal anaerobic power (MAP) was obtained by bicycle ergometer (Power max VⅡ, Combi co. Japan). Subjects were performed ten seconds with the maximal efforts intermitted of three steps work load, and requested to have warm-up and two minutes rest. Relative maximal anaerobic power to body weight (MAP/BW) and to fat free mass (MAP/FFM) were calculated in all the subjects. And also, the relative load and pedalling rate of 2nd and 3rd sets to 1st set were calculated in all the subjects. Muscle thickness of anterior, lateral and posterior of the right thigh were measured by the B-mode ultrasonic method. The index of muscle volume (MVI) for quadriceps was calculated by the muscle thickness and thigh length from trochanter to tibia in the right thigh.

MAP in TG (1150.3 ± 166.1 w) was significantly higher than that of SG (930.5 ± 181.9 w) and MLG (742.3 ± 133.5 w). Relative powers of MAP/BW and MAP/FFM in SG were highest value in all the groups. The highest power was obtained the load of the 2nd set. Significant difference was observed among the groups in work loads of MAP (TG: 9.0 ± 1.6 kp, SG: 7.3 ± 1.2 kp, MLG: 6.2 ± 1.7 kp). However, no significant differences among the three groups were observed in pedalling rate of MAP (TG: 132.2 ± 18.5 rpm, SG: 130.4 ± 19.7 rpm, MLG: 127.5 ± 20.7 rpm). On the other hand, relative load and pedalling of 2nd and 3rd set to 1st set were not observed significant difference. Muscle thicknesses of anterior and posterior in TG were significantly higher than that of MLG. And also, MVI of TG was showed higher value than that of SG and MLG. Significant correlation coefficients were observed between muscle thicknesses of anterior and posterior in all the subjects. And also, the MVI was closely related to the MAP in all the subjects.

In this study, anaerobic power production capacity of TG was higher than SG and MLG. Significant difference was obtained among the three groups in work load of MAP. Moreover, significant difference of muscle thickness was obtained by the groups. From these results, it was cleared that anaerobic power production capacity on bicycle exercise was differed by the athletic event. As the factor, load and muscle size may affect to the anaerobic power production capacity in track and field athletes.

TIME COURSE OF MECHANICAL AND NEURAL CANGES OF THE TRICEPS SURAE MUSCLE GROUP DURING 1 HOUR SSC SIMULATION

Avela, J., Peltonen, J., Kanervo, M., Komi, P.V.

University of Jyväskylä, Finland

It has been shown in several studies that the sensitivity of the short latency reflex component decreases immediately after SSC type of muscle fatigue (e.g. Nicol et al. 1996). In general, the responsible mechanisms have been divided into three different categories, including 1) supraspinal fatigue, 2) disfacilitation of the alpha motoneuron pool, as a result of reduced Ia afferent activity and 3) peripheral inhibition

through stimulation of the small muscle afferents group III and IV (Gandevia 1992). Our recent experiments, which were done with a passive muscle, could also suggest that the changes in the tendomuscular compliance induced by the continuous stretching of the muscle could contribute to this reduction in the reflex sensitivity (Avela et al. 2004). Therefore, the purpose of the present experiment was to examine the time course of the mechanical and neural changes during SSC fatigue condition where the supraspinal activity was minimized. Fatigue of the plantar flexor muscles was induced in a special ankle ergometer, where the initial ankle position was 90 degrees and the knee ankle was fixed to 140 degrees. Mechanical stimuli was set as a 10 degree ankle joint dorsiflexion with an average velocity of 3.5 rads-1 and a frequency of 1.5 Hz. Electrical stimulation (frequency of 30 Hz, duration of 0.2 ms and intensity of 10 % of MVC) was maintained during each mechanical perturbation with a pre-stimulation of 100 ms. The whole fatigue stimulation occupied one hour. The fatigue model induced only a slight reduction in the force production capability (MVC) of the muscle (6.1 ±16.5%, n.s). However, there was a clear decreasing trend for the peak-to-peak amplitude of the stretch reflex and for the H/M –ratio towards the end of the fatigue stimulation. For the stretch reflex this decrease was statistically significant 60 minutes after the exercise (-41.4 ±43.5%, $p<0.05$) and for the H/M –ratio from 45 minutes after the exercise (-25.0 ±24.3%, $p<0.01$). Interestingly, the time course for the reduction in the passive stiffness and fascicle length was parallel with the changes in the reflex sensitivity. Therefore, these preliminary results suggest that during the fatigue task the increased compliance of the muscle-tendon unit results in a reduced mechanical response of the muscle spindle and/or induces a slack in the intrafusal fibres of the spindle, leading to reduced reflex sensitivity in both cases.

References

Avela J. et al. (2004) J Appl Physiol 96(6):2325-32

Gandevia S.C. (1992) Sports Med. 13: 93-98

Nicol C. et. al (1996) Eur J Appl Physiol 72: 401-409.

CHANGES IN MOVEMENT COORDINATION OF THE THROWING ARM THROUGHOUT A SIMULATION OF A TEAM HANDBALL GAME

Zapartidis, I., Gouvali, M., Bayios, I., Boudolos, K.

University of Athens, Greece

Introduction

The proximal-to-distal segmental sequence pattern is identified in overarm throwing skills of team handball (Joris et al 1985). This movement coordination pattern is probably modified under the influence of the load deriving from the game circumstances. The purpose of the study was to examine if the movement pattern of the throwing arm is indeed modified throughout a simulation of a team handball game.

Methods

The sample consisted of 6 female team handball players (age: 20.6±1.8yrs, height: 1.67±0.7m, mass: 63.84±4.2kg). After a typical warm up, they performed 3 throws on the spot from a 7m distance against a target of 1m2 (initial measure-IM). Afterwards, they followed a 60min simulation circuit (2 halves  30min) where they reproduced the most common handball activities. Every 10min, 3 throws were performed and the second was selected for analysis. Ball velocity and linear velocity of the shoulder (SH), elbow (EL), and wrist (WR) were calculated by 3-D kinematic analysis conducted with 2 HSVC (Redlake, 125Hz) and a motion analysis system (Peak Motus), while accuracy was measured as the deviation from the centre of the target from videotape data. The maximum linear velocities (Vmax) and their timing (t_Vmax) were identified. Anova with repeated measures ($p<.05$) was conducted in order to estimate the effect of time on Vmax and t_Vmax of the joints and the ball and on ball accuracy.

Results

Ball velocity was low at the IM, improved during the first half and it was stabilized during the second half. Accuracy was high at the IM, while, during the game simulation, it was the highest after the 2nd 10min period of each half. The main effect of time on Vmax of the joints and the ball and on the respective t_Vmax was not significant. However, the temporal sequencing of Vmax of the joints was fluctuated. Defining as zero the time of ball release, t_Vmax of SH occurred slightly before t_Vmax of the EL (by 13ms) at the IM. After the 1st and 2nd 10min period, t_Vmax of the SH occurs much earlier than that of EL (32ms and 40ms respectively). After the 3rd 10min period, t_Vmax of the SH and EL gradually approach (3rd period: 20ms, 4th period: 8ms, 5th period: 13ms). During the last 10min period, t_Vmax of the EL precedes (by 8ms) t_Vmax of the SH (75ms). The t_Vmax of the WR remains stable (39ms – 37ms) throughout the game.

Discussion/Conclusion

The results reveal that, under the load of the game, there is an obvious modification in movement coordination. Forestier & Nougier (1998) have reported that the fatigue induced by isometric contractions led to a new inter-segmental organization in order to prolong performance. Consequently, the observed reconstruction of the movement pattern, under loaded conditions, offers a potentially less dangerous upper extremity pattern.

References

Forestier N. & Nougier V. (1998). Neuroscience Letters. 252, 187-190.

Joris et al. (1985). J Biomechanics. 18, 409-414.

FLAT AND TOPSPIN SERVES IN TENNIS: NEUROMUSCULAR PARTICIPATION IN A TOP PLAYER

Coutinho, C., Correia, P., Veloso, A.

Technical University of Lisbon, Portugal

The purpose of this study is to verify the key factors of the neuromuscular coordination in the tennis serve, and the differences between the Flat and the Topspin serves in the Upper Limb muscles of the racquet arm, performed by a quality tennis player (Davis Cup National Team). The developed methodology in this study can be used in others similar studies of the throwing movements. The following muscles where EMG analysed: Anterior Deltoid (AD), Pectoralis Major (PM), Posterior Deltoid (PD), Latissimus Dorsi (LD), Vastus Medialis and Vastus Lateralis of the Triceps Brachii (VM and VL respectively), Biceps Brachii (BB) and Brachioradialis (BR). The athlete executed ten flat and ten topspin serves. 3D cinematic data was collected. All the data was introduced in SPSS 11.5 program for statistical analysis.

There is a relationship between proximal antagonists and distal agonists in order to maximize the velocity flow over the segments chain of the dominant arm. AD and PM are the first active muscles in the main phase and are the main responsibles for the horizontal adduction of the arm. LD is fundamental in the serve action, with a short activation before hitting the ball. This muscle joins two different functions, antagonist of the horizontal adduction and agonist of the internal rotation of the arm. Comparing the flat and the topspin serves:

AD and PM have higher intensities (iEMG) in the flat serve; VM and VL activate earlier and have a longer activation period in the topspin serve. The sweetspot velocity in the instant of ball contact is higher in the Z and Y axis in the topspin serve and in the X axis in the flat serve.

EFFECTS OF THROW-IN MOVEMENT OF PARTIAL JOINT ON THROWING PERFORMANCE IN SOCCER PLAYERS

Yumigeta, R., Teshima, T., Kumagawa, D., Tanaka, S., Tsunoda, N.

Kokushikan University, Japan

Throw-in is an action, most frequently occurred in soccer game. It was reported that the sequence of segment rotations from the trunk to the forearm during throw-in movement in a few researchers. However, the relation between throw-in movement velocities on partial joint and throwing performance are not yet clear. Therefore, the purpose of this study was to clarify the effects of throw-in movement of partial joint on throwing performance in soccer players.

The subjects were ten male varsity soccer players (SP) and 10 physical education students as a control group (CON). Their mean (SD) values of age, height, weight were 21.4(1.6) yrs, 177.3(6.9) cm, 73.0(5.9) kg in SP, and 21.6(2.0) yrs, 175.4(6.6) cm, 70.5(7.8) kg in CON, respectively. These subjects performed using a parallel throw-in in which was placed both feet side by side. The maximal ball velocity in the distance of 5m was measured by a Radar Gun (Mizuno, Japan). Maximal throw-in movement velocities on partial joint for whole body, trunk and shoulder were obtained a custom-made movement velocity measurement system connected to the Speed Meter (VINE, Japan). The throw-in on the sitting position was performed from a custom-made chair, the subjects were tied up with a strap in order to avoid the participation of lower limbs during the trunk throw-in. And same as lower limbs and trunk were tied up in shoulder throw-in.

Maximal ball velocity was significantly higher in SP than that of CON ($p<0.01$). Significantly higher value of shoulder throw-in movement velocity was obtained in SP. In addition, significantly correlation coefficients were observed between trunk throw-in movement velocity and maximal ball velocity in SP ($r=0.674$, $p<0.05$). On the other hand, no significant correlation coefficients were observed between trunk throw-in movement velocity and maximal ball velocity in CON. Shoulder throw-in movement velocity was not significantly related to the maximal ball velocity in both groups.

From these results, it was considered that trunk movement is important factor for throwing performance in soccer players. Although, from the results for the relationships between movement velocities and ball velocity, throwing performance may influence to the lower limbs movement in untrained subjects.

DIFFERENCES IN GROUND REACTION FORCE ACCORDING TO STRIKING PATTERN

Young-Sook, L., Kyung-Ok, Y., So-Yeon, J., Ji-Hee, S.

Ewha Womans University, Korea, South

Purpose

The purpose of this study was to evaluate the effects of foot striking patterns on ground reaction force during jogging.

Methods

The original test group consisted of over 50 students, however, since only three subjects were able to sustain over 100 minutes of exercise, analysis was done on only those three subjects. Within this group, one subject (A) was a fore-foot striker(normal body weight), and. Subject (B) was a mid-foot striker(overweight). Subject (C) was a heel striker(normal body weight). The Kistler Force Platform was used to measure ground reaction force variables at ten minute intervals for the duration of the test. These variables included three dimensional force variables such as impact and active force. Statistical analysis was performed via the SAS program, utilizing ANOVA. Follow-up analysis was performed via the Duncan method.

Results

1. There is no statistical difference for either lateral and medial impact force and active force between all groups.

2. There is a statistical difference in anterior/posterior ground reaction force for all groups, especially for braking active impulse and breaking time as well as propulsive active impulse and propulsive time.

a. Forefoot strikers have lower breaking active impulse and breaking time, but have larger propulsive active impulse and larger propulsive time.

b. Midfoot strikers exhibited characteristics opposite of forefoot strikers. Midfoot strikers had high braking active impulses and times, while propulsive active impulse and time were both lower.

3. There is a statistical difference in vertical ground reaction force for all groups, Midfoot strikers had low impact force variables (passive impulse, passive loading rate, passive decay rate) for vertical ground reaction forces.

Conclusion

Foot striking patterns had statistically significant effects on vertical, anterior/posterior ground reaction force. Midfoot strikers exhibited low values for vertical impact force variables. Forefoot and heel-strikers showed alternatively high levels of vertical impact force and active force variables. Therefore, midfoot strikers may be best adapted to minimize the negative consequences of impact while jogging.

reference

Yi, Kyung-Ok(2004), The Effects of Time and Striking Patterns on Ground Reaction Force While Jogging, Journal of Korean Physical Education Association for Girls and Women, Vol.18.No.4.pp.105-115

Frederick, E. C., Clarke, T. E., & Hamill, C. L. (1984). The effect of running shoe design on shock attenuation. In Frederick, E. C(Ed.), Sport Shoes and Playing Surfaces. Champaign. Ⅲ: Human Kinetics. 190-198.

Nigg, B. M. (1986), Biomechanical aspects of running, In Biomechanics of Runnig Shoes, B. M. Nigg(ed.), Champaign, Ⅲ,:Human Kinetics Publishers, Inc. 1-25.

MODELING OF THE SWIMMERS JOINT MOMENT DURING THE IMPULSE OF GRAB START

Houel, N., Rey, J.L., Boissière, E., Lecat, S., Taiar, R., Quièvre, J., Hellard, P.

Fédération Française de Natation, France

INTRODUCTION: Analysis of the temporal distribution of the races shows that the start phase accounts for 15 % of total time for 50 m freestyle events (Arellano et al., 1994). Regardless of underwater factors, the start phase depends primarily on the quality of the swim-

mer's impulse on the starting platform (Vilas-Boas et al., 2003). A model based on inverse dynamic was developed in order to predict impulse's parameters during grab starts. The study presented here aimed i) to evaluate the precision of this model by comparing predicted speed and power values with experimental data collected in situ, ii) to predict the mean angles for each articulation at the instant of the swimmer's joint moments are maximal during the impulse phase.

METHOD

Eight national swimmers performed a grab start. For each start, the ground reaction force was recorded using a force platform. This one is fixed near the pool in respect of simulating start actually met in international race. The sampling frequency was 1000 Hz. Speed of the swimmer's centre of mass was obtained by integration of its acceleration. In parallel, a high speed camera (125 frames.s-1) was used to record the profile movements which were then analysed in order to determine the angle between the subjects' segments (right side) and the horizontal axis. The sum of segment energies was obtained using the anthropometric tables and equations of sum of segment energies as defined in Winter (1990). For each start, the kinematics and dynamics of the platform signal were synchronised (0.008 s accuracy). Based on swimmer's kinematics and morphological properties, the model permits to determine joint moment, joint power and velocity of take-off of the centre of mass.

RESULTS AND DISCUSSION

The model presented in this study was able to predict parameters, observable by kinematic and dynamic data, with the following mean dispersions: of 0.4 m.s-1 for speed with the force platform, 1 % for swimmer's internal joint power with the time derivative of the sum of segment energies (Winter, 1990). During the impulse phase, the mean angles at the instant of the swimmer's joint moments are maximal are: 77.4° for the ankle, 92.2° for the knee, 57.1° for the hip. The mean maximal joint's moment are: 447.5 N.m for the ankle, 275.2 N.m for the knee, 295 N.m for the hip. The main interest of this model lies in the possibility of analysing and better understanding the joint's moment of each articulation and the segmental coordination of each swimmer performing a grab start.

REFERENCES

Arellano R., Brown P., Cappaert J., Nelson R. (1994). Analysis of 50, 100, 200 m freestyle swimmers at the 1992 Olympic Game. Journal of Biomechanics, 10: 189-199.

Vilas-Boas J.P., Fernandes R. (2003). Swimming starts and turns: Determining factors of swimming performance. 3ème Journées spécialisées de Natation, Lille, France, 19 & 20 June.

Winter D.A. (1990). Biomechanics and motor control of human movement. A. Wiley Interscience Publication. Second Edition.

VELOCITY OF THE SKI JUMPERS DURING THE TAKE-OFF IN OLYMPIC SKI JUMPING COMPETITION (HS-106 M)

Virmavirta, M., Isolehto, J., Komi, P.V., Schwameder, H., Pigozzi, F., Massazza, G.

Neuromuscular Res. Center, Dept. of Biol. of Phys. Activity, University of Jyväskylä, FI, Institute of Sport Sciences, University of Salzburg, AT, University Institute of Sport Science, Rome, IT, Finland

Velocity of the ski jumpers during the take-off in Olympic ski jumping competition (HS-106 m)

Virmavirta Mikko*, Isolehto Juha*, Komi Paavo*, Schwameder Hermann#, Pigozzi Fabio+, Massazza Giuseppe+

*Neuromuscular Research Center, Department of Biology of Physical Activity, University of Jyväskylä, Finland

#Institute of Sport Sciences, University of Salzburg, Austria

+University Institute of Sport Science, Rome, Italy

The purpose of the present study was to clarify the velocity changes during the take-off phase and analyze the efficient take-off technique of the ski jumpers participating to the Olympic HS-106 m hill competition. Take-off phase was recorded for the 3-dimensional motion analysis with two fixed high-speed (200 Hz) video cameras synchronized by recording the RF -audio sync pulse in the audio line of the tape. It is well known that the inrun speed reflects the aerodynamic quality of the jumpers' inrun position before the take-off and it is the most important parameter affecting the jumping distance in ski jumping. Therefore this "officially measured" inrun speed of the jumpers (average speed from 8-meter distance during the latter part of the inrun curve) was compared with the different velocities of the jump-ers' segment model used in this study (de Leva 1996, adjusted from Zatsiorsky & Seluyanov). The official speed was examined for the first round (n=50, 88.12 +- 0.42 ms-1) and final round (n=30, 88.73 +- 0.36 ms-1) separately and it correlated significantly with the length of the jump for both rounds (r=0.628, p<0.001 and r=0.418, p=0.021, respec-tively). The comparison between the longest jumps (n=10) and the shortest jumps (n=10) demonstrated well that the best jumpers had significantly higher inrun speed in both rounds (p<0.001 and p<0.01, respectively). The preliminary results of the digitized data (10 best jumpers, 2nd round) during the take-off phase showed that, the CM velocity pa-rameters at the end of the takeoff phase provided no significant (p< .05) correlation to the jumping performance. However, the angular data showed that the high acceleration velocity of the knee during the take-off phase and small torso to X-axis angle at the instant of toe-off are correlated (r=0.561 and r=0.583, p<.05, respectively) to the result of the jump. This way the best jumpers are probably able to maintain the resultant velocity after the take-off and early flight phase.

de Leva (1996). J. Biomechanics 29, 9, 1223-1230.

Virmavirta et al. (2005). J. Biomechanics 38, 2157-2163.

BIOLOGICAL GROWTH AND DEVELOPMENT FOR SKATING PERFORMANCE, THIGH MUSCLE STRUCTURE AND FUNCTION IN MALE AND FEMALE JAPANESE SPEED SKATERS

Kumagawa, D., Tsunoda, N.

Kokushikan University, Japan

The purpose of this study was to clarify the effects of biological growth and development on skating performance, muscle structural and functional characteristics in male and female Japanese speed skaters. One hundred thirty-three males and 96 female speed skaters aged from 10 to 22 years were served as subjects. All subjects had belonged to speed skating clubs, which were deemed to be representative of the skating clubs in Japan. Therefore, they exercised regularly in technical drills relating speed skating throughout the year. They were classified 11 groups in males (from 130cm to 180cm) and 7 groups in female (from 130cm to 165cm) according to body height every 5cm. Muscle thicknesses of the thigh anterior (MT) as muscle structural parameter were measured by B-mode ultrasonic method. The maximal anaerobic power production capacity (MAP) as muscle functional characteristics was obtained by using a bicycle ergometer. The mean 500m skating velocity as a skating performance (SV) was used to the individual best records recently produced. MT, MAP and SV corresponding to body height were plotted on a logarithmic graph to obtain the allometric equation y=bxa, where "a" is a growth index and "b" is a constant.

Significant correlation coefficients were observed between MT, MAP and SV in all the subjects in both male and female. The relationships between MT, MAP, SV and body height observed broken lines, which had three phases with two critical points in both male and female, respectively. The growth indexes "a" between the first and second critical points in all the above relations were observed large value than that of other phases. Ranges of body height between the first and second critical point in MT were from 152.2cm to 168.1cm in male, and from 142.8cm to 154.4cm in female. It range of MAP were from 139.8 to 166.8cm in male, and from 138.8cm to 157.8cm in female. However, it range of SV were from 147.4 to 167.8cm in male, and from 143.2cm to 153.2cm in female. In addition to these results, the index "a" between first and second critical points on MT, MAP and SV were showed higher values in female than that of males ones.

These results suggest that biological growth and development of skating performance, muscle size and functional characteristics might not correspond mutually in the initial stage of growth process in male and female speed skaters. Moreover, the comparisons between male and female skaters indicate that skating performance of female are more superior growth than that of males ones in pubescence period.

MUSCLE FORCE GENERATION CAPACITY ON ISOMETRIC AND ISOKINETIC DURING TRUNK ROTATION MOVEMENT

Takahashi, Y., Tanaka, S., Kumagawa, D., Tsunoda, N.

Kokushikan University, Japan

Trunk movements are important factor in many athletic activities. Therefore, the purpose of this study was to examine for the force generation capacities to trunk rotation movement at different rotated positions on isometric and isokinetic actions.

The subjects were 13 right-handed healthy males (age: 22.5±0.7 yrs, height: 174.0±1.4 cm, body weight: 69.9±3.6 kg, fat free mass: 55.7±1.8 kg). Muscle force generation capacities during trunk rotation movement were measured by isokinetic dynamometer (Biodex system 3, torso rotation test) on sitting. All the subjects performed trunk rotation movement for right and left directions with maximal effort. The position in turn to front of trunk was defined 0degree, and right hand sides in left rotation were defined plus degrees, on the other sides were minus degrees. In contrast, right rotation was minus degrees in right hand side, and plus degrees in left hand side. Measured rotate ranges were -50 to 50 degrees consist of each 10degree in both rotations. Passive torque during trunk rotation movement was measured of each rotated positions except for 0degree. Maximum voluntary isometric peak torque values (ISM) were measured on pre-sets each rotated positions. ISM-ratios were calculated from both side rotated ISM. Maximum voluntary isokinetic peak torque values (ISK) test were performed with angular velocities of 30, 60, 120, 180 and 240 deg/sec.

Passive torque was less than 8% to ISM. Passive torque in left rotation was higher than that of right rotation in all positions. ISM was increased from –50 to 50 degrees in both rotations. ISM-ratio of left rotation was significantly higher than right rotation in –50, -40 and –30 degrees (-50 and –40 degrees: $p<0.01$, -30degree: $p<0.05$). However, significant differences were not observed from other rotated positions in left and light rotation. On the other hand, ISK decreased from 30 to 240 deg/sec. PT of ISK in 30 and 60 deg/sec observed significantly higher than that of right rotations ($p<0.05$). Positions on the PT appeared phase changed from 30 to 240 deg/sec. Although positions on the PT appeared phase were no significant difference between left and right rotations.

From these results, it was clarify that isometric and isokinetic muscle force generation capacities during trunk rotation movement may difference on left and right rotation movements in male subjects.

THE WINDMILL PITCH OF BALL VELOCITY AND ACCURACY IN JAPANESE FEMALE SOFTBALL PLAYERS

Kitagawa, Y., Kumagawa, D., Tanaka, S., Tsunoda, N.

Kokushikan University, Japan

Windmill pitching performance in the softball game such as ball velocity and accuracy was important factor. Therefore the purpose of this study was to clarify the pitching performance for ball velocity accuracy of target throwing in Japanese female softball players. The subjects were twenty female varsity softball players who were 8 pitchers and 12 fielders. All subjects exercised regularly in technical drills relating softball throughout of the year. These subjects classified according to softball position by two groups of pitcher and fielder.

The maximal ball velocity (MBV) was measured in the distances of 13.11m using a Radar Gun (Mizuno, Japan) for all the subjects. Each subject was requested to have fully warm-up routine before the measurement. Then they performed to 10 fastballs pitch with maximal effort. Accuracy in ball control to the target throwing in all the subjects was evaluated by a number of target hit. The ball velocity of target hit (TBV), the ratio of target hit with 20 pitches (RT) and the ratio of TBV per MBV (RTV) were also calculated as an index of pitching performance in both pitcher and fielder. The coefficient of variation (CV) in MBV, TBV, RTV and RT were also calculated.

No significant difference was observed between MBV and TBV in both pitcher and fielder. MBV, TBV and were significantly higher in pitcher (MBV: 22.7±1.5 m/s, TBV: 23.0±1.6 m/s, RT: 50.0±12.0%) than that of fielder (MBV: 18.6±2.0 m/s, TBV: 18.8±2.0 m/s, RT: 30.0±14.1 %) ($p<0.05$). CV of MBV, TBV and RTV were showed almost same value in both pitcher (MBV: 2.1%, TBV: 2.1%, RTV: 1.9%) and fielder (MBV: 2.6%, TBV: 2.6%, RTV: 3.6%) respectively. On the other hand, CV in RT was obtained higher value in pitcher (24.5%) than that of fielder (47.1%). Significant correlation coefficient was observed between MBV and TBV in both pitcher and fielder ($r=0.979$, $p<0.001$). And also significant correlation coefficient was observed between TBV and RT in all the subjects ($r=0.520$, $p<0.05$).

In this study, it was considered that pitching performance with windmill pitch was not influence on the target in female softball players. The pitcher showed higher pitching performance for pitched ball velocity and accuracy on target throwing.

RLATIONSHIP BETWEEN ATHLETIC PERFPRMANCE AND MUSCLE FUNCTIOIN IN JAPANESE FEMALE THROWERS

Aoyama, S., Aoyama, T., Tsunoda, N.

Kokushikan university , Japan

Recently, there has been a remarkable improving on the throwing performances in Japanese female throwers. Therefore, the purpose of this study was to clarify the relationship between muscle function of lower limb and throwing performance in Japanese female throwers.

The subjects were thirteen female Japanese throwers aged from 18 to 23 years. The peak torque of maximal isokinetic knee extension (PTe) and flexion (PTf) muscular force during concentric action was measured at velocities of 60,120 and 270 deg/sec using by isokinetic dynamometer (Biodex system Ⅲ). Maximal anaerobic power (MAP) was measured by cycle ergometer (Power max V2). Subjects were performed ten seconds with the maximal efforts intermitted three steps of work load, with warm-up and two minutes rest. The Athletic Achievement ratio (AAR) was used by record of each throwing event, so that AAR was calculated by personal best record / Japanese national record ×100 in all the subjects.

The subjects of MAP (891±147.7) were showed near by Japanese male elite athletes. The peak torque has reduced due to increase angler velocities. PTe was closely related to the AAR in both left (60deg/sec: r = 0.774, 120deg/sec: r = 0.744, 270deg/sec: r = 0.732) and right legs (60deg/sec: r = 0.678, 120deg/sec: r = 0.771, 270deg/sec: r = 0.701). There are significant correlation coefficients observed between PTf and AAR in both left (60deg/sec: r = 0.656, 120deg/sec: r = 0.744, 270deg/sec: r = 0.732) and right legs (60deg/sec: r = 0.734, 120deg/sec: r = 0.722, 270deg/sec: r = 0.676). And also, significant correlation coefficient was obtained between MAP and AAR (r=0.812 p<0.001).

In this study, muscle function of lower limb was closely related to the AAR. In addition, it is useful index that evaluation of throwing performance level with female throwers. From these result, it was suggested that increasing muscle function of lower limb may be improvement factors for athletic performance in female throwers. Furthermore, it was considered that increase muscle function of lower limb in training can be expectation of better throwing performance.

EFFECT OF A NEW DEVELOPED PEDAL-CRANK TRAINING SYSTEM ON MECHANICAL EFFICIENCY IN CYCLING

Böhm, H., Siebert, S., Senner, V.

Technical University Munich, Germany, Germany

To improve the transfer of human power into cycling performance, technical solutions such as oval chain rings or pedal-crank systems with varying lengths has been developed to maximize mechanical efficiency (ME), defined as the ratio between total force applied to the crank and the propulsive tangential force (Davis 1981). Because the effect of these systems is small (Zamparo 2002), the present mechanism with fixed crank length and circular chain rings are commonly used in cycling competition. However, these classic systems give the athlete itself the possibility to optimize its mechanical efficiency by changing to a better orientation of the force on the pedal. The task of the athlete is hereby to increase the propulsive force, which is tangential to the crank rotation. The aim of this study is to investigate whether training with the new developed "SmartCranks" (SmartCranks GmbH, Switzerland) training system improves the ME of the athlete during cycling. SmartCranks are bicycle cranks that are completely independent from each other using a free-running bearing.

A group of 20 male healthy, non-professional road cyclists volunteered to participate in this study. The subjects performed a 5-week training program on a cycling ergometer with 10 subjects training with the SmartCranks, the other with a conventional crank system. Before and after the training period, the subjects perform an incremental test to exhaustion, starting at 100W, with 30W increments every 3min at a constant pedalling rate of 90rpm. During the whole test, pedal forces were measured with the PowerTec system (o-tec GmbH, Germany). Lactate was determined to calculate the individual anaerobic threshold of the athlete.

Tangential and radial forces were assigned to 360 degrees and averaged over about 200 cycles of each incremental step. ME was calculated and summed up over a cycle of 360 deg (Davis 1981). Additionally the mechanical efficiency was separately summed up over four sections ranging from 315-45, 45-135,135-225, 225-315°, with 360° defined at the pedal top most position.

Training with smart cranks results in a significantly better ME at 280W as well as on the individual maximal power level. The lower power levels did not show any significant differences between the smart crank training and the control group. Training with smart cranks does not significantly increase the maximum power or the power at the individual aerobic threshold of the athletes. The potential for increase of ME is mainly in the topmost section ranging from 315-45°. This section shows the greatest significant increase in ME during the whole training. The results suggest that training with smart cranks can improve mechanical efficiency when high workloads are required.

Davis R, Hull M (1981), Measurement of pedal loading in bicycling II: Analysis and results, J Biomech 14:857-872

Zamparo P, Minetti A, Prampero P (1981), Mechanical efficiency of cycling with a new developed pedal-crank, J Biomech 35:1387-1398.

BIOMECHANICAL ANALYSIS OF THE JAVELIN THROWING AT 11TH IAAF WORLD CHAMPIONSHIPS IN ATHLETICS IN HELSINKI

Murakami, M., Tanabe, S., Ishikawa, M., Isolehto, J., Komi, P.V., Ito, A.

Graduate school, Japan

INTRODUCTION

The purpose of the present study was to clarify the kinematic characteristics of the javelin throw movements of finalists at the 11th IAAF World Championships in Athletics held in Helsinki Finland. The javelin throwers analyzed in this study were fifty-seven males including eight finalists at the 11th IAAF World Championships in Athletics held in Helsinki Finland (World Championships). The best performance of each throwers ranged from 87.17m (the gold medallist of World Championships) to 45.25m was analyzed.

RESULTS

Although a significant positive correlation was observed between the initial velocity of the javelin and the official record ($r = 0.889$, $p < 0.001$), non significant correlations were obtained between the official record and the release angle, attitude angle, attack angle and release height of javelin. A significant positive correlation was observed between the official record and the calculated theoretical distance ($r = 0.909$, $p < 0.001$).

The pull distance was correlated positively and significantly with the official record ($r = 0.426$, $p < 0.01$), but the pull time was negatively correlated ($r = -0.418$, $p < 0.01$). The significant positive correlation between the official record and the approach run velocity was obtained ($r = 0.742$, $p < 0.001$).

Although the significant negative correlations were observed between the official record and the elbow joint angle ($r = -0.484$, $p < 0.001$) and adduction-abduction angle of the shoulder joint ($r = -0.474$, $p < 0.001$), the horizontal adduction-abduction angle of the shoulder joint showed a non significant correlation with the official record.

Although a significant positive correlation was observed between the official record and the forward trunk rotation angle ($r = 0.463$, $p < 0.001$), a non significant correlation was observed between the official record and the lateral rotation angle of the trunk. The official record and the fore leg knee joint angle showed the significant positive correlation ($r = 0.310$, $p < 0.05$).

CONCLUSION

The direct factor for achieving a high performance was the initial velocity of javelin. And the characteristics of throwing movement of finalists of World Championships to obtain faster initial velocity of javelin were as follows.

They approach with faster velocity and keep the fore knee angle in the extended position during the final phase of throw to change the approach velocity into the forward rotation of trunk. During the forward rotation of trunk, they keep their elbow joint angle small and adduction-abduction angle of the shoulder also small to be able to transfer the internal rotation velocity of shoulder joint to the grip velocity effectively. And they performed large movements in a short time.

INFLUENCE OF CONTRACTION INTENSITY AND JOINT ANGLE ON MEDIAN FREQUENCY OF KNEE AGONIST MUSCLES IN PREPUBERTAL BOYS AND ADULT MEN

Tsatalas, T., Hadjixenofontos, M., Katsanis, G., Giannakos, A., Michailidis, C., Lazaridis, S., Kotzamanidis, C.

Aristotle University of Thessaloniki, Greece

Introduction: Based on evidence, it is suggested that the median frequency (MF) of the EMG power density spectrum can be used as a motor unit recruitment tracking parameter in human voluntary muscular contractions (Solomonow et al 1990). The purpose of this study was to examine the influence of contraction intensity, joint angle and age on the MF of knee agonist muscles during step-wise increasing isometric knee extensions. Methods: 10 healthy adult male volunteers and 10 prepubertal boys 9-10 years old took part in the study. The subjects performed 2 maximal voluntary isometric extension contractions (MVC) on an isokinetic dynamometer at 2 knee angles (30° and 90° knee flexion,0°=full extension) for 5s. The subjects were then asked to perform one voluntary isometric extension contraction at the following intensities:20, 40, 60, and 80% of their best MVC. The MF was assessed through surface EMG for the vastus medialis muscle. A power spectral analysis was performed on a 3s window and MF was estimated based on the study of Pincivero et al (2001). A three factor repeated-measures ANOVA was performed on the MF. The level of statistical difference was set at $P<0.05$. Results: The results demonstrated that the MF was significantly higher for the 30° knee angle (short muscle length) in both age groups. MF values in boys were significantly lower than in men in both joint angles and in every contraction intensity. The effect of contraction intensity on MF was significant only for the 30° knee angle in both age groups. Specifically, a small increase of the MF values between intensities 20 and 80% of MVC was observed. Discussion/Conclusion: The higher MF values for the 30° knee angle can be attributed to the increase in action potential conduction velocity that results when a muscle becomes shorter and its diameter increases. (Trontelj 1993). The higher MF values in men compared with boys could in part be explained by a greater percentage of Type II fibers (Lexell et al 1992) and a greater motor unit recruitment of Type II motor units for men (Halin et al 2003). Finally, the fact that the effect of contraction intensity on MF was significant only for the 30° knee angle suggests that joint angle should be taken into consideration when median frequency is used to examine motor unit control strategies of agonist and antagonist muscles during step-wise increasing isometric knee actions.

THE EFFECT OF LOAD ON ARM MUSCLE ACTIVITIES DURING MOVEMENTS IN THE DIRECTION AND AGAINST THE DIRECTION OF GRAVITY

Laczko, J., Keresztenyi, Z.

Semmelwesi University, Faculty of PE and Sport Sciences, Hungary

Introduction: The electrical activities of skeletal muscles are increasing if a movement is executed under the effect of external loads. We studied arm movements and the effect of load if the movements were executed in the direction of the gravitational acceleration or in the opposite direction. This kind of studies are more frequent for lower extremities Here we studied arm movements and investigated the role of the agonist and antagonist elbow muscles.

Methods Subjects lay on a plate of weight bench and they hold a bar in their hands above their chest (in the starting position the upper arms were placed horizontally along the trunk and elbows were fully flexed, thus the hands with the bar in it were positioned above the shoulder of the subject. Starting from this position they lifted the bar by fully extending their arms and then they reposed the bar removing it to the original position. They performed this movement 10 times consecutively without load and 10 times with a load of 100N. Nine healthy subjects participated in the experiment. The movements were recorded with a Zebris Movement Analysing System. The coordinates of six anatomical points were recorded: one in the shoulder, two in the elbow, and two in the wrist and one on the back of the hand. From these coordinates we approximated the coordinates of the rotational centers of the three main joint of the arm: shoulder, elbow and wrist joints and the angular changes in the elbow joint. Simultaneously, we measured EMG signals from two muscles of one arm: m. biceps brachii and m. triceps brachii – short head. We computed the averaged amplitude of the EMG of the biceps in the lifting phase for the case with load and without load and we computed the ratio of the values obtained from these two conditions. We computed this ratio for the reposing phase as well. We made the same computation for the triceps

Results: The angular position profile in the elbow was not symmetrical, the absolute angular velocity was higher in the lifting phase. In the case of the biceps, the computed ratio of the EMG values was larger for the lifting phase and in the case of the triceps the ratio was much larger for the reposing phase. Thus the load has a bigger effect on biceps activity in the lifting phase and a significantly bigger effect on the triceps activity on the reposing phase.

Conclusion: This quantitatively supports that if the movement is executed with load, the triceps must exert significantly higher force in the reposing phase. Thus it slows down the reposing process to prevent a sudden fall of the bar and the triceps activity insures the smooth reposing. In the pushing phase the biceps activities while working against gravity may regulate the smooth lifting with load and without load as well.

Supported by the Hungarian research Fund OTKA34548.

ELECTROMYOGRAPHIC DESCRIPTION OF LIGHT VS. HEAVY RESISTANCE EXERCISE PROTOCOL

Holm, L., Aagaard, P., Kjær, M.

Bispebjerg Hospital, Denmark

Introduction. Recently, we developed an exercise protocol aiming to investigate the acute response and long-term adaptation of muscle and tendon to a light resistance (LR) or heavy resistance (HR) exercise protocol. Based on a 1 repetition maximum (RM) strength measurement the light and heavy loads approximately corresponded to 15.5% and 70% relative load, respectively. The aim of the present study was to provide an electrophysiological description of the two contraction-intensities from surface electromyography (EMG) recordings. Secondly, to compare the relative neural firing to the relative 1RM strength-based intensity determination. Methods. Sedentary males without any known neural disorders had their 1RM determined. On a separate occasion EMG signals were collected during the 1st, 5th and 10th (final) set of the LR as well as the HR exercise protocols. Adjacent electrodes were placed at muscles vastus medialis (VM), lateralis (VL), and rectus femoris (RF) muscles as the main prime-movers of the knee-extension exercise and at the biceps femoris (BF) as a measure of the antagonist activity. Signals were sampled at 1000 Hz, led through an AD-converter and amplified before stored in a computer. Raw data files were analysed in custom-made software (Biomax, v. 2.5), rectified and smoothed out by a root mean square (RMS) filter. The relative firing was calculated by dividing the current obtained from the LR and HR exercises wit the recordings from a maximal voluntary contraction (MVC) test conducted prior to the exercise trial. Data are mean ± SD. Results. The mean relative EMG was 14.0 ± 6.8% during the LR protocol and 51.2 ± 14.3% during the HR protocol. No difference was apparent from the 1st to the 10th set for the

mean relative EMG, neither for the LR nor the HR exercise protocol. Median power frequency tended to diverge slightly for VM in the LR exercise protocol whereas during the HR protocol median power frequency increased significantly for VM and VL and tended to increase for RF throughout the 10-set protocol. Discussion/Conclusion. The relative neural firing for the light resistance intensity corresponded to the 1RM strength-based intensity, whereas for the heavy resistance exercise intensity the relative neural firing was less than the 1RM strength-based intensity. No signs of neural exhaustion appeared during any of the intensity protocols.

DESIGN AND CONSTRUCTION OF AN AMBULATORY ANKLE ERGOMETER DEVICE

Gueib, J., Grosset, J.F., Lambertz, D., Vanhoutte, C., Pérot, C.

Université de Technologie de Compiègne, France

In our laboratory neuromechanical properties are routinely investigated (Lambertz et al., 2003; Grosset et al., 2005). These tests are made by using heavy and huge ergometer devices with a torque motor and thus difficult to be placed in other locations. However, most of the neuromechanical properties did not need the use of a torque motor. The aim of the present study was the design and construction of an ambulatory ankle ergometer device allowing for investigating neuromechanical properties in passive and active conditions of the ankle plantar flexor muscles.

The ergometer device is conceived to be easily carried and therefore built of different parts (around 10 kg each) easy to join and take apart. The ergometer structure is composed of a rigid frame and a mobile footplate to which different transducers are connected. Force measurements in active and passive conditions are carried out by using two exchangeable force transducers (see below) connected at the end of the footplate. A 13-bit absolute optical encoder is fixed within the rotation axis of the footplate providing the measurement of angular position and its derivatives. A 12-bit acquisition board is used for data sampling.

The main tests are:

- the quantification of the force from isometric contractions, used to characterize the contractile properties of the muscles and to quantify the variation of maximal voluntary contraction of the triceps surae as a function of ankle position.

- quick release tests, carried out by a fast and sudden release of the footplate. The release is obtained by switching off a holding magnet, connected between the force transducer and the footplate. Measurements included the isometric force just before the release and angular displacement, from which angular acceleration is calculated.

For these two tests, a 750 N load cell with a sensibility of 2,5 mV / V / F.S. is used.

- Range of motion and passive tension measurements obtained from pseudo isokinetic movements operated manually. In this test, a 125 N load cell with a sensibility of 2mV / V / F.S. is attached on the lower side of the footplate.

In order to provide repeatability and comparability between the measurements, the position of the subject has to be standardized. Consequently, the ergometer structure must be compliant to the subject's morphology and thus adjustable in many ways. Furthermore, quick-release and isometric contraction tests are done with the subject seating while the passive force measurements are made with the subject lying. This leads us to build a chair with a modular architecture.

After validation experiment, the ergometer device will be transported in places as rehabilitation centers or sport halls, in order to test different population in their usual environment.

Lambertz D (2003) et al JAP 95 : 64-72

Grosset JF et al (2005) Ped Res 58 : 966-970.

EFFECT OF STRETCHING VELOCITY ON ACTIVE AND PASSIVE FORCE ENHANCEMENT

Rácz, L., Váczi, M., Costa, A., Sáfár, S., Tihanyi, J.

Semmelweis University, Faculty of physical Education and Sport Science, Budapest, Hungary

Introduction. It is well known that the eccentric force increases in a function of stretching velocity. Also it is demonstrated on muscle fibres, animal and human muscle in vivo that after stretch the muscle force remained elevated for some seconds called passive force enhancement (PFE). In the previous studies relatively low stretching velocities was used (Lee and Herzog 2002). The aim of this study was to investigate the effect of low and high stretching velocity on both active (AFE) and passive force enhancement.

Material and methods. Six physically active male subjects were recruited in the study. The subjects were seated in a dynamometer (Multi-Cont II) and the shank above ankle was attached the lever arm of the servo motor. Isometric knee extension was performed by the subjects at a joint angle of 30, 40, 50 degrees, respectively. Muscle stretch was carried by applying 30/s, 60/s, 120/s and 300/s constant angular velocity flexing the knee between 30 and 50, 40 and 50, respectively. Also, eccentric contractions were carried out between 30 and 40 followed by a second stretch between 40 and 50 with 200 ms delay. EMG activity of vastus lateralis and biceps femoris was also measured.

Results. The peak eccentric torques enhanced gradually in a function of the increasing velocities during the first stretch and AFE was significantly greater at 300/s than at 30/s. Having finished the first stretch the torque dropped to the respective isometric torque level when 30/s, 60/s and 120/s velocity was applied. When 300/s was applied the torque after 200 ms was lower with 12.9 % compared with the respected isometric torque. The decrease in torque during 200 ms interval was not gradual. We experienced oscillating decrease and increase during this period. The amplitude of the oscillation increased in a function of the increasing velocity. The peak torques at second stretch increased in a function of the increasing stretching velocity, however, the trend of the enhancement was lower comparing with those of the first stretch. The iEMG activity of vastus lateralis and biceps femoris did not show significant differences comparing the first and second stretch and 200 ms interval between the two stretches.

Conclusion. The results of the present study confirm that the active force enhancement is depending on the stretching velocity. The applied stretch did not elicit passive force enhancement when relatively low stretching velocities are applied at the ascending limb of the torque-angle curve in agreement with the previous findings. It seems that high stretching velocity decreases the passive force after the stretch which decreases the peak torque in turn during the subsequent second stretch. Because the iEMG activity did not change, neural inhibition can be excluded. It seems that the oscillation manner of the torque decrease can be attributed to the visco-elastic properties of the muscles.

References

Lee HD, Herzog W. J Physiol 2002,545: 321 –330.

DIFFERENCES IN KINEMATICS, KINETICS AND ELECTROMYOGRAPHIC ACTIVATION PATTERNS BETWEEN PREPUBESCENT BOYS AND ADULT MEN DURING DROP JUMPS

Lazaridis, S., Hadjixenofontos, M., Giannakos, A., Charitonidis, C., Tsatalas, T., Gollhofer, A., Kotzamanidis, C.

Laboratory of Coaching , Greece

Relevant studies in the past examined the neuromuscular strategy of lower limb during a stretch shortening cycle performance (Arampatzis et al 2001). However, this performance has not widely studied in prepubertal population. For this reason the purpose of this study was to identify the neuromuscular differences in a stretch shortening cycle task between adults and prepubescent. Ten prepubertal boys (8-10 years of age) and 10 untrained male adults (23-28years of age) were asked to perform five drop jumps from 0.2m (DJ20) and 0.4m (DJ40). The instrumentation included six M3 cameras with Vicon 612 motion analysis system for the 3-D kinematics of the lower limbs, a Bertec 4060 force plate for the ground reaction forces (GRF) and a BTS Τelemg EMG system for the measurement of the electrical activity of m.gastrocnemius, soleus, tibialis anterior and peroneus longus. The instruction given to the subjects was to perform the highest possible jump. A two factor ANOVA with repeated-measures was used for statistical analysis($p<0.05$). Adults jumped higher in both heights,had shorter braking, propulsion and total contact time periods.Adults presented higher average and peak vertical ground reaction forces, but smaller values when these were normalized to body weight in braking phase, and it took longer time for them to reach peak vertical GRFs compared to prepubescent. The amplitudes of the pre-activation EMG levels of all muscles were greater in the prepuberts. In addition, prepubescents activated earlier their calf muscles before landing compared to adults. Adults displayed higher EMG activity of the agonist calf muscles at both phases of ground contact (braking/propulsion), but the co-activation of tibialis anterior was greater in prepubescents. Prepubescents compared to adults, exhibited reduced knee and ankle flexion at initial foot contact, more flexed angles at these joints at the knee deepest position and as a result greater range of motion over these two joints, mainly in DJ40 condition. Finally in both heights, prepubescents presented higher knee and ankle angular velocities than adults did in the braking phase, but smaller angular velocities in the same joints in the propulsion phase. The obtained results indicate that prepubescent followed different strategy during a stretch shortening cycle task compared with adults. It seems that preactivate earlier their muscles prior to contact. The fact that children landed with smaller joint angles during initial contact and succeeded higher normalized impact forces and preactivation EMG levels, could be attributed to learning factors. The higher joint angular velocities and the deepest joint flexion observed in children during braking phase could be caused by the higher elasticity of their muscle –tendon unit (Kubo et al 2001).On the contrary, the lower achieved height, agonist activity and higher antagonist activity observed in children during and after propulsive phase could be attributed mainly to the children's immature neuromuscular system (Quatman et al 2006).

BREASTSTROKE LEG MOVEMENT PATTERNS IN DIFFERENT TECHNICAL EXERCISES

Alves, F., Louro, H., Cardoso, L., Veloso, A.

Faculty of Human Kinetics, Portugal

Technical exercises using only the legs cycle are very often used in swimming training sessions. The aim of this study was to compare the kinematical characteristics of the breaststroke kick in partial technical drills to free swimming and its influence in body position in age group swimmers. Fifteen swimmers (age: 12.07 ± 1.84 years; height: 155 ± 0.12 cm; weight: 46,71 ± 12.70 kg) performed 3 x 25m at maximal velocity with full recovery, the first in breaststroke (BC), the second using a kick drill with the arms and hands in a glide position (SP), and the third using a kick drill with the hands supported on a kick board (CP). Each swimmer was filmed underwater by two synchronized fixed cameras for digitising and 3D kinematical analysis (APAS). A 30 points control volume (4.42m:1.41m:2.00) defined a global reference system. Ten body landmarks were manually digitised, corresponding to a 7-segment model of the human body, head and arms excluded. Swimming velocity (SV), distance per stroke (Ds) and stroke rate (Sr), were calculated from the intracycle kinematics of the body center of gravity (CG). Maximal trunk inclination decreased significantly from BC to SP and CP swims. Hip maximal vertical position increased from BC to CP. When comparing the two stroke drills we found that stroke frequency were higher for CP (0.88 ± 0.09 vs. 0.78 ± 0.12), keepeing SP a very close frequency to BC. The occurrence of maximal trunk inclination in reference to total leg cycle duration also varied: 57.8%, 50.4% and 30.4% of total duration in, respectively, BC, SP and CP. Average foot resultant velocity during the insweep was lower in CP, probably linked to the higher stroke frequency observed in this condition. The main conclusion of this study is that breaststroke kick drills with the board seem to change in a rather important degree the kinematics of the leg cycle, especially body undulation. This effect is much weaker in the kick drill without arms in gliding position. Swimming with the kick board constrains the body to assume a much flatter position in the water, increasing maximal hip flexion, which is an undesirable movement characteristic since it increases frontal drag. Moreover, the anticipation of the moment when maximal trunk inclination occurs may have negative influence on the synchronization of breathing with the leg cycle, with possible interference with free swimming in young swimmers who have not yet attained a high level of movement stability. Nevertheless, CP can be useful in stimulating higher stroke rates and in inducing specific leg power development.

A 30-MINUTES TRAINING IS SUFFICIENT TO LEARN THE BASIS OF MARTIAL ARTS FALL TECHNIQUES TO REDUCE FALL SEVERITY IN SIDEWAYS FALLS

Weerdesteyn, V., Groen, B.E., Duysens, J.

Sint Maartenskliniek, Netherlands

Falls are a major source of health problems in the elderly, including 90% of hip fractures. Although, fall prevention programs can reduce fall incidence successfully, falls still occur. Hip fracture risk is dependent on both bone strength and mechanics of the fall (1). Therefore, fracture prevention interventions should involve maintenance of bone strength, reduction of falls and fall techniques to fall safely. It has been shown that martial arts techniques significantly reduce hip impact forces in experienced fallers (2). Furthermore, practice of these techniques was feasible in elderly (3). However, it is not known yet whether extensive training is required to benefit from these techniques. The purpose of this study was to determine whether MA techniques can reduce hip impact forces in naive subject after a brief training. Ten young adults without prior experience in MA participated in a 30-minutes training in sideways MA fall techniques. Following this training, MA techniques with and without use of the arm to break the fall (MA-a and MA-na, respectively) were compared with the common way of sideways falling, in which the outstretched arm is used to block the fall (Control). Hip impact force and hip impact velocity were obtained for each fall. Compared to the Control condition, hip impact force was reduced in the MA-a and MA-na falls by 16.7% ($p=.001$) and 15.5% ($p=.006$), respectively. Impact velocity was 6.7% lower than in the Control condition ($p=.003$ and $p=.38$ for the MA-a

and MA-na falls, respectively). There were no significant differences between MA-a and MA-na falls. The present results mirror those previously obtained in experienced fallers, except that the reduction in forces and velocities was nearly twice as large in the experienced fallers (2). The finding that people can learn these techniques during a brief training, is very promising for the use of these techniques in fracture prevention interventions. Further studies are needed to investigate the trainability and effects of these techniques in elderly.

References: 1. Greenspan SL et al., JAMA 1994; 271: 128-133; 2. Groen BE et al., J Biomech, in press.; 3. Weerdesteyn V et al., Gerontology, in press. This study was supported by ZonMW, POM and Rheumatology Sint Maartenskliniek.

SHOE ORTHOTICS AND GROUND REACTION FORCES DURING SOCCER SPECIFIC 'OFF THE BALL' ACTIVITIES

Scurr, J., Cogger, L.

University of Portsmouth, United Kingdom

Soccer is a dynamic activity with relatively high injury incidences (17-24 injuries per 1000 hrs1). Lower extremity injuries account for over 75% of soccer injuries and approximately one third of these are overuse injuries.2 Overuse injuries are often the result of exposure to high loads, caused by incorrect biomechanical alignment and inappropriate footwear or terrain3. Hawkins et al.4 reported that running, turning, jumping, landing and other non-contact actions accounted for 42% of all injuries sustained by professional soccer players. During sporting activities, the ability of shoe orthotics to cushion high-frequency impact forces is beneficial to the athlete for reducing activity-related injuries. The purpose of this investigation was to assess the effect on GRFs of commercially available foot orthotics designed for use by soccer players, during various soccer specific, 'off the ball' activities. Eight male soccer players completed 6 trials over a force platform, during five activities; walking (1.5 m.s-1), jogging (3 m.s-1), sprinting (maximal), turning (180°) and jumping (maximal), with and without a Superfeet Blue Trim-to-Fit orthotic. Subjects wore new astro turf trainers and the force platform was covered by an astro turf runway (Evergreens, UK; 4.37% absorption property). Results showed that the orthotic significantly reduced impact peak force by 11% of body weight (BW) during walking (p=0.03). In all activities peak medial force was reduced by 1% BW with the orthotic, but this was non-significant. Vertical loading rate, time to impact peak, first active vertical and propulsive peak, peak anterior and posterior force, peak lateral force and stance time all demonstrated no significant differences during any activity with the orthotic. The effectiveness of the orthotic was subject specific, with some subjects demonstrating no effect and others a significant positive effect across a number of force variables and activities. The activity that demonstrated the greatest positive effect with the orthotic intervention was walking. Subject specificity may be due to anatomical, biomechanical and technical differences between individuals. Future research should combine kinetic and kinematic techniques to monitor rearfoot movement with orthotic intervention, within subjects, during soccer specific activities.

1. Rahnama, N., Reilly, T., Lees, A., 2002. Injury risk associated with actions during competitive soccer. Brit Jn of Spts Med 36, 354-359.

2. Ekstrund, J., 1994. Injuries. In: Ekblom, B. (Eds.), Football (soccer). Blackwell Scientific, Oxford, pp.75-194.

3. Reilly, T., Howe, T., Hanchard, N., 2003. Injury prevention and rehabilitation. In: Reilly, T., Williams, A.M. (Eds), Science & Soccer. Routledge, London, pp.136-147.

4. Hawkins, R.D., Hulse, M.A., Wilkinson, C., Hodson, A., Gibson, M., 2001. The association football medical research programme: an audit of injuries in professional football. Brit Jn of Spts Med 35, 43-47.

THE INFLUENCE OF SNOWBOARD MATERIALS AND DIFFERENT STANCE ANGLES ON THE MUSCLE ACTIVITY DURING BASIC TURNS

Zinzen, E., Hagman, F., Van Gheluwe, B., Dauwe, W., Bossu, J., Op de Beeck, P., Clarys, P.

Vrije Universiteit Brussel, Belgium

Introduction.

The development of snowboarding in the sixties – it was called snurfing at that time – was not an immediate success due to the reluctance of the ski areas in admitting snowboarders on the slopes. It is only from the nineties that snowboarding is considered as a full skiing equivalent with even some predicting that snowboard will be more popular than skiing by 2012 (Coeckelberghs and Urkens, 2000). Quite some studies evaluate the injury risk of snowboarding (Bladin et al., 2004; Made and Elmqvist, 2004, …) but no international publications towards muscle activity were found.

Purpose.

The purpose of this study was to investigate the activity of different leg muscles when using different snowboard material (bindings, boards) and in different stance angles on the board during basic turns. This information may be used to give advice to beginners during several teaching processes.

Methodology.

The investigations took place on a covered slope (18%) in Peer – Belgium (Snowvalley), on a standardized track consisting out of a slalom with 3 backside and 3 frontside turns.

6 test conditions were measured in a randomized order: freestyle board compared with a freeride board; classic strap bindings compared to cap strap bindings, forward stance compared to duck stance. Each condition was performed 3 times (9 back- and 9 frontside turns) by 12 experienced snowboarders.

Muscle intensity was measured by means of portable EMG equipment (Becker-Meditec) with 8 channels. Investigated muscles were the m. rectus femoris, the m. biceps femoris and the m. gastrocnemius lateralis on both legs. The residual channels were used for a goniometer on the knee of the front leg and for a manual synchronization button.

Integrated EMG (IEMG) was calcultated for each experimental condition and for every turn (back- and frontside). Normalisation in time and amplitude (highest peak) were performed. For the quantitative analysis the IEMG variables were checked for normality and comparisons between test situations were done with paired t-tests. A qualitative analysis was performed with the IDANCO technique as described by Clarys et al. (1988) also.

Results.

Quantitative analysis: no significant (all p>0,05) differences were found between the different test conditions for both back- and frontside turns.

Qualitative analysis: In general low muscle intensities of the measured muscles were noted for both turns normalised to the highest peak. The EMG curves during the movement were each time considered as identical according to the IDANCO system.

Discussion and conclusion.

The investigated snowboard situations did not provide different muscle activities. Therefore the material choice for beginners seems to be less important in view of muscular activity. These results however were obtained with experienced snowboarders. It is possible that real beginners have different muscle tones and patterns. Therefore further research with beginners is planned in the near future.

VELOCITY PROFILES AND STRIDE PATTERN IN PREPARATION FOR HOP-TAKE-OFF IN ELITE TRIPLE JUMPERS

Niessen, M., Jürgens, A., Hartmann, U.

Technical University Munich - Faculty of Sport Science, Germany

In contrast to well known statements regarding dependency of achieved triple jump (TJ) distances upon available horizontal velocity in run-up in general (e.g. Hay 1992) and each of the take-offs in particular (e.g. Niessen et al. 2004 & 2005) there is scarcely information about velocity profiles and stride pattern in preparation for hop-take-off in elite TJ.

Multiannual we compiled competition-velocity profiles (CVP) of among several male elite TJ during outdoor-seasons (Niessen et al. 2004). Velocity (v) was registered by a laser distance device (LDM 300C), placed in approach direction and focussed on the lower back of the athlete. Speed curves were edit and filtered by 67pt moving average of distance & speed (Sport 3.9, LavegDrei). Additional 2D-kinematic video-analysis of side movement was performed (Niessen et al. 2003). Descriptive and group-specific parametric statistics were applied.

Elite TJ (n=85: >16 m) achieved, independent to technique alternatives, maximum velocities (vmax) of 10.1±0.1 m/s without a significant coherence to effective distance (Deff: official plus toe-to-board distance) (Niessen et al. 2005). There were several significant linear correlations between vmax and position of vmax (Posmax) (r=0.65, p≤0.001), Posmax and difference of Posmax to take-off position of 2nd last (r=0.95, p≤0.001) resp. last stride (r=0.98, p≤0.001) as well as Posmax versus CVP 1m (r=0.20, p≤0.05) resp. CVP 0m (r=0.28, p≤0.01) to board. The pattern of 2nd and last stride in TJ >16.5 m was "long (2.5 m)-short (2.3 m)". Average difference of toe-to-board was 0.11±0.07 m for mean Deff of 16.91±0.35 m.

An important factor in top-level TJ competition performance is the execution of a fast, accurate and controlled approach run, even when wind conditions are inconsistent. Maximum velocity of >10 m/s needs to be achieved between 6 and 7.5 m during 3rd last stride to adjust stride pattern (set variable 2nd last stride) in order to hit the board accurately and relatively flat at hop-take-off. The faster the athlete (e.g. Speed-Jumper), the broader away Posmax and the more precisely steering on stride pattern "long-short" with less speed drop to hop-take-off due to time pressure. Somewhat slower athletes (e.g. Twin-Arm Jumper) have also to render more accurate pattern of the last two strides to compensate distance pressure due to nearer Posmax.

Hay JG (1992). J Sports Sci 10, 343-378

Niessen M et al. (2003). Proceedings of 8th Ann. Congr. of ECSS Salzburg: 304

Niessen M et al. (2004). Proceedings of 9th Ann. Congr. of ECSS Clermont-Ferrand: 336

Niessen M et al. (2005). Proceedings of 10th Ann. Congr. of ECSS Belgrade: 413

Acknowledgements

This study was supported by a grant of the Federal Institute of Sports Science of Germany (VPN 0407/0207/08/2004).

Poster presentation (PP)

PP2-06 Psychology 1-3 - "Exhibition Hall"

A TEST OF ELLIOT'S MULTIPLE GOAL MODEL AMONG ATHLETES PARTICIPATING IN THE XVTH MEDITERRANEAN GAMES 2005

Duda, J., Castillo, I., Balaguer, I.

The University of Birmingham, United Kingdom

Elliot and colleagues have argued for the extension of dichotomous achievement goal frameworks (Dweck, 1999; Nicholls, 1989). Specifically, they have proposed a 2 x 2 achievement goal model (Elliot & McGregor, 2001) which assumes that performance (ego) and mastery (task) goals should be bi-furcated into four distinct orientations, namely Mastery Approach (Mapp), Performance Approach (Papp), Mastery Avoidance (Mav), and Performance Avoidance (Pav) goals. The purpose of the present study was to test, among competitive athletes, a model of theoretically hypothesised antecedents and consequences of the four goal orientations. Based on Elliot (1999), perceived competence (PC) was posited to positively predict approach forms of achievement goals and be negatively associated with avoidance goals. Fear of failure (FoF) was postulated to be an antecedent of avoidance achievement goals and also a performance approach goal. With respect to consequences, it was assumed that the four achievement goals would differentially relate to indices of subjective well being. Mapp goals were hypothesised to predict positive indicators of well-being while avoidance goals were expected to correspond to poorer functioning. Participants were 200 athletes (103 males, 93 females; M age = 24.7 years) participating in the XVth Mediterranean Games 2005 in Almeria, Spain. They completed a multi-section questionnaire assessing their achievement goals (Conroy et al., 2003), fear of failure (Conroy et al., 2002), perceived competence (McAuley et al., 1989), self esteem (Rosenberg, 1965), satisfaction with life (Diener et al., 1985), and degree of emotional/physical exhaustion experienced in their sport (Raedeke & Smith, 2001). The assumed underlying measurement model for each of the scales was tested via confirmatory factor analysis and support was garnered for the factorial validity of the measures. All scales exhibited acceptable reliability except for the Mapp and Mav goal subscales (alpha = .54 and .62, respectively). Results of the SEM analysis revealed the model to provide a acceptable fit to the data (χ2 [18]=2.64, p<.001; RMSEA=0.06; NNFI=0.96; CFI=0.98). However, the predicted paths between PC and the achievement goals were not found to be significant and the Pav goal did not predict any of the well-being outcomes. The model explained 26%, 43%, and 29% of the variance in life satisfaction, self esteem, and emotional/physical exhaustion, respectively. In total, the results provided partial support for Elliot's framework in the competitive sport setting.

SIMPLE AND ELECTIVE REACTION TIME AND INTENSITY OF THE EFFORT IN BASKETBALL

Sillero Quintana, M., Carracedo, G.

Universidad Politécnica de Madrid, Spain

Visual reaction time (RT) is one of the more demanded visual skills in basketball (1). Reacting 0.01 seconds earlier could provide the player with the ball or it could be the time that the defender needs to be aware of a pass, allowing him/her to intercept the ball. Therefore, basketball players need short reaction times in order to improve their proficiency (2) not only in simple actions, in which single decision to be taken, but also in elective actions, which require a cognitive process to take the better decision among several suitable actions.

Most of the studies found in literature relating RT to effort intensity have been carried out by using ergometers (3,4) to cause the subject fatigue just before performing the test. In our study, we tested the visual single and choice reaction time (SRT and CRT) with an application designed in SuperLab 2.0.1 (Cedrus Corporation, San Pedro, CA, USA) under real training conditions in 10 amateur basketball players aged between 21 and 32 years, who had normal vision playing without glasses or with contact lenses.

The target for the SRT test was a 4 centimetres spot, which changed from green to red and for the CRT were three randomized images of the same player dribbling with a ball, right or left, or bouncing forward. In CRT, the subject had to press "z" when the image showed the player turning "left", "-" when he turned "right", or "space bar" when he bounced forward. The test was carried out four times: before warming up, after a 10-minutes warming up, after performing a circuit training at moderate speed and after performing the same circuit at maximal speed. As indicator of the effort intensity, the heart rate (HR) was recorded with a CAT EYE CD-1000 heart rate monitor.

The results showed a direct relationship between HR and both SRT and CRT, and they indicated significant differences for HR, SRT and CRT only when the subject performed the circuit at maximal speed compared with the other three conditions.

Our results point out prolonged SRT and CRT after maximal efforts, which could have influence on the basketball player performance. The differences for the CRT could indicate that the lower performance under high intensity efforts (i.e. at the end of the match) could be due to lowlier decision making processes.

REFERENCES:

1. Gardner, JG, Sherman, A. Vision Requirements in sport. In: Loran, D.F.C., McEwen, C.J., (editors) Sports Vision. London: Butterworth-Heinemann, 1995: 22-36.

2. Getz DJ. Vision and sports. J Am Optom Assoc 1978; 49: 385-8.

3. Delignières, D., Brisswalter, J. & Legros, P. Influence of physical exercise on choice reaction time in sport experts: the mediating role of resource allocation. Journal of Human Movement Studies 1994; 27: 173-188.

4. Sjoberg H. Relations between heart rate, reaction speed, and subjective effort at different work loads on a bicycle ergonometer. J of Human Stress 1975; 1:21-27.

APPLYING THE 'FIVE ASPECTS OF YOUR LIFE' MODEL IN A SPORTING CONTEXT: THE USE OF A COGNITIVE BEHAVIOURAL THERAPY ASSESSMENT TOOL IN ATHELTICS, CLAY TARGET SHOOTING AND KARATE

Cecil, S.

English Institute of Sport, United Kingdom

This study examined the utilisation of the 'five aspects of your life' model (Padesky & Greenberger, 1995) in three case studies with international performers. The model proposed that problems are studied by investigating thoughts, moods, behaviours, biology and environmental factors. Padesky & Mooney (1990) have demonstrated how this model can be utilised in the case conceptualisation phase of cognitive behavioural therapy (CBT). The aim of the model is to make the athlete aware how any of the five aspects can impact on each other: "They all sit inside our environment and interact with it as well. What we feel is closely connected to our thinking, our behaviour, our biology and our environment" (Padesky & Mooney, 1990, pg 13), secondly to make the client understand how changing one of the aspects can impact on the others getting 'better'. When applying the model in sport, socratic questions along with guided discovery are used to uncover 'hot' automatic thoughts followed by formulating the remainder of the five aspects. Alternative thoughts are then identified to illustrate the potential for a different five aspect model. Socratic questioning involves asking questions that the client can answer, which draws the client's attention to relevant info that might not be in the client's focus. (Padesky, 1993a). The results are two models/cycles illustrating how different thoughts trigger different moods, behaviours and biology. The model was utilised with three international performers who participated in athletics, clay target shooting and karate. An illustration from K, an international Karate performer shows how these different cycles manifested themselves. Thoughts about hurting his opponent, led to feeling angry, his technique going out of the window and his body feeling tense. In comparison thinking about being tactical, led to feeling calm and positive, throwing the right moves and stomach turning. The environmental factors for each model were different opponents. All three athletes reported a 'eureka' like feeling when they realised how their thoughts directly impacted on the other aspects of the model/cycle. Some reported increased self awareness and increased perceptions of control and some reported a similar sense of relief that Padesky & Mooney (1990) reported. It is hoped this report may encourage others to utilise and research the efficacy of this CBT technique.

Padesky, C.A. (1993a, September). Socratic Questioning: changing minds or guiding discoveries? Keynote address presented at the meeting of the European Congress of Behavioural and Cognitive Therapies, London.

Padesky, C.A. & Greenberger, D. (1995). Clinician's Guide to Mind Over Mood. New York: The Guildford Press.

Padesky, C.A., & Mooney, K.A. (1990). Clinical tip presenting the cognitive model to clients. International Cognitive Therapy Newsletter, 6, 13-14.

DELIVERING PSYCHOLOGY SERVICES TO ELITE SPORTS IN GERMANY - EFFORTS AND TRENDS

Neumann, G.

German Federal Institute of Sport Science, Germany

For a long time, applied sport psychology was not well established in the field of elite sports in Germany. Many reasons can be named responsible for the lack of systematic use of psychological training: prejudices, missing or false information about psychological training methods and their potential for performance enhancing, structural deficits, missing information about the costs, and problems how to contact an eligible sport psychologist are just some of them. In the last years however, the public opinion of the benefits of sport psychological work for reaching top performances seems to have changed a lot - the status of sport psychological work has risen and more top level coaches and athletes take advantage of sport psychological counceling and promote their effectiveness.

But how and why did this happen? One reason for this positive trend can be seen in the combined effort of three institutions that have started in 2002 to systematically reduce the existing deficits: the German Federal Institute of Sport Science (BISp), the German Sport Federation (DSB) and the German Association of Sport Psychology (asp). Without doubt, BISp has been leading in initiating, organizing, coordinating and funding sport psychological research and counceling of elite sports in Germany. Within the last years, the Federal Institute has been established as the top "go to" address for sport psychologists, federations, coaches and athletes.

Especially the following means have contributed to the upwind of sport psychology in elite sports:

2002>: launch of the website "http://www.bisp-sportpsychologie.de": (a) BISp offers an information portal for the fast and easy access to applied sport psychological issues and topics for elite sports, (b) with the help of a sport psychologist expert pool, experienced and top quality addressees for sport psychological counseling and training are provided, (c) quality ensurement of listed sport psychologists: applying persons must fulfill demanding criteria, (d) quality ensurement of the psychological work in elite sports: for the funding of sport psychological projects, only sport psychologists listed on the BISp-expert pool are accepted, (e) regulation of fees for sport psychological services by using a "sport psychological fee scale" as obligatory for federal funding.

2002-2004: the amount and duration of sport psychological counceling for potential Olympic athletes could be increased enormously by funding more than 30 projects in 23 different Olympic summer sports by BISp and DSB.

2005>: sport federations have started to finance sport psychological work (partly) by themselves by considering these services within their yearly budgets.

For the further acceptance of sport psychological work it will be crucial to secure its quality and ethical standards - in particular, to make clear the quality differences between so-called "mental" or "motivation" coaches as compared to sport psychologists.

EFFECTS OF MENTAL AND PHYSICAL FATIGUE ON A COGNITIVE TASK WITH UNPREDICTABLY CHANGING DEMANDS

Tamm, M., Kreegipuu, K., Jürimäe, T.

University of Tartu, Estonia

In task switching experiments, performance is generally slower after a task switch than after a task repetition. However, mental fatigue tends to slower down speed of processing information and the percent of mistakes increases (Lorist, Klein, Nieuwenhuis, De Jong, Mulder, & Meijman, 2000), whereas physical exertion may actually facilitate switching from one task to another (Pesce, Capranica, Tessitore & Figura, 2003). Thirteen healthy non-smoking college age men participated in the study. The subjects were divided into a sports group (SG) and a control group (CG). In a physical exertion task the subjects exercised 45 minutes on a cycle ergometer at approximately 80 % of individual heart rate threshold. To induce mental fatigue, a 45 minute long number comparison task on a computer was accomplished. A cognitively demanding task with randomly (after 3-6 repetitions) changing test question leading observers to attend either structural or semantic properties of numbers displayed on the screen was conducted before and after the fatigue experiments. The performance difference in time or errors between switch (i.e., new) and nonswitch (i.e., repeated) trials reflects additional cognitive load and is analyzed in switch costs (SC). The temporal SC was bigger in mental (787.9 ms) than in physical (517.7 ms, p=.012) task. Interaction between group, test and testing time occurred as the only condition where the SC did reduce, was the physical test for the SG (p=.014). In analyzing the accuracy of the task, the results showed that although responses to the second similar question tended to be more correct than responses to the new question, the difference was bigger in post-test situation. Also, a significant rise in the percentage of correct answers was observed after the physical fatigue experiment (p<.05), whereas after the mental fatigue experiment an opposite effect was present. SG remained relatively more stable throughout the test whereas the CG got relatively heavily disturbed in responding to a new question in the mental fatigue procedure [group x test x sequence x time, F(1, 11)=5.55, p=0.038]. Moderate physical exercise seems to facilitate cognitive processes whereas mental fatigue has an opposite effect. Moreover, facilitation of information processing depends on physical fitness of the subjects.

Lorist, M. M., Klein, M. & Nieuwenhuis, S., Dejong, R., Mulder, G., Meinam, T.F. (2000). Mental fatigue and task control: planning and preparation. Psychophysiology, 37, 614-625

Pesce, C., Capranica, L., Tessitore, A., & Figura, F. (2003). Focusing of Visual Attention under Submaximal Physical Load. International Journal of Sport and Exrercise Psychology 1, 275-292.

ACUTE MOOD AND ANXIETY EFFECTS OF QIGONG EXERCISE

Johansson, M., Hassmén, P., Jouper, J.

Department of Health Sciences & Department of Psychology, Sweden

Introduction

Qigong is a low intensity activity that uses slow movements, deep breathing and a relaxed focused mind for health-benefits. Regular qigong exercise has positive effects on health and wellbeing. Less studied than chronic effects are acute psychological effects of qigong exercise. We predict, however, that acute effects on mood and anxiety will be more positive after qigong exercise than in a non-physically active control group.

Method

Fifty-nine individuals (51 women & 8 men with a mean age of 51±13 years, having practiced qigong for 5±3 years) participated. Individuals were randomized to either a Qigong or Control group, according to age, exerciser/instructor and sex. The Qigong group performed thirty minutes of qigong exercise whereas the Control group listened to a thirty-minute lecture. Mood and anxiety levels were assessed by completing the six subscales of the Profile of Mood States (POMS), and also the State and Trait Anxiety Inventory (state form) immediately before and after the interventions.

Results

No significant differences were found between the Qigong and Control group at pretest. Separate Time (pre–post) x Group (qigong–control) mixed ANOVA's were performed. All seven analyses revealed similar results with main effects of Time significant, Group effects non-significant, and Time by Group effects significant (all ps <0.05) except on POMS-Confusion. T-tests revealed significant (ps<0.01) reductions from pre- to post-intervention in Tension, Depression, Anger, and Fatigue in the Qigong group, but not in the Control group. Vigor increased significantly in the Qigong group, but was unchanged in the Control group. Confusion was reduced in both the Qigong and Control group. State Anxiety decreased, but only significantly so in the Qigong group.

Discussion

Our hypothesis that reduced anxiety and improvements of mood would result from Qigong exercise, but not in the Control condition (lecture) was supported, except for scores on the Confusion subscale that was also significantly reduced in the Control group. These results show similar acute psychological improvements found in other forms of exercise (jogging, yoga, tai chi, e.g., Szabo, Meskó, Caputo, & Gill, 1998). Although it is known that exercise may alleviate stress and improve psychological health, a large number of individuals are not physically active. One reason for this may be that more intense forms of exercise, such as jogging or aerobics, do not suit everyone. Qigong may offer a low impact alternative to those finding more traditional exercise too strenuous. The result of this study suggests that health professionals can include qigong exercise among activities recommended for psychological benefits.

Szabo, A., Meskó, A., Caputo, A., & Gill, É. T. (1998). Examination of exercise-induced feeling states in four modes of exercise. International Journal of Sport Psychology, 29, 376-390.

HOW DO YOUTH FOOTBALL PLAYERS CONSTRUCT THEIR ENVIRONMENT TO ACQUIRE EXCEPTIONAL PERFORMANCE?

Saito, S., Kitamura, K., Nagayama, T.

Tohoku University, Japan

It is popularly believed that talent are inborn and inherent, and that those players with inborn talent acquire exceptional performance easily．But talent are build through daily cultivated discipline in years (Ericsson,1996). In addition, exceptional levels of talent development require certain types of environmental support, special experiences, excellent teaching, and appropriate motivational encouragement (Bloom,1985). Construction of the environment, or environmental self-regulation plays an important role as a contributing factor for talent development and athletes' sport experiences. Environmental self-regulation is the process of active monitoring, adjustment and readjustment to environmental condition. The purpose of this study is to clarify the process of personal active monitoring and adjusting to environment by youth elite athletes in order to acquire exceptional performance.

The participants were 15 youth elite athletes and their parents in Japan. Their average age was 17.2 years old. Each participated in a semi-structured interview lasting approximately 1 hour. The interviews were focused on the players' environment and the process of deliberate practice during the period from the players' early childhood to the high school age .The interview data was transcribed verbatim and analyzed using inductive procedure for analyzing unstructured qualitative data (Côté, salmela, Baria, & Russell, 1993).

As a result, a total number of 78 meaning units were gathered related to the contextual component from total of 137 gathered from 15 youth elite athletes and 8 parents. The inductive analysis process resulted in regrouping these interview transcripts into 3 definition categories: change in sense of purpose, re-setting of the challenge, and acquisition of the support. They made the practice environment based on a clear sense of their goal and purpose at each stage of development. They feel the importance of addressing the problem on their own way in order to improve self performance. And they set the practice environment continually in order to overcome the more difficult challenge. Moreover they constructed of the most suitable environment for themselves by acquisition of the support from the others. The elite athletes monitored and adjusted the practice environment actively for acquiring or improving personal performance. The sense of environment for the athletes depended on the way they perceived, and constructed the environment. Furthermore, the notion of "environment" is as it is perceived rather than as it may exist in objective reality.

[References]

Bloom, B.S. (1985) Developing talent in young people. Ballantine: New York.

Côté, J, Salmela, J.H., Baria, A., & Russell, S.J. (1993) Organizing and Interpreting Unstructured Qualitative Data. The Sport Psychologist, 7:127-137.

Ericsson, K. A., Krampe R.T., & Tesch-Romer, C. (1993) The role of deliberate practice in the acquisition of expert performance. Psychological Review, 100(3) : 363-406.

THE INFLUENCE OF COACH'S BEHAVIOUR ON THE PERCEPTION OF THE MOTIVATIONAL CLIMATE IN A TEAM SPORT

Viviani, F., Robazza, C., Bui, C., Bortoli, L.

University of Padua and University of Udine, Italy

The interaction between the individual motivational orientation and the motivational climate created by a coach can influence the athlete' intrinsic motivation, emotion, perception of competence, and sport participation. A purpose of the present study was to examine sex and age differences in the motivational orientation of team athletes. A second objective was to verify the influence of the athlete's perception of coach's behaviour on motivational orientation and motivational climate. The Task and Ego Orientation in Sport Questionnaire (TEOSQ; Duda et al., 1995), the Perceived Motivational Climate in Sport Questionnaire-2 (PMCSQ-2; Newton et al., 2000), and the perception of several positive and negative behaviours of the coach during practice and competition were administered to female (32 senior and 29 junior) and male (20 senior and 21 junior) basketball players. MANOVA analysis (followed by univariate ANOVAs) was performed on the TEOSQ and PMCSQ-2 subscale scores, with sex and age (senior and junior) as independent variables. Females were shown to be significantly more Task oriented than males, and to perceive less intra-team member rivalry. In addition, junior players reported higher scores in Task orientation than senior players. MANOVA analysis (followed by univariate ANOVAs) was also conducted on the TEOSQ and PMCSQ-2 subscale scores, with high (positive) and low (negative) evaluation of the coach's behaviour as independent variable (the median-split technique was employed to separate scores into high and low evaluation categories). Results revealed that those athletes who evaluated more positively their coach's behaviour, compared to those who evaluated more negatively their coach, reported higher scores in Task orientation and Important Role, and lower scores in Unequal Recognition. Findings support the contention that the coach's behaviour can influence either positively or negatively the individual motivational orientation and the motivational climate too.

References

Duda, J. L., Chi, L., Newton, M. L., Walling, M. D., & Catley, D. (1995).

Task and ego orientation and intrinsic motivation in sport. International Journal of Sport Psychology, 26, 40-63.

Newton, M., Duda, J. L., & Yin, Z. (2000). Examination of the psychometric properties of the Perceived Motivational Climate in Sport Questionnaire-2 in a sample of female athletes. Journal of Sports Sciences, 18, 275-290.

THE EFFECTS OF PERCEIVED AND RECEIVED SUPPORT ON PERFORMANCE

Rees, T., Freeman, P.

University of Exeter, United Kingdom

Although Sarason, Sarason, and Pierce (1990) proposed that social support might affect sports performance, there have been no explicit attempts to test this proposal in relation to objective performance outcome. The purpose of the present study was therefore to examine the main and stress-buffering effects of both perceived and received support upon objective performance outcome in golf. Participants were 126 high-level male British golfers, mean age 25.2 years (SD 5.4), with handicaps ranging from +2 (national/international level) to 4 (strong club player). Recruitment of participants was opportunistic (convenience sample) but spread across various golf courses in England on the practice day preceding major competitions. Participants completed measures of perceived support, stressors, stress, and received support before competitions. Performance outcome was recorded (low scores represent high performance levels). Moderated hierarchical regression analyses revealed a significant main effect for stress upon performance (Rsqu = .10, b = .66, p = .00), with higher levels of stress associated with lower levels of performance. Over and above the variance in performance explained by stress, there were significant main effects for both perceived (Rsqu ch. = .08, b = -.83, p = .00) and received (Rsqu ch. = .07, b = -.75, p = .00) support upon performance, with higher levels of support associated with higher levels of performance. However, when perceived and received support were entered in a model simultaneously, it was primarily perceived support (and not received support) that was associated with higher levels of performance. The stress-buffering effects accounted for 2% of the variance in performance outcome, but were just non-significant (ps = .07). The results demonstrate that although both perceived and received support have a beneficial impact upon objective performance outcome, perceived support may be more important than received support. In the present study, the knowledge that others were available to provide help if needed may therefore have been more important for performance than support actually received. This observation has important applied implications for sport psychologists and coaches, and suggests that a supportive environment may need to be nurtured over time for athletes to perceive they have high levels of available support. To this end, a number of strategies might be implemented to help develop a supportive environment, including educating athletes, their coaches, family, and friends as to the benefits of social support, and encouraging athletes to be proactive in using this resource. To further develop understanding, future research could examine the psychological states that might mediate the social support-performance relationship.

Sarason, I. G., Sarason, B. R., & Pierce, G. R. (1990). Social support, personality and performance. Journal of Applied Sport Psychology, 2, 117-127.

IDENTIFICATION OF ATTENTIONAL FEATURES IN TOP-LEVEL FENCERS

Taddei, F., Di Russo, F., Zoccolotti, P.

University of Motor Sciences (IUSM), Rome, Italy

Introduction

Fencing is commonly regarded as a discipline that engages cognitive processes and in particular attentional effort. In fact in competition, fencers are required to face highly mutable situations which demand responses involving accuracy and fast execution.

The aim of this study is to identify and isolate attentional features in top-level fencers by comparing them to non-athletes and swimmers (a discipline requiring less cognitive effort than fencing).

Methods: The attentional tasks were selected from the Italian version of the TAP battery for attention (Zimmermann & Fimm, 1992). Three attentional tests were used 1) alertness for intensive features, 2) divided-attention and 3) go/no-go for selective features.

Subjects: Three groups of subjects were studied. Thirty top-level fencers (15 females; mean age 22.5; SD=6.25), 18 top-level swimmers (8 females; mean age 20.6; SD=2.19) and 22 non-athletes (15 females; mean age 23.9; SD=3.67).

Procedure: Participants were requested to press a button as rapidly as possible using their dominant hand and their Reaction Times (RTs) were measured in all three tests. In the alertness test, subjects responded (with or without a warning signal) when a cross appeared at the center of the computer screen. In the divided-attention test, subjects responded to two simultaneous tasks (one visual and one acoustic). In the go/no-go test, subjects responded when two of five equi-probability stimulus configurations appeared on the computer screen and inhibited their response at the appearance of the other three configurations.

Data analysis: ANOVAs, having the Group (fencers, swimmers and non-athletes) as independent factor and the median RTs, the False Responses (FR) and the Omissions (OM) as dependent variables, were performed for each test. Age was considered as a covariate. The Newman-Keuls post-hoc test was used.

Results: In the go/no-go test, the group factor for RTs resulted significant [$F(2,62)=6.16$ $p<.005$; fencers=461 ms, swimmers=509 ms, non-athletes=502 ms]. The post-hoc analysis showed that fencers were significantly faster than the other two groups. The difference between swimmers and non-athletes was non significant.

There were no other statistically significant findings across groups or tests (i.e., alertness and divided-attention).

Discussion: The study showed that the fencers' RTs were faster in the go/no-go task and this may be due to a better administration of the cognitive processes related to the decisional phase and the selection of the appropriate response. The fencers have to respond to a very complex spatio-temporal situation that requires both rapid decision and quick execution. The superiority of the fencer in the go/no-go task could also be related to better inhibition skills, which are a fundamental feature of this discipline.

Reference: Zimmermann, P., & Fimm, B. (1992). Testbatterie zur Aufmerksamkeitssprüfung (TAP). Würselen: Psytest.

THE COMPARATIVE RESEARCH OF THE RESULTS OF THE KINETIC SURVEY AMONG CHILDREN BETWEEEN THE AGE OF 5 AND THE AGE OF 6

Katalin, R., Betty, B., Rita, F., Éva, M.

Semmelweis University - Phisical Education and Sport Sciences, Hungary

The focus of interest of many specialists and phsychologists dealing with evolutionism and infant neurology has been the connection between motion and the development of intelligence and it is still today. Between 1999 and 2005 Katalin Lakatos studied the movement and state of mind of nursery school children and she found close connection between the results of the maturity tests before going to school and the kinetic surveys. Furthermore, she showed that intellectually normal children, who had lower cognitive capacity or mental trouble - serious difficulties in reading, writing and calculating - and, who achieved lower results in the test of maturity also accomplished a lower level of the kinetic survey compared to those children, who were higher on the maturity level.

During the kinetic survey, which we started in 2005, we searched the answer for the question whether there is a connection between the maturity before going to school and the complex kinetic survey - referring to the state of the nervous system worked out by the neurologist Éva Marton-Dévényi and her coworkers - or there is not. According to our assumptions the capacity examined on the ground of motion, evolutionary indices, of those children who are not mature enough to go to school lag behind the avarage capacity of the age group. We analysed the motion of 60 nursery school children from Budapest between the age of 5 and the age 6 of. We investigated the infant elemental big movements, the toddler movements, the automated oblique movements, the static- and dinamic equilibrant ability, the growing independence of the lower and upper limbs, the resilience of the children, the auditive- and movement rhytm, fine motor coordination, body schem, the spatial movements and the dominance of the eye, hand and leg. We devided the children into two groups according to the survey made by the generative educators of the nursery school. The first group unites those children, who are mature enough to go to shool, the second unites those who are not. We used groups of movement activities and within these groups we valued each activity on a five-point scale, the points were summed.

We carried out the analyses of the results with the help of the program SPSS. We used T-test for independent samples to show the difference between the capacity of the two groups. As a final result we have found connection between the maturity before going to school and the results of the complex kinetic survey. Moreover we have shown difference between the capacity of the two groups.

TASK AND EGO IN ITALIAN COMPETITIVE OLDER ADULTS: GENDER, AGE AND SPORT DIFFERENCES

Capranica, L., De Pero, R., Amici, S., Benvenuti, C..

IUSM of Rome, Italy

Introduction

The task and ego orientation seems to provide valid predictors of sport achievement and participation (Newton & Duda, 1999), with differences due to gender, age, and type of sport (Duda et al.,1995; White & Zellner, 1996). However, research in older athletes lagged behind that studied on young and elite athletes. Thus, the aim of the present study was to investigate the task and ego orientation for adult participation in sport with reference to gender, age and type of practiced sport.

Methods: To represent the total elite adult track and field (N=306) and swimming (N=125) populations with an error < 4%, 431 individuals (N=82 females and N= 349 males) were randomly pooled. They were divided into three age groups (45-55 yrs; 56-65 yrs; >65). Athletes were administered the Task and Ego Orientation in Sport Questionnaire (TEOSQ) (Duda & Nicholls, 1992), which includes seven items reflecting task-involvement and six items representing ego-involvement. A 2 (gender) x 3 (age group) x 2 (sport practice) MANOVA with two subscales of task and ego orientation as dependent variables was applied to test significant differences ($p<0.05$).

Results: Significant differences for gender (Wilk's Lambda(2.418) = 3.742, $p<0.01$), for sport (Wilk's Lambda(2.418) = 5.164, $p<0.01$) and for the gender x sport interaction (Wilk's Lambda(2.418) = 3.319, $p<0.01$) were found. Gender showed a significant effect for Task ($F(2,174) = 3.208$, $p< 0.01$) with higher values for women (3.93 ± 0.8) than men (3.67 ± 0.8). Sport practice showed a significant effect for Task ($F(2,174) = 3.991$, $p<0.01$) and for Ego ($F(2,174) = 4.729$, $p<0.01$), with swimmers always showing higher orientation (Task: 3.81±0.74; Ego: 2.80±0.85) than track and field athletes (Task: 3.55 ± 0.84; Ego, 2.32 ± 0.80). Ego orientation showed a significant gender x sport interaction ($F(2,174)= 6.410$, $p< 0.01$). Among swimmers, women showed higher values (2.40±0.90) than men (2.35±0.87) while the opposite occurred among track and field athletes, (women: 2.09±0.76; men: 2.35±0.80). No significant difference was found for age and the interaction age x gender x sport.

Discussion/Conclusion: According to the literature for younger athletes (Duda, 1989), gender differences in goal orientation emerged in older age too, with higher task orientation in female than male athletes. On the other hand, older adults did not show the age effect reported for task and ego orientation in young athletes. Furthermore, type of sport practice seems to influence task and ego orientation, with swimmers more task and ego oriented than track and field athletes.

References:

Newton M Duda JL (1999). Int J Sport Psychol, 30, 63-82

Duda JL (1989) J Sport and Exerc Psychology, 11, 318-335.

White SA Zellner S (1996). Sport Psychol, 10, 58-72

Duda JL et al. (1995). Int J Sport Psychol, 26, 40-63.

BURNOUT IN ATHLETES: A COMPARISON BETWEEN TEAM AND INDIVIDUAL SPORTS

Gustafsson, H., Hassmén, P., Kenttä, G., Lundqvist, C.

Örebro University, Sweden

Introduction

Athlete burnout is characterized by exhaustion, sports devaluation and lack of sports accomplishment (Raedeke, 1997). It has been suggested that individual athletes are more likely to burnout than team sport athletes (Smith, 1986). Aims of this study were to determine the prevalence of burnout in young competitive athletes, and to test the hypothesis that burnout is more common in individual than team sports.

Methods

Eades Athlete Burnout Inventory (EABI: Eades, 1991) was used to assess burnout; it was distributed to 980 young elite athletes (402 females and 578 males, mean age = 17.5 years, SD = 0.95) representing 29 different sports, 23 individual (n=665) and 6 team sports (n=315). For the purpose of this study, four of the six original subscales in EABI were used: Negative Self-concept of Athletic Ability, Emotional and Physical Exhaustion, Devaluation by Coach and Team-mates, and Psychological Withdrawal and Devaluation of Sport Participation.

Results

Frequency data in relation to low (lower third), average (middle third) and high (upper third) levels of burnout was established (Maslach, Jackson & Leiter, 1996). Between 1 and 4% of the athletes scored in the upper third of the subscales. A higher frequency was found in team sports on all subscales. Especially evident was the difference in Physical and Emotional Exhaustion, with 3.5% in team sports vs. 1.8% in individual sports. A one-way MANOVA with the four EABI subscales as dependent variables and Sport (team vs. individual) as independent variable was significant, ($F(4,975)=9.42$, $p<.001$). Follow up analyses, using Bonferroni adjustments, showed significantly higher values in team sports compared with individual sports for Physical and Emotional Exhaustion ($F(1,978)=6.29$, $p=.012$) and Devaluation by Coach and Team-mates ($F(1,978)=32.69$, $p<.001$).

Discussion/conclusion

In contrast to what earlier has been suggested, our results show that athletes from team sports display higher burnout scores than individual sport athletes. Even if the differences are small, the higher frequency of team sports athletes with high levels of Physical and Emotional exhaustion, which is considered the core dimension of burnout, highlights the need for addressing the issue of burnout also in team sports.

References

Eades, A (1991). An investigation of burnout in intercollegiate athletes: The development of the Eades Athlete Burnout Inventory. Paper presented at the North American Society for the Psychology of Sport and Physical Activity National Conference Asilomar CA

Maslach, C., Jackson, S. E., & Leiter, M. P. (1996). Maslach Burnout Inventory. Manual (3rd ed). Palo Alto, CA: Consulting Psychologists Press.

Raedeke, T. D. (1997). Is athletic burnout more than just stress? A sport commitment perspective. Journal of Sport and Exercise Psychology, 19, 396-417.

Smith, R. E. (1986). Towards a cognitive-affective model of athletic burnout. Journal of Sport Psychology, 8, 36-50.

RELATION OF PLATELET MONOAMINE OXIDASE (MAO-B) ACTIVITY TO THE EFFECTS OF MENTAL AND PHYSICAL FATIGUE IN COGNITIVE TASKS

Kreegipuu, K., Tamm, M., Paaver, M., Jürimäe, T., Allik, J., Harro, J.

University of Tartu, Estonia

A possible biological marker of the performance and mental (MF) or physical fatigue (PF) in cognitive tasks, monoamine oxidase isoenzyme B (MAO-B) activity in platelets, was investigated. Platelet MAO activity reflects the capacity of central serotonergic system and has been shown to correlate negatively to sensation seeking, monotony avoidance and impulsiveness. Participants were 13 non-smoking men (mean age 20.6±2.7 years, BMI 22.3±1.7 kg m-2) who were at least moderately fit (VO2 max kg-1 57.1±13.5 ml min-1 kg-1). MF and PF were induced either by 45 minutes of a simple but attentionally demanding number comparison task or cycling on an ergometer (at about 80% of heart rate of an individual anaerobic threshold), respectively. Effects of fatigue were studied in a simple manual reaction time (RT) task in which the onset of motion was detected. In every experimental session, ratings of perceived fatigue (BCR10, Borg, 1998) were asked before and after and ratings of perceived exertion (BRPE, Borg, 1998) after fatigue-inducing tasks. The mean ratings of fatigue on the BCR10 scale showed an increase after both tasks: in the MF condition the ratings rose from 1.6± 0.9 in the pre-task to 3.5±2.1 in the post-task condition (t=-3.81, p<.01) and in the PF from 1.1±0.8 to 3.9±2.2 (t=-4.57, p<.001), respectively. Post-test BCR10 ratings did not differ between the MF and PF condition (t=-0.62, p=.54). Also the BRPE ratings were similar for the MF and PF conditions (13.5±1.5 after the mental task, and 14.3±2.5 after the cycling, t=1.22, p=.25). Post-test ratings correspond approximately to moderate or somewhat strong fatigue (BCR10) or somewhat hard exertion (BRPE). For RT, the interaction between the type of fatigue and the testing time (before or after the strenuous procedure) was statistically significant (F(1, 12981)=11.1, p<.001). There was a considerable rise in the RT after the MF procedure, whereas after the physical experiment an opposite effect was seen which remained statistically insignificant. Subjective ratings of fatigue and performance in the RT task were related to platelet MAO-B activity measured radioenzymatically with beta–phenylethylamine as the substrate. Lower MAO-B activity associated with higher ratings in the BRPE scale in both, the MF and PF task (r=-.69, p=.009 and r=-.63, p=.021, respectively). Perceived fatigue related to MAO-B activity only in the physical post-test (r=-.62, p=.024). Also the simple RT tended to correlate negatively with MAO-B activity, although the relation became statistically significant only in the mental post-test (r=-.77, p=.002). Thus, participants with lower MAO-B activity (and possibly central serotonergic capacity) tended to rate their feeling of fatigue and difficulty of the experimental procedure higher.

Reference

Borg, G. (1998). Borg's perceived exertion and pain scales. Champaign, IL, US: Human Kinetics.

PERCEIVED POSITIVE GENERAL AND PERCEIVED INFORMATIONAL TEACHER FEEDBACK IN PHYSICAL EDUCATION: STABILITY EFFECTS AND RELATIONS WITH INTRINSIC MOTIVATION OVER A TWO-YEAR PERIOD

Koka, A., Hein, V., Pihu, M.

University of Tartu, Estonia

Introduction

Research in the field of physical education (PE) have shown that the perceived positive general teacher feedback tends to be a stronger predictor of students' intrinsic motivation than perceived informational feedback (Koka & Hein, 2003, 2005). No study, however, has determined how students' perceptions of feedback might change or exhibit stability over time. The aim of this study was to examine the stability of the perceived positive general feedback and informational feedback, and the influence of these constructs on students' intrinsic motivation in PE over a two-year period. It was expected that perceived positive general feedback would have a stronger effect on students' intrinsic motivation over time than perceived informational feedback.

Methods

In the first part of the study (Time 1) 302 students, aged 11 to 15 years, responded to the items assessing perceived positive general feedback and informational feedback from the PTF questionnaire (Koka & Hein, 2003). Two years later (Time 2), the same students filled out the questionnaire again, along with the measure of intrinsic motivation from the modified version of the SMS (Hein at al. 2004). Data were analyzed using structural equation modeling.

Results

The hypothesized model was specified in which the stability of the perceived positive general feedback and informational feedback over a two-year period were estimated. The model specified a direct effect of the perceived positive general feedback and informational feedback at Time 2 on intrinsic motivation measured concurrently, and a longitudinal direct effect of previous perceived positive general feedback and informational feedback at Time 1 on intrinsic motivation at Time 2. The hypothesized model exhibited adequate fit with the data (CFI=.94; NNFI=.91; RMSEA=.040). Both types of perceived feedback exhibited moderate stability over time. Perceived positive general feedback at Time 2 showed a significant effect on students' intrinsic motivation measured concurrently. Fixing to zero the effect of perceived positive general feedback at Time 2 on intrinsic motivation measured concurrently, an effect of previous perceived positive general feedback (Time 1) on intrinsic motivation over time emerged.

Discussion/Conclusions

Results supported the hypothesis that perceived positive general feedback have a stronger effect on students' intrinsic motivation than perceived informational feedback over time. Nonsignificant effect of the perceived informational feedback on intrinsic motivation may be due to the fact that the enhancing effect of perceived informational feedback on intrinsic motivation may be through the perceived competence that was not measured. PE teachers should bear in mind that previous experience of perceived feedback may have an effect on later intrinsic motivation.

References

Hein V, Müür M, Koka A (2004). EPER 10: 5-19
Koka A, Hein V (2003). Psychol Sport Exerc 4: 333-346
Koka A, Hein V (2005). Int J Sport Psychol 36: 91-106.

PARENT-INITIATED MOTIVATIONAL CLIMATE QUESTIONNAIRE (PIMCQ) TRANSLATED AND APPLIED TO BRAZILIAN YOUNG ATHLETES

Goulart, C., Valdés, H.

Brasilia University; Brazillian Sport Ministry, Brazil

The purpose of this work is the translated and the validation of PIMCQ (parent-initiated climate questionnaire) adaptation for the Portuguese Language. This questionnaire refers to the motivational climate of young athletes offering an important skill to the sport psychologists that are interest about motivational aspects related to the sports. The PIMCQ instrument was created by White, Duda and Hart (1992) based on classroom activities (AMES & ARCHER, 1988) and on the sporting environment (SEIFRITZ, et al. 1992). The authors have searched about the significant influence that parents and colleagues have in the most motivational climate of the students and athletes, especially the younger than 17, once their parents still have a strong influence. In terms of the development of the initial version of the PIMCQ, 14 items were adapted from three scales of the Learning and Performance-Oriented Physical Education Climate Questionnaire (LAPOPECQ) (i.e., Teacher's Promotion of Learning, Students' Worries about Mistakes, Outcome Orientation without Effort; Papaioannou, 1994) and written with reference to fathers, and the same 14 were written with reference to mothers. One factor (Learning-Oriented Climate) reflected a task-involving situational goal structure, with 5 items and two factors (Worry Conductive Climate and Success without Effort) reflected an ego-involving structure, with 9 items. The translation, application and validation of PIMCQ by White, Duda and Hart (1992) were not found in Brazil. In addition, not any analysis of the validation of this instrument was found, only its means and standard deviations. This research was applied in Rio de Janeiro city and District Federal to 226 athletes who play it at federations and confederations championships of volleyball, handball, basketball, table tennis, soccer, running and swimming. The data's analysis was made using the SPSS 10.0 program for windows. The instrument was analyzed as two questionnaires: one referring to father's motivational climate and another referring to the mother's motivational climate. Exploratory factor analysis showed (principal components followed by orthogonal rotation which method used was varimax) that the matrix predominate the requisites minimum of factorability. The mother's instrument showed: KMO 0,739, consider moderate; Bartlett's test of sphericity 691,353, significance 0,00, qualification significant; This analyses revealed two factors (explaining 31,9% of the variance) that was satisfactory. The father's instrument showed: KMO 0,767, consider moderate; Bartlett's test of sphericity 1007,447, significance 0,00, qualification significant; This analyses revealed two factors (explaining 31,9% of the variance) that was satisfactory. The internal consistency of the scales, using Cronbach's alpha, ranged from .85 (factor 1) to .76 (factor 2).

CONTENT VALIDITY AND INTERNAL CONSISTENCY OF SELF-EFFICACY TOWARDS GENERIC SKILLS TEST FOR PHYSICAL EDUCATION PROGRAMME

Chan, W.K., Hui, S.C., Sum, K.S.

The Chinese University of Hong Kong, Hong Kong

Introduction

This study investigated the content validity and internal consistency, reliability of a questionnaire for secondary school students' self-efficacy towards generic skills regarding their performance in the physical education programme. The Hong Kong Education and Manpower Bureau (HKEMB) has included nine generic skills which should be developed throughout the school curriculum. They are collaboration and communication skills, creativity, critical thinking, information technology skills, numeracy, problem-solving, self-management and study skills.

Research Methods

The research team tried to create as many question items as possible for each generic skills component for junior grade students (Secondary 1-3). A total 80 items for the raw questionnaire were designed. The questionnaire was revised and distributed to 3,205 students in this age range from 28 secondary schools in Hong Kong using statistical random sampling procedures.

Results

1) This research invited five experts, experienced physical education teachers who evaluated 80 designed questions, in order to conduct a content validity analysis. The questions which achieved over 80% agreement by the five experts were adopted. The final version of the questionnaire included a total of 64 questions corresponding to the nine generic skills components.

2) There were 2,840 students who completed the questionnaire. The return rate was 88.6%.

3) The internal consistency for reliability test as revealed from Cronbach's Alpha indicated that the nine generic skill components received fair to good reliability (r=0.55 – 0.80) with the exception of the components related to 'Creativity' (r=0.278). However, the analysis of inter items correlation revealed that there was one item in the component of 'Creativity' and two items of 'Critical thinking' which yielded negative correlations. Hence, when these items were dropped, the reliability of internal consistency for 'Creativity' (r=0.778) and 'Critical thinking' (r=0.656) were improved respectively.

Conclusions

It is concluded that the questionnaire for secondary school students' self-efficacy towards generic skills regarding their performance in the physical education programme demonstrated acceptable consistency validity and reliability resulting in a final version of 61 items.

This study was funded by the Education and Manpower Bureau, Hong Kong SAR.

A FIRST STEP IN EXPLORING REASONS OF DROPOUT FROM MAINSTREAM FITNESS CLUB MEMBERSHIP: ASSESSING NEW CLIENTS' CHARACTERISTICS

Piffaretti, M., Lenzen, B., Kayser, B.

University of Geneva, Switzerland

In view of the epidemics of the sedentary lifestyle and its related burden of chronic disease, factors influencing adherence to an active lifestyle are of great interest. Fitness club membership has become increasingly popular and may help individuals integrating physical activity into their lives. However, attrition rates are high while the factors predicting pursuit or dropout from using fitness clubs have not been much investigated. In the absence of sound data it is difficult to take efficient and scientifically coherent measures to prevent attrition. Ideally, a full investigation of predictors of perseverance and dropout concerning fitness clubs should encompass: a) a description of the characteristics of new fitness club clients at the time of their initial subscription ; b) a descriptive analysis of dropout rates at different times (e.g. 3 and 6 months) after initial subscription; and c) an exploration of potential relations between clients' characteristics and their decision to continue or drop out of the program.

This exploratory study focused on step (a) of this prospective approach. We made an inventory of the psychological, demographical, environmental and physical factors that characterise a group of adults at the moment of entering a program in a fitness-club. Five mainstream clubs belonging to the same fitness-concept located in the two main linguistic regions of Switzerland agreed to participate, allowing us to contact 156 individuals (mean age=36.6 +/- 13.9; 67 male and 89 female), to participate on a voluntary basis and fill in a self-report questionnaire at the moment of their subscription to a fitness program within the club.

Prior to their subscription, 42% of the new clients had already practiced other physical or sport activities for more than 6 months, 23% had practiced irregularly, and 24% had either recently ceased or totally abandoned any form of physical exercise before applying for membership to the fitness club. 48% declared they like physical exercise, whereas the others are either mildly interested (44%) or totally dislike exercising (8%). The most frequently cited fitness goals are improving or maintaining health, improving physical appearance and finding better ways to cope with a stressful life. Attrition rate and factors predicting dropout in this cohort will be assessed in a planned follow-up study.

In conclusion, a large fraction of new clients applying for membership to mainstream fitness-clubs are non- or ex-exercisers who do not particularly like or even dislike physical exercise. Better knowledge of factors that can increase fidelity of members and/or continuation of physical exercise outside membership is necessary in order to increase the chances that these individuals continue exercising, within or without a fitness club.

PERCEPTUAL DIFFERENCES IN TENNIS PLAYERS AND TRIATHLETES: A BATTERY OF TESTS THAT MAKES THE DIFFERENCE

Overney, L.S., Blanke, O., Herzog, M.H.

Brain-Mind Institute EPFL, Switzerland

The link between sport performance and various perceptual and cognitive abilities has been investigated by several authors in different sports such as basketball (Starkes et al., 1994), volleyball (Borgeaud & Abernethy, 1987) or tennis (Goulet et al., 1989). Until now, different types of abilities have been tested in order to identify differences between athletes and non-athletes but only few studies have tried to identify, at a larger scale, the complex network of perceptual and cognitive abilities underlying sport performance, especially in tennis. For instance, rapid target detection, tracking in three-dimensional space and visuo-motor coordination are part of the abilities of a tennis player. Thus, tennis skill requires high-speed visual processing and fine spatio-temporal resolution to reach optimal performance. Whereas many studies have investigated the involvement of higher information processing in sports, much less is known about the basic visual information processes with limited timing.

Here we present a battery of tests that allows to further narrow down which information is used during visual information processing and how this information is extracted. The battery includes low level discrimination tasks in different fields such as motion (coherent motion, speed discrimination), attention (attentional blink, visual detection tasks) or time-related tasks (B-type backward masking, flash-lag), as well as a higher level anticipation task (representational momentum). Tennis players were compared to age-matched triathletes and non-athletes. Triathletes were chosen as a control group because they share the same level of fitness but do not need such fine spatio-temporal resolution as tennis players. Preliminary results show that tennis players seem to perform better on motion- and time-related tasks than triathletes and non-athletes, whereas the other tasks do not seem to significantly discriminate the three groups of subjects. Future steps of this study will investigate how these abilities can be improved.

References:

Borgeaud, P., Abernethy, B. (1987). Skilled performance in volleyball defense. Journal of Sport Psychology, 9, 400-406.

Goulet, C., Bard, C., Fleury, M. (1989). Expertise differences in preparing to return a tennis serve: A visual information processing approach. Journal of Sport & Exercise Psychology, 11, 382-398.

Starkes, J. L., Allard, F., Lindley, S., O'Reilly, K. (1994). Abilities and skill in basketball. International Journal of Sport Psychology, 25, 249-265.

A GERMAN VALIDATION OF THE ACHIEVEMENT GOAL QUESTIONNAIRE FOR SPORTS (AGQ-S)

Birkner, H.-A.

ASPIRE - Academy for sports excellence, Qatar

Recently the achievement goal orientation concept has been extended by a 2x2 factor structure (Elliot 1999, Elliot & Church, 1997, Elliot & Covington, 2001; Elliot. & McGregor, 1997, Elliot & Trash, 2001). The same workgroup also provided a sport specific questionnaire has been provided by the same work group (Conroy, Elliot & Hofer, 2003) in English, according to the same theoretical structure. To be able to use the AGQ-S in the German setup a German translation has been validated on a sample of 116 adult (M = 30.7 years) participants of introduction courses indoor climbing.

Internal consistencies of the German AGQ-S varied from  = .64 (mastery approach scale), 

= .81 (mastery avoidance scale),  = . 86 (performance avoidance scale) to  = .87 (performance approach scale). By means of confirmatory factor analysis using the unweighted least squares method (ULS) the overall model fit of the data with the theoretical model was found to be very good (GFI = .988, AGFI = .981, NFI = .981, RFI = .971, RMR = .05) thus proving a high construct validity of the German AGQ-S. Criteria validity of the German AGQ-S was proven by significant correlations with external criteria like level of identification with the sports of indoor climbing, level of effort during indoor climbing courses and climbing performance.

A validation of an Arabic version of the AGQ-S is currently under construction and some results of this validation process will be presented as well.

-Conroy, D.E., Elliot, A.J. & Hofer, S.M. (2003). A 2x2 achievement goals questionnaire for sport: Evidence for factorial invariance, temporal stability, and external validity. Journal of Sport & Exercise Psychology, 25, 456-476.

-Elliot, A. (1999). Approach and avoidance motivation and achievement goals. Educational Psychologist, 34, 169-189.

-Elliot, J. E. & Church, M. A. (1997). A Hierarchical Model of Approach and Avoidance Achievement Motivation. Journal of Personality and Social Psychology, 72 (1), 218-232.

-Elliot, J. E. & Covington, M. V. (2001). Approach and avoidance motivation. Educational Psychology Review, 13 (2), 73-92.

-Elliot, J. E. & McGregor, H. A. (1997). A 2 x 2 Achievement Goal Framework. Journal of Personality and Social Psychology, 80 (3), 501-519.

-Elliot, J. E. & Trash, T. M. (2001). Achievement goals and the hierarchical model of achievement motivation. Educational Psychology Review, 13 (2), 139-156.

THE IMPORTANCE OF THE MOTIVATIONAL CLIMATE FOR THE PERSEVERANCE IN RECREATIONAL INDOOR CLIMBING

Birkner, H.-A.

ASPIRE - Academy for sports excellence, Qatar

During the last decade there has been a vast amount of research on the importance of a match between the motivational orientation of people and the motivational climate of a sports environment (matching hypothesis) for the development of a perseverance in sports (e. g. Biddle, Wang, Kavussanu & Spray, 2003). Surprisingly research has focused on the school- and elite sports and almost completely neglected out the recreational sports domain (see Ntoumanis & Biddle, 1999). Hence the question arose if the concept of the motivational matching hypothesis could have any predictive value in the area of recreational sports. A five weeks field study (N = 116) in the area of recreational indoor climbing has been carried out. Introductory courses in indoor climbing for adults (M = 30.7 years), differing in achievement motivational course climate (performance vs. mastery climate) were conducted. The course climate was manipulated in a standardized way, referring to basic motivational climate criteria (Nicholls, 1984; Elliot & McGregor, 2001) as well as to Epstein's TARGET concept (Epstein, 1989). The feedback of the instructor, the spectator situation, the competition situation and the image of indoor climbing were manipulated. Achievement orientation was measured with a German translated version of the achievement goals questionnaire for sport (AGQ-S, Conroy, Elliot & Hofer, 2003). Three weeks after the intro course, participants were asked about any further participation in climbing since the course and any identification with climbing. Both participants and the instructors of the intro courses were blind against the purpose of the study. The results with regard to the participation in climbing after the course indicated a matching effect between task orientation and mastery climate (p = .03, h = .64) but not between ego orientation and performance climate (p = .45). With regard to identifying with indoor climbing, a non significant (p = .08), but meaningful (η2 = .052) interaction effect between task orientation and mastery climate was found. The results indicate that further field research on the effect of creating motivational mastery climates in recreational indoor climbing courses are recommended.

-Biddle, S., Wang, C.K., Kavussana, M. & Spray, Ch. M. (2003). Correlates of Achievement Goal Orientations in Physical Activity: A Systematic Review of Research, European Journal of Sport Science, 3 (5), 1-11.

-Conroy, D.E., Elliot, A.J. & Hofer, S.M. (2003). A 2x2 achievement goals questionnaire for sport: Evidence for factorial invariance, temporal stability, and external validity. Journal of Sport & Exercise Psychology, 25, 456-476.

-Epstein, S. (1989). Family structures and student motivation: A developmental perspective. In C. Ames and R. Ames (Eds.), Research on motivation in education: Vol.3. New York: Academic Press.

-Ntoumanis, N. & Biddle, S.J.H. (1999). Affect and achievement goals in physical activity: a meta-analysis. Scandinavian Journal of Medicine & Science in Sports, 9, 315-332.

COACHES' INTERACTION DURING TIME-OUTS IN NORWEGIAN NATIONAL HANDBALL

Johansen, B.T., Hoigaard, R., Grimestad, B.B., Berglihn, S., Eidem, A., Pedersen, L.K.

Agder University College, Norway

During handball the coach has the disposal of different possibilities to create turnovers, changes tactics, give information, and motivate the athletes. Time-out and the way coaches use this period may be significant for the athletes and the team performance. Based on a sort of best practice approach and in order to gain better understanding in coaching, detailed investigation of what good coaches actually do may be one useful research avenue. The purpose of this study was to make a time-out interaction profile from Norwegian head coaches in handball.

Method Design and participants Four Norwegian female handball matches in World championship (Russia, 2005) and four male handball matches in the European championship (Switzerland, 2006) were video recorded. 23 timeouts (13 female and 10 male) were selected based on the possibility to hear what the coaches said during the time-out. The time-out interaction was analysed by four national top coaches.

Time-out interaction Hasties (1999) instrument for recording coaches' interactions with their players during time-outs were used in order to assess the interactions. The instrument consists of four major categories for the communicative statements. These statements are: technical, those relating to skill performance; tactical, those relating to strategic game matters; psychological, those relating to the emotional/cognitive aspects of play; and other statements, which are those unrelated to the game, or which are not likely to provide any benefit to the players.

Results The results indicated in average 2.4 different interactions content in each time-out. The coach for the female national team use 48% of the available time on tactical statements, 33% on psychological, 8% on technical, and 11% on other statements. For the male national team the distribution was 43% of available time on tactical statements, 21% on psychological, 26% on technical, and 10% on other statements.

Discussion In general the results indicated a focus on the technical or tactical components which may not be surprisingly based on the fact that these factors may directly influence the play. Interesting is also that even on this competitive level and situation psychological statement related to motivation, self confident is highly presented. A closer inspection of the psychological components revealed that the coach for the female team was without critical comments and extremely focused on the supportive. The male coach focused more extensively on correction of errors. Further research should focus how different situational conditions like tight matches, to be ahead or behind in the goal score in general or in the last minute of a competition will influence the interactions during time-outs.

References Hastie, P.A. (1999). An instrument for recording coaches' comments and instructions during time-outs. Journal of Sport Behavior, 22, 4.

Poster presentation (PP)

PP2-07 Physical Education and Pedagogics 1-2 - "Exhibition Hall"

PRESCHOOL PE TEACHING - STUDENTS SELF ANALYSIS - QUALITATIVE APPROACH

Serbetar, I., Sagud, M., Lozancic, A., Evic, K.

Teachers college Petrinja, Croatia

INTRODUCTION

Insight in one owns perception of teaching performance is very important. Qualitative research was performed on the data obtained through videotaping of students teaching and later on notes of participants' recall during the viewing of self performance.

METHODS

Similar to the research of (Palomaki, 2004), 16 kindergarten PE classes were videotaped during one semester practicum - Students Teaching. The data for the study were collected using recall method. Each of 16 subjects' viewed his own teaching performance 1 to 3 days after the performance were done and commented and analyzed his class during watching. All the classes were performed with preschoolers' in age of 4 and 5-yrs and consequently lesson lasted 25 and 30 minutes, respectively. Verbal responses on their own teaching behavior were noted during reflective self-evaluative analysis and then classified.

RESULTS

The main aim's of the study were to gain knowledge of the students reflectional thoughts on his own teaching and to give students the tools for conceptualizing some critical issues in PE teaching. Quality analysis according to Baumgartner and Strong (1998) was done on total of 175 statements and comments. The mass of the data were reconfigured and condensed in 14 new categories based on Pangrazzi (1995) model. Statement's are divided as follows: proper use of equipments and facilities (18), supervision and safety of the children during practice (14), children involvement in class and equipment preparation (9), communication and speaking skills (5), misbehavior and reinforcing the desirable behavior (4), management and discipline (19), instructional process and class management (13), instructional feedback and error correction (10), quality of instructions - establishing the rules - instructional and management errors (12), quality of instructions - meaningful input and check for understanding (9), instructional time - management time, practice time and dead time (11), demonstrating - modeling the task (12), learning through games of pretending and simulation (15). Last 24 comments from original three group's can be summarized in one purely pedagogical category of reflective practitioner (Sagud, 2001).

REFERENCES

1. Baumgartner, T.A., Strong, C.H. (1998). Conducting and Reading Research in Health and Human Performance. McGraw-Hill, New York.

2. Pangrazzi, R.P. (1995). Dynamic Physical Education for Elementary School Children. Allyn & Bacon, Boston.

3. Pallomaki, S., Heikinaro-Johansson P. (2004). Analysing physical education teaching-learning processes: How preservice teachers see their own teaching performance. Preolympic Congress, Thessalloniki.

4. Sagud, M. (2001.). Preschool teacher – reflexive practitioner and pedagogical documentation (in Croatian), Teachers College Cakovec, p. 19 -24.

PONDERAL AND MOTOR DIFFERENCES BETWEEN CHILDREN WHO PRACTICE SOME SPORTIVE DISCIPLINE AND SEDENTARY CHILDREN

Mondoni, M., Casolo, F., Cereda, F., Faina, M., Galvani, C.

Catholic University of Milan, Italy

Sedentariness in infantile age favors the beginning of a pre-disease state on osteo-skeletal apparatus which predisposes to pathologies involving rachis and lower limbs. It has been demonstrated that 1 or 2 physical activity hours at school are not able to sufficiently improve motor abilities and to prevent different pathologies. The aim of our research is to verify if 2 hours of physical education at school are effectively not enough for children wellbeing and accordingly if it is necessary to practice in addition a sportive discipline.

120 boys and girls (10–11y) were divided in two different groups, active and sedentary (ACvsSE). The active children practiced 1 or 2 hours of physical education at school plus 90 minutes training sessions twice or 3 times per week. Sedentary children participated only to physical education lessons. All children were not controlled in their lifestyle. Children underwent 3 times during the year anthropometric evaluation (weight and height), motor field tests for detecting organic-functional qualities (upper and lower limbs' strength, endurance and rapidity) and flexibility tests.

Weight significantly increased during the year for both groups, especially for SE ($p<0,05$). Upper limbs' strength did not change over time, even if AC seem to be stronger than SE ($p<0,05$). Lower limbs' strength significantly improved for both groups, even if AC enhanced more than SE ($p<0,0001$). The Sit&Reach test significantly progressed over time for both groups ($p<0,0001$). Concerning cingulum scapulo-humeral flexibility, AC and SE performances significantly decreased, especially for AC group ($p<0,05$); AC resulted to be less flexible at any time ($p<0,01$). Speed ability is improved for both groups ($p<0,01$), even if it is more developed in AC people at any time ($p<0,001$). Resistance ability significantly increased for both groups, even if the improvement is higher for AC group ($p<0,0001$).

Looking at these preliminary results, it seems that physical education programs in Elementary schools alone are not able to enhance motor abilities. In fact upper and lower limbs' strength, speed and resistance qualities are at any time higher or increase more in AC group than in SE group. For this reason we can think that the SE group improvements are due more to the effect of growth than to the effect of physical activity. The only addition of free-living activities is not sufficient to offer a conditioning of organic-functional qualities. Additional hours of sportive activity are necessary to develop strength, aerobic and anaerobic capacities. It is on the contrary necessary to train flexibility in a specific way if the negative effect of growth must be counterbalanced; the sport specific training programs at this age seem not have this aim.

A.A.V.V. L'attività motoria nella scuola elementare, Comitato Prov.le CONI Ravenna, Ravenna 2002

Salmon J et al (2005) Health Promot Int. Mar;20(1):7-17. Epub 2005 Jan 24.

THE EFFICIENCY OF EDUCATIONAL STANDARDS TESTS IN SPORT RECREATION

Konczos, C., Ihász, F.

University of Western Hungarian Faculty Apáczai Teacher Education , Hungary

More of two-thirds of the Student Council, working in the Hungarian higher education, don't support the obligatory aptitude tests of the students. With the popularization of the physical tests introduced in the USA, they discovered that the number of heart attacks had lowered. (Keresztesi K., Kovács E., Andrásné Teleki J., Gombocz J., Kovács I. 2004). The goal of the examination was to determine the endurance ability with a humane walking test. After the survey the results will be used to make an individual training program for the students. The Rockport Fitness Walking Test was done by female students from the first class. We have monitored the symptoms of the exhaustion, the time results, and the relative maximum pulse. We also estimated the VO2 max from the data. We substituted the results for the valid Rockport Fitness Walking Test table and we found the endurance ability of our students. The students showed a big interest and they undertook the survey with pleasure. They found this test better than the earlier known running survey.

More than half of the student reached "very good" or "excellent" performance, but quarter of them only reached the "acceptable" performance. Each student displayed a positive attitude, accepted the most optimal development possibility, and will take part in the further surveys.

Key-words: educational standards test, sport recreation, endurance ability walking test, female students, efficiency

References

Bíróné N.E. (2004): Sportpedagógia Dialóg Campus Kiadó Budapest-Pécs

Keresztesi K., Kovács E., Andrásné Teleki J., Gombocz J., Kovács I. (2004): Vizsgálatok a közoktatás és a felsőoktatás testnevelésének tartalmi megújításához Kalokagathia 2004/1-2 sz. Testnevelési Egyetem Budapest

Szabó J. (2004): Rekreáció az elmélet és a gyakorlat alapjai JGYF Kiadó.

SOCCER COACH INSTRUCTION IN COMPETITION - BEFORE, DURING AND HALF TIME OF THE GAME

Crispim-Santos, A., Rodrigues, J.

Sport Sciences School of Rio Maior, Portugal

Introduction

We think it is essential that the coaches instruction during a competition reveals a high congruency, because with that he can help the players to achieve a higher performance. Therefore the aim of the present study is based on the comparative analysis of the soccer coach instruction, between different moments in the competition.

Methods

Twelve situations of competition were analyzed. Each competition contained 3 different moments: before game, during game and half time. Six soccer coaches were observed (two sessions each) in male senior teams on 2nd B Portuguese League. We used the System Analysis of the Information in the Competition (SAIC) as an instrument to collect data and evaluate the Instructions. To be able to prove the existing differences between the 3 different moments in the competition, the statistical test of wilcoxon was used, with the error probability (p- value) ≤ 0.05.

Results

Before the game Vs. During the game – regarding the objective of the instruction, we verify significant differences on the prescriptive category, although in both moments this instruction comprehended 80%; concerning the direction of the information, the instruction before the game was mainly focused on the team and during the game focused on the player; regarding the contents of the information, we found significant differences, because before the game, it exist a supremacy of psychological than tactical contents, although in both moments more than 75% of the instruction belonged to this two categories.

Before the game Vs. Half time - regarding the objective, more than 80% of the instruction doesn't reveal any differences, and it's mostly prescriptive; concerning the direction of the instruction, more than 60% of the instruction doesn't reveal any significant difference; regarding the contents of the information, we verified similar results of the last comparison.

During the game Vs. Half time – concerning the objective, in both moments more than 75% of the instruction is prescriptive; regarding the direction of the instruction, clearly exists a significant difference, so during the game the instruction is mainly focused on the player, while at the half time the coach focuses on the whole team or on various groups; concerning the contents of the instruction, the majority of the information doesn't show significant differences.

Conclusion

In all different moments of the competition, the information that is instructed by the coach has a strong remark on prescriptive and descriptive information regarding its objective and the contents are mainly tactical and psychological. Although we found some remarkably specification, such us, a more descriptive information during the half time of the game, a more individual approach during the game and a more psychological contents before the game, when compared with other moments, we can assume that the soccer coaches demonstrate a high congruence profile of instruction in competition.

YOUNG SOCCER COACH INSTRUCTION BEFORE COMPETITION

Crispim-Santos, A., Pereira, D., Gouveia, J., Costa, J.P.

Sport Sciences School of Rio Maior, Portugal

Introduction

Each coach has a specific way to prepare his team, psychologically and tactically for the competition. There are a few studies that characterize the coach's instruction in briefing of game preparation, and only a small amount of them in young teams. We pretend with this study, to analyse a briefing of game preparation (BGP) in a young soccer coaches, and compare graduate and non graduate coaches to verify if it exists differences between them.

Methods

Eighteen situations of BGP were analyzed. Eighteen young soccer coaches (9 graduate and 9 non graduate) were observed in tree young stages (under 19, Under 17 and Under 15 years old), on Portuguese League. The instrument used to collect data was adapted of the System Analysis of the Information in the Competition (SAIC - Pina & Rodrigues, 1993). To be able to prove the existing differences be-

tween graduate and non graduate coaches, the statistical test of Mann-Withney U was used, with the error probability (p- value) ≤ 0.05.

Discussion / Conclusion

In BGP, this young soccer coaches have an instruction with this characteristics:

• Objective of instruction - The information are prescriptive (≥ 80%) and without negative sentences;

• Direction of instruction - Direct to all team although we found some differences between coaches;

• Contents of instruction - Tactical and psychological, with a few technical and physical information and none information about the referees.

We found some important significantly differences between graduate and non graduate coaches. As a result, graduate coaches gave significantly more prescriptive information, and never said any negative sentence. They prefer speak to all team or individual player, however, non graduate coaches prefer speak to groups (defenders - with significantly differences and midfielders).

Concerning the contents of information, graduate coaches gave always more tactical instruction than non graduate. Game methods, missions/functions of players and set pieces (with significantly differences) are the specific tactical instruction of graduate coaches, while non graduate spoke more about game systems. In opposite, the non graduate coaches speak always more psychological information, with special emphasize about self-confidence.

The non graduate coaches have more instruction without contents than graduate coaches, but without significantly differences.

Our results seem that the instruction of graduate coaches is more complexity and specific, because the objective of information is more prescriptive and the contents are more fundamental tactical aspects than non graduate coaches instruction. Based in another studies, this characteristics show a BGP with better quality and pertinence of graduate coaches.

References

Pina, R. & Rodrigues, J. (1993). Episódios de informação do treinador e a reacção dos atletas numa situação de competição. "Proceeding 8º World Congress of Sport Psychology." ISSP. SPPD. (pp. 271-274). Lisboa: FMH-UTL.

A STADY OF THE CAUSES AND SOLUTIONS OF THE CONFLICTS IN THE INTERACTIONS BETWEEN THE FOOTBALL COACHES OF JUNIOR PLAYERS AND THEIR PARENTS

Németh, Z.

University of Pécs, Hungary

We can encounter with several forms of interpersonal relations around football fields, which potentially include the occurrences of conflict situations. In the course of my career as a coach, I have experienced that my appropriate relationship with the players and their parents has fostered the efficiency of my teams. In this study, I analyze the causes of conflicts between coaches and parents, and make concrete recommendations for their solution.

The aim of the study

I would like to call the experts' attention to the possibilities and significance facilitating the solution of conflict situations. In this way, I would like to emphasize that, beside expertise, pedagogical and psychological knowledge should also be applied. The first step to be taken can be the early recognition and treatment of conflicts.

Questions

Which might be the most frequent causes of evoking conflicts between coaches and parents?

Is it possible to establish a hierarchy of causes evoking conflicts between coaches and parents?

Is it possible to draw any conclusions from the sites of the occurring conflicts?

What opportunities are the parents provided with for expressing their opinions?

Hypothesis

One of the most frequent first causes evoking conflicts between coaches and parents is considered to be when the child is assigned to play as a beginner or as a bench player.

The second cause occurs when the child is assigned to play on an inappropriate post.

Materials and methods of the study

Handing out questionnaires 12-18.05.2005

Sampling

The junior players' (U 13, U 15) parents: n=129 subjects.

The junior players' coaches: n=16 subjects.

Methods

Observation

Questionnaires handed out to parents (anonym, 10 closed and open questions)

Deep interview with coaches

Data processing

By means of mathematical and statistical methods

Results and their analysis

My first hypothesis was justified. 71% of the parents got into conflict because their child was assigned to play as a bench player; and 24% of the parents got into conflict because their child was assigned to play on an inappropriate post.

Considering these facts, it can be concluded that the majority of the parents accept the expertise of the coaches, but they would like their children to spend more time on the field, providing them with more opportunity of development.

This study supported my assumption that the same coaches preferred to assign the goalkeepers on the principle playing for equal time; in case of field players, they forgot about this principle. This was one of the most frequent causes evoking conflicts. The coaches can solve this problem by assigning children for equal time, a practice justified in case of goalkeepers; naturally, within the framework of rules. Otherwise the parents in question will take their children from the club. In several cases, it also turned out that the coaches could not always employ the best methods for solving the conflicts.

THE DIFFERENCE OF PSYCHOPHYSIOLOGICAL AND VEGETATIVE FUNCTIONS OF SPORTSMEN DEPENDING ON THE DOMINANCE OF BRAIN HEMISPHERES

Praulite, G., Spunde, A.

Riga Teacher Training and Educational Management Academy, Latvia

Wide observation about functional asymmetry of brain hemispheres in mental processes, emotional perception as well as information processing of tactical, spatial and time analysis neural mechanisms is found in works of various authors (Zigmond et al, 1999). The extent of functional asymmetry of brain hemispheres may be different for different people. Most of all the specialisation of brain hemispheres are characteristic for people with right hand dominance. In general more typical for left handers is dominance of right hemisphere. Statistic data show that in various branches of sports (for example box, tennis, fencing) left handers have some advantages in comparison with people with right hand dominance (right handers). Investigations carried out with sportsmen, showed that in definite branches of sports, for example box or wrestling, in some elements better are right handers but in some elements left handers. During motor and postural skill acquisitions (long term judo training) lateral preference are modified probably due to neuroplasticity (Mikheev et al, 2002).

The analysis of psychophysiological and vegetative functions of sportsmen was carried out. The estimation of sportsmen physical condition level was made. Accomplished work, capacity, maximal oxygen uptake as well as will properties, typical reactions in conflict situations, distribution of attention, precision of work and the speed of information processing was carried out.

Estimation of functional asymmetry of brain hemispheres was carried out using Coren test. All tested sportsmen were divided into three groups: people with exact left hemisphere dominance, people with exact right hemisphere dominance and people without exact asymmetry of brain hemispheres. All tested sportsmen were with excellent physical condition level. Determination of physical condition level was made by Harward steptest index (HSTI). The results of investigation showed that relative maximal oxygen uptake was statistically significant higher for person with right hemisphere dominance (left handers) than for person with left hemisphere dominance. The analysis of typical reactions of sportsmen in conflict situations by Tomass test showed that competition reaction is more expressed for person with left brain hemisphere dominance.

Literature: 1. Mikheev M., Mohr C., Afanasiev S., Landis T., Thut G. (2002). Motor control and cerebral hemispheric specialization in highly qualified judo wrestlers. In: Neuropsychologia, Vol. 40 Issue 8, p. 1209 – 1211. 2. Zigmond M. J., Bloom F. E., Landis S. C., Roberts J. L., Squire L. R. (1990). Fundamental Neuroscience. San Diego: Academic Press, 1575 p.

SURVEYING SCHOOL-CHAMPION PLAN FROM THE PERSPECTIVE OF EXPERTS, SCHOOLS MANAGERS, AND PHYSICAL EDUCATORS OF IRAN

Khajavi, D., Kashef, M.

Iranian Association of Physical Education & Sport Sciences, Iran

Before the development and performance of School-Champion Plan, school competitions of Iran were held electively. In these champions, selected student-athletes were qualified from districts, zones, states, and finally country respectively. On the basis of School-Champion Plan, qualified schools (not selscted ones) should participate in higher levels of school champion competitions.

The objective of this research was surveying and analyzing the way in which School–Champion Plan competitions were held from the perspective of experts, schools managers, and physical educators of both successful and unsuccessful provinces. This research is a descriptive one and was field–based. The required data were collected by a questionnaire, validated by 4 physical education experts. Its reliability was calculated (0.9). The statistical population included all school managers, physical education and sport science teachers and experts of physical education at Education Organizations. Cluster sampling was performed randomly. On the basis of Morgan Table, the number of statistical sample of male and female teachers of physical education, of both successful and unsuccessful provinces, was 381; the number of statistical sample of male and female school managers of these provinces was 381; the number of statistical sample of male and female teachers of physical education of unsuccessful provinces, was 375; and the number of statistical sample of male and female school managers of these provinces was 375. in order to analyze the data the researcher has used descriptive and inferential statistics(Kruskal Wallis Test, Mann-Withney-U Test, X2).

The results of the research showed that from successful and unsuccessful statistical population's perspective, School-Champion Plan had a significant effects in the following areas of development: 1) developing schools sports and increasing the number of engaged students (α = 0/000). 2) providing the grounds for development and progress of student's sports abilities (α = 0/000). 3) Using empty capacities of schools facilities for physical education and sports (α = 0/000). 4) creating more appropriate background for the development of physical education and sports at schools (α = 0/000). 5) Moreover, the results exhibited that, according to statistical populations of successful and unsuccessful provinces, School-Champion Plan is significantly superior than traditional method of holding schools matches (α = 0/000).

References:

1- Ramazaninezhad, R.(2002). Physical Education in Schools (pp. 286-287). SAMT.

2- Bompa, T. O. (1999). From Childhood to Champion Athlete. Champaign, IL: Human Kinetics.

3- Kashef, M., Bonyan, A., Naghavialhosseini, S. J. (2002). A Survey of Schools Morning Exercises From Physical Education Teachers and Managers Point of View. EDPEH.

4- Sajadi, S. N. (1997). A Survey of The Method of Executing Physical Education Course in High Schools of Tehran, Msc. Thesis. Tehran University.

ETNOPEDAGOGICHESKIYE CONDITIONS OF USING OF GAMES AND CONTESTS OF THE TRADITIONAL PHYSICAL TRAINING OF THE RADICALSMALL PEOPLES OF THE NORTH

Krasilnikov, V.

Russian state is professional -pedagogiceskogi1 university, Yekaterinburg , Russia

Russian state is professional –pedagogical university, Yekaterinburg

Article is prepared on the basis of the materials, obtained as a result of expeditions (conducted from 1990 through 1993 j.) in the places of dense population center of one of the ancient peoples of Siberia - Hunts. As a result of field etnopedagogicheski studies we have revealed more than hundred people games, which we classified.

Our classification consists of four blocks: the 1st block - the game of children from 1,5 to 6 years, 2-1 - from 6 to 10, the 3rd - from 10 to 14; the 4th - game, contest, the original physical exercises of young people and adult.

The results of theoretical analysis and field etnopedagogicheski studies made it possible to isolate and to base the totality of the etnopedagogicheski conditions.

The first condition for the effective use of people games - this is realization in the pedagogical process of the intellectual potential of the carriers of traditional knowledge about the content, the rules of the games, transferred from one generation to another.

Second condition - system scope by the people games of the diverse spheres of the vital activity of hunts (trades, school, housework, way of life, holidays, etc.).

Third condition - use of traditional technology of organization of play activity (organization and management of game by elders, the gradual complication of rules, content of games and an increase in the load on the organism of children and adolescents; conducting games under the conditions, approximating nature and trade activity).

Fourth condition - application of an adequate traditional symbolism, attributs (toys, inventory for the games and the contests, the sport equipment), of the accompanying conducting games and observing the traditional rituals.

People pedagogy of Hunts manufactured means and in parallel with this it formed the system of the etnopedagogicheski conditions for the effective use of people games for purposes of training the growing up generation. That presented makes it possible to consider that the use of people games, contests with the specially created etnopedagogicheski conditions will make it possible to considerably enrich the spiritual life not only of Hunts, but also other peoples of the north, also, as a whole of Russia.

Literature

1. Krasil'nikov V.P. Theory and the history of the traditional games of the radical peoples of the North Urals and Siberia. Mezhvuz. the coll. of nauch. tr.: Social work in the Urals. - Yekaterinburg: Publishing house RGPPU, 2002.

2. Krasil'nikov V.P. Etnopedagogicheski conditions of the effective use of people games of the traditional physical training of Hunts: Author's Abst. of Cand. dis/the Urals State of ped. university. Yekaterinburg, 1994.

HOW BOYS AND GIRLS PERCEIVE GENDER RELATIONS IN PE CLASSES

Silva, P., Botelho-Gomes, P., Graça, A., Queirós, P.

University of Porto, Portugal

Introduction: PE programs at Portuguese schools are developed in the mixed gender classes, in which boys and girls experienced a variety of physical activities and sports.

However, the fact that PE classes take place on a mixed regimen that does not mean that relationships, whether positive or negative, were evaluated in the same way by boys and girls (Bain, 1985; Scraton, 1995; Bonal, 1997). So, how do boys and girls relate to one another within the context of PE classes? How do boys and girls perceive those relations?

Method: This study aims at examining students' perceptions about the gender relations in physical education.

We have applied structured interviews to 60 Portuguese secondary school students from both sexes (30 boys and 30 girls). In order to inspect the material we have applied content analysis technique.

Results: It is interesting to verify that a large majority of boys (72%) consider that relations between sexes are good, while 57.1% of girls report the existence of problems in the relationship between boys and girls during PE activities (only 28% of boys think the same).

Results convey that the opinion about the relationship between boys and girls is highly dependent of the sex (X2=4.567; p=0,031).

The thoughts and feelings underlying this evidence are patent in the following quotes of girls' voices:

"I think that they [boys] should not be sexist, they should give us more opportunities. But no chance, it's always the same thing." [Girl, Af1FN: 6, 64-76].

"... for instance if we [girls] lost the ball, if we do anything wrong they jump on us arguing the team is weaker because of the girls, and they see us as weaker and not so competent as them. That's what I think." [Girl, Lç2FN: 6, 63-69].

"I think that over and over again we are criticized for not doing things correctly or they see themselves as superior, and this also interfere. It's not motivating for us. Sometimes the way they talk to us «oh! You don't know how to do this, you don't know to do that» or «you have no aptitude for this. Sometimes we are demoralized by that»" [Girl, RTIS1FS: 6, 83-85].

"... I think sometimes, you know, boys are more, yeah; they can be more offensive than girls. Girls sometimes even dare to call «hey moron» but only as a joke. Now, boys are different, sometimes they bad-mouth us «you girls, you are good-for-nothing»." [Girl, RTIS4FN: 6, 64-74].

Conclusion

The context of PE lessons seem to reproduce and reinforce androcentric beliefs and ideologies of sport; some female students complain about their colleagues' behaviours and attitudes which bother them, offend them and lead them to a disinvestment in the activities.

References

Bain, L. (1985). The hidden curriculum re-examined. Quest, 37, 145-153.

Bonal, X. (1997). Las actitudes del profesorado ante la coeducación. Propuestas de intervención. Graó. Barcelona.

Scraton, S. (1995). Educación física de las niñas: Un enfoque feminista. Ediciones Morata, Madrid.

A STUDY OF THE POSSIBILITIES OF INTEGRATED PHYSICAL EDUCATION AT SCHOOLS IN HUNGARY

Prisztóka, G., Vass, M., Tóvári, F., Papp, G.

University of Pécs, Hungary

Keywords: integrated physical education at schools, "adapting school", coeducation

Integrated education more and more frequently becomes the topic of discussion and debate in Hungary being a member country of the European Union.

Does integrated education have a reality and possibility in the Hungarian public education?

No doubt, a serious change in stance is needed among teachers of physical education: the curricula-minded and achievement-minded stance should be transformed into a child-minded strategy. Physical education at schools is an area where the integration of children with different abilities and particular educational background can be established by providing them with common experience and by the utilization of the positive impact of sport activities on their health and mental development.

The aim of study

In our opinion, the first steps in bringing about changes in the teachers' stance in practice should be taken in the education and training of the would-be experts. In the first part of our study (2004), we assessed the knowledge levels of notions and information of the regular and correspondent students participating in the teacher training programs of physical education (n=157). Then we gathered information (2005) about the issue in question from the active PE teachers (n=80), parents (n=100) and students (n=100). These data were compared in order to be capable of deciding how far the current teaching practice, the PE teachers' and parents' stance should be considered.

The main results

• The participants in the investigation have a low level of knowledge of notions:The notion of segregation is not known by 72% of the university students, by 44% of the teachers of physical education, by 71 % of parents and 81% of schoolchildren. The situation is even worse in case of inclusion.

• 60% of the teachers of physical education cannot accept endeavors of integrating children of special education, whereas 76% of the parents and 64% of schoolchildren regard endeavors of integration as achievable in physical education.

• 56% of the university students would undertake common education with children of special education after sufficient preparation, whereas only 32% of the teachers of physical education would do so.

• According to teachers, parents would regard a situation as disadvantageous for their children if children of special education could participate in common lessons of physical education. Contradictory results were obtained from the investigation.

• Schoolchildren regard common education with children of special education as correct. In their opinion, in this way, they would be able to come to know the problems of children of special education better, and their acceptance could become more natural.

ERASMUS MUNDUS MASTER IN ADAPTED PHYSICAL ACTIVITY: AN IDEAL STRUCTURE FOR INTERCONTINENTAL COOPERATION IN TEACHING AND RESEARCH

Van Coppenolle, H., Dobreva, I., Djobova, S., Van lent, M.

Katholieke Universiteit Leuven, Belgium

In January 2005, a proposal for a joint Master in Adapted Physical Activity (APA) was selected for a period of 5 years, under the call of Erasmus Mundus Master Programmes. With these Erasmus Mundus Programmes, the European Commission aims to enhance the quality of higher education in Europe by improving the collaboration between European Universities and providing a joint diploma for non-EU students.

The Erasmus Mundus Master in Adapted Physical Activity (EMMAPA) originated from the European Master Degree in Adapted Physical Activity which has existed for over 14 years. The Erasmus Mundus framework allows us to extend this programme beyond the borders of Europe by providing substantial scholarships for both students and scholars from outside Europe to either attend or teach the course.

The master course has a duration of 1 year, consists of 60 ECTS and involves a study period in at least 2 of the 4 consortium universities: K.U.Leuven (Belgium), Norwegian School of Sport Sciences (Norway), University of Limerick (Ireland), Palacky University of Olomouc (Czech Republic). For the first academic year of the Erasmus Mundus Master in Adapted Physical Activity, 39 students from 25 different countries (10 European and 15 non-European), were selected. All the students studied the first semester in the K.U.Leuven and are currently completing the master course in a second consortium university. Upon completion of the course, the students should have sufficient knowledge on the nature of indications and limitations of physical activities for persons with disabilities, the current initiatives in APA and the state of the art in research in APA.

The unique aspect of this Master course is the intercontinental character. Under action 3 of the Erasmus Mundus framework, this international aspect was even extended by establishing partnerships with 3 non-EU universities: Queensland University (Australia), the University of Stellenbosch (South Africa) and the University of Virginia (USA). EU-students have the opportunity to apply for a 3 month scholarship to study in one of these partner-universities. Scholars from the consortium can also teach and work in these universities. This dynamic exchange of knowledge, experience and ideas of the EMMAPA course will make a substantial contribution to the establishment of an intercontinental cooperation in teaching and research in APA.

THE EFFECTIVENESS OF SECONDARY SCHOOL PHYSICAL EDUCATION IN DEVELOPING GENERIC SKILLS OF JUNIOR STUDENT

Chan, W.K., Hui, S.C., Sum, K.S.

The Chinese University of Hong Kong, Hong Kong

The Hong Kong Curriculum Development Committee (HKCDC) believes that generic skills are a part of students' basic ability and must be learned. These should be developed through learning and teaching in the context of different school subjects. They classify the generic skills as including collaboration and communication skills, creativity, critical thinking, information technology skills, numeracy, problem solving, self-management and study skills. This study attempted to evaluate the effectiveness of the secondary school Physical Education (PE) curriculum in developing junior students' generic skills. The samples included 2,840 junior (Secondary 1-3) grade students from 28 secondary schools in Hong Kong using statistical random sampling procedures. The questionnaire for secondary school students' self-efficacy towards generic skills test for physical education programme was adopted. The content validity (over 80% agreement by five experts) and the reliability (Internal Consistency (r) range from 0.55 to 0.80) of the questionnaire have been evaluated.

There were 61 items in the questionnaire which was designed for students' perception of performance corresponding to the nine generic skills components in the physical education programme. Five-point Likert scale was adopted, where 5 was 'strongly agree'. The results indicated that there was a positive trend in students' perception of their performance of the nine generic skills (Mean = 3.34) in the PE programme. The top three generic skills for junior secondary students were the skills of collaboration (Mean = 3.65), self-management (Mean = 3.48), and problem solving (Mean = 3.45). The findings suggested that the Hong Kong PE curriculum has adopted a traditional teaching approach in which the traditional team games are the core teaching contents and the skill-oriented teaching approach is adopted. This approach contributes towards students' development in certain generic skills, as proposed by the HKCDC. However, the findings showed that this traditional teaching approach may contribute comparatively less development on the generic skills of numeracy (Mean = 3.08), information technology skills (Mean = 3.19) and creativity (Mean = 3.22) in the junior secondary school PE programme. These findings may be useful references for educators in the design and evaluation process for the physical education programme during the educational reform.

This study was funded by the Education and Manpower Bureau, Hong Kong SAR.

PEDAGOGICAL QUALITY EVALUATION OF THE FITNESS TEACHERS

Rodrigues, J., Franco, S., Lougo, H.

Escola Superior de Desporto de Rio Maior, Portugal

This study it is fit in the evaluation of the health and fitness council program "Mais Desporto Mais Saúde" (MDMS), appointed in the area of Evaluation of the Pedagogical Quality. For such, it was proceeded an evaluation in the beginning and another one in the end of the time, with the objective to verify if the teachers and clients had modified its opinions and behaviours. The sample of this study was constituted by 6 groups of Fitness for adults and 2 groups of Sport Education of the related council program, in Rio Maior, Portugal. For each group two sessions of data collection had been carried through (filming video), one in the beginning (December 2004) and another one in the end (June 2005). In this way, we got 17 interviews and 18 videotapes of lessons. The interviews had been codified in units of information, through the use of the analysis of the content of the answers. The sessions had been analyzed through the SOTA (System of Observation for Coaches and Athletes) or of the SOCIF (System of Observation the Behaviour of Fitness Instructors), in accordance with the type of lesson. The pupils opinions had be treated from the results evidenced in the questionnaires that reflected an appreciation in ratting scale (5 levels). A descriptive analysis of the results was carried through. We conclude the following: a) related to the daily pre-interaction decisions, the teachers have expectations simultaneously to the session and to fit within the MDMS program and in accordance with the plan; this plan duly does not seem to be elaborated, having some errors when they tell us about the general objectives and the exercises; b) related to the pedagogical behaviour, this is fit in the desired profile of the efficient teacher, existing however, some difficulties in the groups of sport education that evidence a lower preparation of the involved teachers; c) in the supervision of the experienced teachers these difficulties and some fragility in the explanation of the exercises and the correction of the pupils execution had been proven; d) related to the preferences of the pupils, the positive interventions of support and encourage are valued, as well as the had explanation of the exercises and tasks; e) in the comparison between 1st and 2nd session we did not get great differences, however, the data that we obtain to get do not allow to trace conclusions on this objective. The recommendations can easily be taken care of will have an effective supervision of the lessons, with the formation of the teachers through the self-analysis and mentorship. We still recommend, that this study it is talked back with regularity in order to exert the determinative function of evaluation of program MDMS and simultaneously to supply information concerning the income of this program.

PHYSICAL EDUCATION SCHOOL BOOKS: HOW GENDER IS REPRESENTED IN 7TH, 8TH AND 9TH GRADE

Botelho-Gomes, P., Caetano, S.

University of Porto, Faculty of Sport, Portugal

Physical Education School Books: how gender is represented in 7th, 8th and 9th grade

Botelho-Gomes, P.; Caetano, S.

University of Porto, Faculty of Sport, Portugal

Introduction

School books are pedagogical instruments of unquestionable importance within the learning process. They also can carry gender stereotypes and transmit social representations of men and women in sport.

The purpose of our study was to find out which were the representations of gender, portrayed by Physical Education (PE) school books.

Methods: 4.252 images from seven PE school books were analyzed by content analysis technique. We have defined 4 categories a priori: male image, female image; image representing both genders, and undefined image, when was not clear which gender was represented.

In each book we also have inspected images and illustrations in: book cover, front page, index, thanks, and introduction.

Results: The results reveal that male images were the predominant (55.3%). Girls were represented in 25.7% of the images, and images with both genders counted only 12.0% of the total images. These results were unexpected in a coeducational school.

The association between gender and content showed that girls were more represented than boys only in gymnastics (48%), golf (58%), swimming (46%), and rhytmics (43%).

Conclusions: This kind of results reveals that PE school books portray mainly the masculine model. Because feminine representations are more associated with some contents and masculine representations are associated to others, we believe that there is a strong tendency to represent girls and boys in sports that are "appropriated" to them. According to this, PE school books reveal inequalities, asymmetries of gender and reinforce stereotypes, conveyed by the majority of the social patterns.

References: Correia, A.; Ramos, A. (2002). Representações de Género em Manuais Escolares. Língua Portuguesa e Matemática: 1º ciclo. Lisboa. CIDM., Ferreira, A. (2002). Desigualdades de Género no Actual Sistema Educativo Português. Lisboa. Quarteto Editora.

Fonseca, J. (1994). Representações femininas nos manuais escolares de aprendizagem da leitura do 1º ciclo do ensino básico. Lisboa. CIDM., Henriques, F.; Joaquim, T. (1996). Os Materiais Pedagógicos e o Desenvolvimento de uma Educação para a Igualdade entre Sexos. Lisboa. CIDM., Martelo, M. (1999). A Escola e a Construção da Identidade das Raparigas: o exemplo dos manuais escolares. Lisboa. CIDM., Rocha, F. (1999). Manuais Escolares: estatuto, funções, história, 415-421. Braga. Universidade do Minho.

PROBLEMATIC OF EXCUSING FROM PE LESSONS IN SLOVENIA

Jurak, G., Kova, M., Strel, J., Starc, G.

University of Ljubljana, Faculty of Sport, Slovenia, Slovenia

The increased level of body fat as a consequence of modern everyday life is one of the main health risk factors in children and youth (Strel et al., 2004a). It is accompanied by a growing number of youth with excess weight (Strauss & Pollack, 2001; Wedderkopp et al., 2004; Currie et al., 2004; Strel et al., 2004) and consequential diminishing of their motor potential, especially their endurance and strength (Beunen et al., 1992; Strel et al., 2004).

These trends triggered many declarations in which the experts recommend at least one hour of sport per day. Slovenian school enables children 3 school hours of physical education (PE) per week (135 minutes) and a vast palette of extracurricular sport activities (Kovač, 2001). The question of efficient realisation of PE lessons still remains problematic, especially because of the absence of pupils and their excusing from active participation.

The analysis of pupils' excusing from PE was carried out with a questionnaire on the sample of 1333 secondary and high school students. The characteristics of differences were analysed by t-test and variance analysis while the characteristics of correlations were analysed by correlation coefficients.

The results reveal a poorly developed system of excusing from PE. Its deficiencies are especially obvious in high school adolescent girls who are far too inactive in the times when they would need the most physical impulses.

Our estimation is that 8,8% of high school girls is inactive more than one fifth of the lessons. Other groups (secondary school pupils and high school boys) show far lower frequency of excusing than high school girls. Excusing from PE lessons is negatively correlated with general success in school. The most common used excuses to avoid physical activity are health related while material or hygiene reasons are not very common.

Many times pupils tell the teacher the real reason of their inactivity which shows that, in addition to many inexcusable reasons, teachers to easily excuse pupils from physical activity and thus enable abuse of excuses. These abuses are visible from a large share of false parents' excuses and improperly issued medical excuses.

In the time they are excused pupils remain inactive or do what they want. It is concerning that during this time they are more often learning other school subjects than theoretical subjects of PE that are parts of new PE curriculum in Slovenia.

The problematic of excusing in PE classes demands specific solutions. In order to decrease excusing we should combine two mechanisms: 1) we need to limit the reasons for excusing by pointing out the characteristics of pupils who are often excusing, 2) schools need to implement a system of excusing from PE lessons by obeying school legislation and at the same time plan the activities of the excused pupils that are in accordance with the curriculum. The teachers should remain professionally autonomous in planning and implementation and should thus take responsibility for the decrease of excusing from PE lessons.

FACTORS AFFECTING THE PROFESSIONAL LIVES OF PE TEACHERS IN HONG KONG

Sum, K.W., Ha, S.A., Chan, W.K., Johns, P.D.

The Chinese University of Hong Kong, Hong Kong

This study endeavours to understand the impact of the pressures on teachers and to determine the factors that affect the professional lives of PE teachers in Hong Kong.

Methods

The data for this research were gathered through an in-depth interview with a group of PE teachers during a teacher development program. Twelve teachers participated in the interview. Open-ended questions were asked with the following core themes: (1) the influence of work on the personal lives of the PE teachers, (2) their participation in ongoing professional development opportunities, and (3) their perception on satisfaction with their career. The data collected were examined using qualitative analysis techniques. Applying the principles of grounded theory (Strauss & Corbin, 1998), theoretical constructs that focused on factors affecting the professional lives of PE teachers were developed. Qualitative data generated from the interviews were analysed, coded and utilized to classify the constructs. These constructs were then adopted and formed the framework upon which a description and explanation of the factors that influences teachers' professional lives could be presented.

Results: This study found that there were 10 factors which affect the professional lives of PE teachers. They were (1) family and marital status, (2) gender, (3) years of service, (4) education/curriculum reforms, (5) school culture/leadership, (6) distinct nature of the profession, (7) preference of professional development, (8) identity and status, (9) sense of achievement, and (10) nature of the dynamic subject. Most of the factors underlying these core themes were interlinked

Conclusions and Discussions

This research suggests that education/curriculum reforms have a significant impact on the daily lives of PE teachers and are often perceived as a source of stress. In contrast, PE teachers perceived student achievement and satisfaction with their roles as coaches to compensate for the stresses encountered in their school life.

From the data collected in this study, it appears that PE teachers may experience a degree of ambivalence over the importance of PE. Many teachers are required to teach up to three other subjects besides PE and ranked them as more important especially when required to identify subjects for professional development. While PE has few opportunities for such in-services development there is substantially more opportunity to enjoy professional development in other subjects.

A third area of significance in the lives of teachers concerns the years of services and the experience that long service provides in elevating the status and identity of PE as a school subject. It appears that with age comes maturity, respect and even admiration for the role that PE plays in schools. It would seem that reputations are earned with regards to the impact that PE has on school life. With a sustained effort and consistency, experienced teachers and their subject enjoy a higher status.

ATHLETES RETENTION OF COACH'S INSTRUCTION IN JUDO PRE-COMPETITIVE INSTRUCTIONS

Rosado, A., Breia, E., Mesquita, I.

Faculty of Human Movement, Portugal

The aim of the present study was to describe coaches' instructional profile in pre-competitive meetings preceding the judo competitions and the athletes' level of retention of coaches' instructions. We observed 11 coaches and 58 athletes. The independent variables were gender and competitive level. The dependant variables were the quantity of information on coach instructions, the nature of the information and the information's reproduction by the athletes, both in a quantitative and qualitative (coherency) approach. The coaches pre-competitive instructions were audio and video recorded and immediately afterwards athletes were asked (by interview) to reproduce the coach's information. The information given by the coach and the athlete's answers were analyzed through quantitative and qualitative (content analysis) procedures, being the data described and compared.

Coach instructional profile showed a focus on technical and tactical aspects, in information's about the adversaries and about psychological aspects. Globally, athletes reproduced and perceived coaches instructions but there are always an important lost of information (31,3%). Male athletes presented a significant better retention level. The retention of the information was, globally, inversely related with the number of transmitted ideas and its extension. The results suggest that the retention of the information depends, generally, on its nature and structure but some personal characteristics, however, were, also, associated with retention (gender and practice level).

Poster presentation (PP)

PP2-08 Nutrition 1/1 - "Exhibition Hall"

DIETARY BEHAVIOUR AMONG COMPETITORS OF THE HUNGARIAN NATIONAL TEAM OF RHYTHMIC GYMNASTICS

Fogarasi, G., Nikl, A., Katics, L.

University of Pécs, Hungary

In case of competitors in the National Team of rhythmic gymnastics by apparatus, thin physique and low-built body mass are basic requirements. It can cause problems if the competitors are able to achieve slimness only with great difficulties.

The investigation was performed in the National Team of rhythmic gymnastics (six persons, mean age: 18.2 ± 3.2 ys). Female university students, not pursuing any sports, of Pécs University, (14 persons, mean age: 18.8 ± 0.2 ys) were studied as a control group. Despite the low number of subjects, we did not intend to involve any more competitors of rhythmic gymnastics not belonging to the National Team.

Body height, body weight and percentage of body fat were measured; Body Mass Index was calculated. In addition, an anonym questionnaire including questions about the date, frequency and length of their periods, contraceptive pills, fluctuation in body temperature, bone fracture and about their satisfaction with their bodyweight. The competitors were supposed to complete two standard validated questionnaires, the Hungarian versions of Eat-26 and the Eating Disorder Inventory including 64 items. The results obtained in this way were analyzed by the means of the SPSS-13 statistical software.

Significant differences were found in the following variables: Body Mass Index, body fat percentage, body fat kilogram, the date of first period. Two of the 6-member National Team have regular periods at present; three have periods irregularly, 3-4 times a year; one member has no period at all; whereas 14 members of the control group have their periods regularly, 28.4 ± 1.3 days as an average. All the members of the team would like to lose weight; whereas six subjects with higher body weight of the control group would like to lose weight. One competitor and one control subject had fluctuation in body temperature. In case of Eat-26, two of the team members and one of the control group produced pathological symptoms. One of the competitors and two of the control group inclined to get into the subscale of EDI. No one of either groups got into the Bulimia subgroup, whereas one of the team and two of the control group got above the pathological symptom level of the Body Dissatisfaction subgroup of EDI.

To summarize it should be noted that, though all the team members, despite their low body weight, would like to lose weight and most of them have disturbances in their periods, it can be supposed to be a transitory state, and these complications will cease when they stop pursuing this sport. To obtain realistic data about their real state of health, whether these complications are transitory or not, the same investigations should be performed again following their sport career.

A STUDY OF DIETARY BEHAVIOUR IN SECONDARY SCHOOL FEMALE STUDENTS MAJORING IN BALLET

Fogarasi, G., Ockenfusz, E.

University of Pécs, Hungary

Slim, ethereal physique in female ballet students is a basic requirement. Certain components of physique are genetically determined, e.g. body height, thickness of bones. However, fat content, the proportion of lean body mass and fat body mass can be affected by diet, physical activity, and mode of life.

We carried out a study among female ballet students of Pécs Arts School (n=22, mean age: 17.2±1.2 ys). As a control group, the dancers of a hip-hop sport club participated in the study, who regularly dance but their physique is not a determining factor (n=30, mean age: 17.7 ys). Body height, body mass, body fat were measured, and the BMI was calculated. Their dietary behaviour was studied by the means of EAT-26 and Eating Disorder Inventory, and a questionnaire with items concerning their periods, changes in body temperature, bone fractures, contraceptive pills. The groups were compared by the SPSS-13 software. In the two groups, significant differences were found in the following parameters: body weight, body mass index, body fat percentage. Seven ballet dancers (32%) have rare periods, 3-5 times a year, while in the control group seven subjects (10%). 64% of the ballet dancers, despite their low body weight, would like to lose weight; 43% in the control group. In case of the EAT-26 questionnaire, seven ballet dancers (30%) and three control subjects (10%) scored above the risk level. Four ballet dancers and no control subjects scored above the cut-off-score in the subscale Drive for slimness. No subjects scored above the cut-off-score in the Bulimia subscale. Four ballet dancers and one control person scored above the risk level in the Body Dissatisfaction subscale.

To summarize, it was found that the ballet dancers were taller and slimmer than the control dancers; their body fat content was lower; third of them had disturbances in their periods; despite, most of them would like to lose weight in order to meet the requirements concerning the physique.

ENERGY AND MACRONUTRIENT INTAKE IN FEMALE WINTER UNIVERSIADE ATHLETES

Lee, A.S., Meyer, N.L., Krulatz, A., Burtscher, M.

University of Innsbruck, Austria

INTRODUCTION: Adequate energy and macronutrient intake are essential in maintaining performance and health in female athletes. Several studies show that female athletes are not meeting their energy and carbohydrate needs (Burke, 2001). Nutrition research on female Winter Universiade athletes is lacking. The Winter Universiade is an international sporting festival open to all student athletes and is highly competitive. Success requires academic and athletic excellence, and adequate nutrition plays a key role. PURPOSE: To describe the energy and macronutrient intake and supplement use in female Winter Universiade athletes in comparison with non-athletes and current sport nutrition recommendations. METHODS: Participants were female Winter Universiade athletes (n = 21) (cross-country ski [n = 14], alpine ski [n = 4], and snowboard halfpipe [n = 3]), and non-athlete controls (n = 20), aged 19-27 y. Energy and macronutrient intake and supplement use were assessed using a standardized Food Frequency Questionnaire (Block et al., 1989) and a self-developed questionnaire on dietary history, addressing the athletes' intense autumn training period prior to the 2005 Winter Universiade. RESULTS: Independent t-tests revealed no significant differences between athletes and controls for average daily energy (34.8 + 13.2 vs. 35.6 + 22.8 kcal/kg/d), carbohydrate (4.2 + 1.7 vs. 5.1 + 4.2 g/kg/d), protein (1.5 + 0.6 vs. 1.1 + 0.6 g/kg/d), and fat (1.2 + 0.5 vs. 1.1 + 0.6 g/kg/d) intake. Athletes had significantly lower intakes for energy (comparison value: 45 kcal/kg, [Economos et al., 1993]; $p<0.01$) and carbohydrate (comparison value: 7 g/kg/d; [Burke et al., 2004]; $p<0.0001$), using one-sample t-tests. Expressed in frequencies, 11 % of the athletes

met these guidelines for energy and carbohydrate. Only the athletes reported supplement use, specifically sport drinks (57%), sport bars (48%), and protein powder (24%), and the use of multi-vitamin and vitamin C supplements was higher in athletes than controls (47.6 vs. 15.0%; 57.1 vs. 20.0%; p<0.05, Chi-square test). CONCLUSION: The findings show that female Winter Universiade athletes and non-athlete controls have similar energy and macronutrient intake. Although underreporting should be considered, it appears that female winter sport athletes do not meet current sport nutrition recommendations, and thus, may not adequately prepare for and recover from intense training. Further research in this population should investigate athletes' knowledge of nutrition, where they obtain such information, and the availability of sport nutrition services at training facilities. REFERENCES: Block G, et al. Health Habits and History Questionnaire: Diet History and Other Risk Factors, NIH Bethesda, MD 1989. Burke LM, et al. Carbohydrate and fat for training and recovery. J. Sports Sci. 22: 15-30, 2004. Burke LM. Energy needs of athletes. Can. J. Appl. Phys. 26:S202-S219, 2001. Economos CD, et al. Nutritional practices of elite athletes. Practical recommendations. Sports Med. 1993 Dec;16(6):381-99.

PHYSICAL ACTIVITIES AND NUTRIENTS INTAKE OF ELDERLY HEALTHY PEOPLE

Assanelli, D. 1, Bandera, F. 1, Tolomio, S. 1, Scudellari, A. 1, Corsetti, G. 2, Bernardi, M. 1, Perdetti, E. 1, Pasini, E. 3, Salvetti, M. 1, Bianchi, R. 2

1 Chair of Sport Medicine, 2 Division of Human Anatomy, University of Brescia,
3 S. Maugeri Foundation IRCCS, Gussago, Brescia - Italy, Italy

Many studies investigated the nutritional habits of elderly people but no study has already analysed both the nutritional habits and the physical activities of old people. We investigated the dietary habits and the physical activities in a group of selected old healthy people. The study was conducted in 70 (13 men, 57 women) selected health subjects aged from 66 to 86 years resident in the town of Brescia (Lombardy, Italy). People were visited by a multispecialist team to exclude chronic and/or acute diseases. ECG, blood pressure, body mass index, tricipital skinfold thickness and arm muscle diameter were evaluated. Total and HDL/LDL cholesterol, triglicerides, glycemia, C-reactive protein and fibrinogen were measured. The EPIC questionnaire was used in order to evaluate nutritional habits and the Laval questionnaire quantified the kilocalories spent in leisure-time physical activities. Cognitive deficit, medical history, demographic and socio-economic variables and lifestyle informations (ie: tobacco smoking or alcohol drinking) were collected.

Subjects had a daily intake of total protein, total fat, disposable carbohydrates of 70.8±3 g, 66,4±2 g, 216±9 g respectively. We found a high intake of saturated fats in 25% of the subjects. In the majority of the elderly we noted a reduced intake of calcium, potassium and vitamin D. Elderly men had also low intake of vitamin E and niacin. The mean daily energy intake was 1791±74 kcal. All subjects had a constant daily physical activities, both in week-days and in Sundays. The SCORE resulted 3 in men, 2 in women. Conclusion: healthy elderly people had a constant daily physical activities and adequate macronutrients intake. However, in the 25% of the subjects we found increased saturated fat intakes. In spite of that habits, all patients were healthy. Probably genetic features and constant adequate physical activities are important to have a healthy senescence more than fat intake.

ORAL AMINOACIDS SUPPLEMENTATION INCREASES MITOCHONDRIA AND SARCOMERE VOLUME IN MYOCARDIUM OF OLD MOUSE

Assanelli, D. 1, Corsetti, G. 2, Pasini, E. 3, Bianchi, R. 2

1 Chair of Sport Medicine, University of Brescia, 2 Division of Human Anatomy, University of Brescia; 3 S. Maugeri Foundation IRCCS Medical Center, Gussago, Italy

Senescence is characterised by reduced proteins synthesis and decreased mitochondrial number which can cause muscular wasting and metabolic alterations. Loss of muscular proteins and mitochondria is not only peculiar of skeletal muscle but it is present in the cardiomyocites as well. Indeed, old heart has specific alteration of systolic and diastolic performances due to structural and energetic disarrangements. Alternated cardiac mechanical activities cause impaired physical activities of the elderly. Recently, it was demonstrated that chronic oral administration of a specific mixture of aminoacids (AAs) stimulate protein synthesis and improve oxidative muscle metabolism. However, data on the effects of specific nutrients such as AAs on morphometry of cardiac cells are not available, yet. Thus, to evaluate the morphometric effects of oral AAs supplementation on mitochondria (Mi) and sarcomere (Sr) of old male mouse (14 months) we performed an experiment using two groups of five animals each. The standard dry food was added with water (controls) or aqueous solution of AAs mixture (1,5g/kg/day) for 90 days. The amount of fluid intake was measured daily. At the end of the treatment animals were killed, the heart was removed, fixed in glutaraldehide and processed for electron microscopy (EM) technique. For each group, data were collected from about 90 EM photographs (x5,900) , randomly taken at different levels of muscle. The morphometric measures were taken twice by three persons using 5mm-gauge stereological grid. We calculated: the total volume of fibres (TotV), the volume of sarcoplasm (SpV), Sr (SrV), Mi (MiV). From these data we calculated the ratio SrV/TotV and MiV/SpV. After 90 days there was no difference in fluid intake and body weight : respectively 6.4+/-1.5ml and 28+/-2g in controls; 5.1+/-1ml and 29+/-1g in AAs treated. In each group, the total area examined was about 7000.003. All parameters changes statistically in AAs treated animals. The MiV/SpV increases about 28% (0.35+/-0.08 vs 0.45+/-0.11), whereas the SrV/TotV, increases about 15% (0.34+/-0.1 vs 0.39+/-0.06). Conclusion: chronic AAs supplementation improved Mi and muscular functionality in old rats. So, we can postulate that nutritional supplementation can : a) prevent sarcopenia and b) increase muscle strength and cardiac performance probably able of improving the quality of live of old subjects.

THE CHANGES IN BRAIN AND MUSCLE METABOLISM BY THE COMBINATION OF CAFFEINE SUPPLEMENTATION AND LOW VOLUME EXERCISE TRAINING

Esaki, K., Yashiro, K., Sako, T., Yoshitake, Y., Ohkubo, M., Kuwamori, M., Yamaguchi, K., Kinugasa, T., Takemasa, T., Hamaoka, T.

University of Tsukuba, Nippon Sport Science University, Japan Women's University, National Institute of Fitness and Sports, Tokyo Therapeutic Institute, Meiji University, Yamanashi Gakuin Junior Coll., Japan

The purpose of this study was 1) to determine whether the changes in energy metabolism and circulation of the brain and muscle by the supplementation of caffeine (CAFÉ) were associated with the increase in resting metabolism and 2) to determine the effects of CAFÉ intake and 1-month, low-intensity exercise training.

Six obese subjects (32-55 yr., BMI 26.2) were recruited for the experiment in a double-blind, cross-over design.

In Exp.1, subjects were given CAFÉ (5mg/kg) or placebo with 200kcal meal and kept rested for 60 min., then performed a 60 min. exercise testing at 40% maximal systemic oxygen consumption (VO2max). Blood samples were collected at rest, 60 min. post intake, and 60 min. post exercise for analyzing blood CAFÉ, glucose, triglyceride (TG), and free fatty acid (FFA).

In Exp.2, the same protocol was used as the Exp.1 pre and post exercise training. The subjects performed 60 min. exercise training at 40%VO2max, 3 times a week 1 hour after the intake of the supplement (CAFÉ or placebo).

We measured body weight, body fat, visceral fat, blood CAFÉ, glucose, TG, FFA, daily food intake, physical activity, total resting metabolic, fat oxidation rates, muscle oxygen consumption, blood flow, brain oxygenation, heart rate, blood pressure, and sympathetic nerve activity (SNA).

CAFÉ intake significantly increased blood CAFÉ, total resting metabolic rate, and blood pressure and decreased brain blood volume and oxygenation. There were no changes in heart rate, glucose, TG, FFA, daily food intake, physical activity. CAFÉ intake also blunted meal-induced decrease in fat oxidation (p=0.065).

There were no changes in body weight, body fat, and visceral fat after exercise training. During exercise after CAFÉ intake, there was an increase in SNA and a blunt response of the decrease both in total metabolic rate and in fat oxidation after training.

It is suggested that CAFÉ increased resting metabolic rate. The physiologic effects of resting CAFÉ intake were the increase in blood pressure, decrease in blood flow in the brain and the elevation of fat oxidation. After the low intensity exercise training, CAFÉ-induced response of fat oxidation would be enhanced both at rest and during low intensity exercise.

This study was supported by part of a grant from the Nestlé Japan science promotion committee.

CREATINE FOOD SUPPLEMENTS IN THE NUTRITION OF ENDURANCE-TRAINING SPORTSMEN

Milasius, K., Dadeliene, R., Tubelis, L.

Vilnius Pedagogical University, Lithuania

Food supplement, creatine, have found a wide application in enhancing the physical performance and functional capacity among sportsmen. However, comprehensive studies on the effect of creatine complexes with other food supplements are lacking.

The aim - to elucidate the effect of creatine mono-hydrate and the vitamin MULTI VITA+ complex on the sportsman's organism.

We examined 20 sportsmen aged 20-24 years. After the first examination when the physical development performance capacity, blood morphological and biochemical indices had been determined, all the subjects were divided into two groups 10 subjects in each. The food ration of first (E1) group was supplemented for five days with creatine monohydrate at a dose 0.3 g/kg body mass. The second (E2) group was supplemented for five days with creatine monohydrate at a dose 0.3 g/kg body mass and one capsule of vitamin daily.

We determined their physical development, single muscular contraction power (SMCP), anaerobic alactic muscular power (AAMP). The mixed anaerobic alactic - anaerobic glycolytic power was evaluated according to a 30-second maximum strain work on an ergometer (Wingate test). Anaerobic glycolytic capacity (AGC) was evaluated according to a 60-second work on a veloergometer.

We studied the peripheral blood picture, determined the erithrocyte and leucocyte counts, hemoglobin concentration, hematocrite percentage. To assess creatine metabolism in the body, we determined the creatinekinase concentration and creatinine content in blood urine with the aid of a REFLOTRON biochemical analyzer.

The sportsmen's food supplementation with creatine and a combination of creatine with the MULTI VITA+ vitamin was beneficial for their physical development. Supplementation of creatine and its complex with vitamin increased sportsmen power in various energy production zones, however, this increase was not statistically significant in either of the groups. The indices of SMCP, AAMP- AGC were higher in the E1 group administered creatine alone.

Changes in the indices of blood morphological composition in the both groups were insignificant. However, leucocyte count was found higher in the group of sportsmen administered creatine with vitamins.

Rather great differences were noted in the changes of creatinekinase concentration. In the group E1 members, blood creatinekinase activity increased on average from 254.6 to 337.9 u/l whereas in group E2 members this index decreased on average from 210.3 to 177.5 u/l. The decreased blood creatinekinase level in E2 group members shows that performing a load of the same intensity takes less reserves of creatine. This implies that the subjects administered creatine in combination with vitamines undergo a less katabolism under physical loads than do the subjects administered creatine alone.

REDOX REGULATION OF VITAMIN C METABOLISM IN C2C12 SKELETAL MYOTUBES

Savini, I., Rossi, A., Duranti, G., Arnone, R., Bartoloni, L., Avigliano, L.

University of Rome , Italy

Reactive oxygen species are naturally produced during physical exercise inducing muscle damage, in this context, small antioxidant species such as vitamin C and alpha-lipoic acid (LA) are essential to protect cells from oxidative damage. LA is a cofactor for several important enzymes related to energy metabolism as well as a modulator of cellular redox balance (1). When large amounts of free LA are available (e.g., with supplementation), LA is reported to function as an antioxidant (2). Vitamin C is involved in a number of biochemical pathways needed for metabolism and health of exercising individuals, including synthesis and activation of neuropeptides, collagen and carnitine, and protection against exercise-triggered ROS generation. The skeletal muscle cells content of vitamin C depends both by the efficiency of transport systems and by the ability to maintain the vitamin in its active reduced form. Mouse C2C12 skeletal muscle cells possess efficient mechanisms to accumulate vitamin C i.e. SVCT2 transporter for ascorbic acid (AA) uptake, GLUT transporters for dehydroascorbic acid (DHA) uptake and enzymatic activities for vitamin C regeneration (3). Several data suggest that the requirement of exogenous vitamin C is closely related to intracellular redox state. The purpose of this study was to investigate, in C2C12 myotubes, the relationship between LA and vitamin C metabolism (i.e transport and recycling activities) and how the modulation of intracellular redox state influences these pathways. Two well-defined transcription factors, nuclear factor NF-kB and activator protein AP-1 are regulated by oxidants, antioxidants, and other factors that influence intracellular redox status. Thus, we evaluated the effect of LA or AP-1 and NF-kB inhibitors on vitamin C metabolism.

C2C12 myotubes, treated with LA (1 mM) for 24h, increased DHA uptake 2.6 fold over control. This increase was associated with increased DHA reductase activity (1.3 fold over control). On the contrary, myotubes showed decreased AA transport (0.6 fold over control), but unchanged ascorbyl free radical reductase activity. In agreement with transport functional data, LA-supplemented cells showed decreased SVCT2 protein amount. Also AP-1 and NF-kB inhibitors treatment lead to a similar result: 0.4 and 0.2 fold over control respec-

tively. On the contrary, oxidative stress induced by H2O2 (300 microM) caused a 2 fold enhancement of SVCT-2 amount. These results suggest that intracellular redox state modulates SVCT2 expression via AP-1 and NF.kB.

In conclusion, in skeletal muscle cells there is a strict relationship between vitamin C and LA. This compound by ameliorating the ability of myotubes to regenerate vitamin C from DHA. lowers the AA requirements, and therefore SVCT2 expression.

1. Savitha S. et al. (2005) Clin Chim Acta. 355;173-180

2. Savini et al. (2005) Free Rad Biol Med. 38; 898-907

3. D. Han et al. (1997) Biofactors 6; 321-328.

THE EFFECTS OF JAPANESE DIET ON BODY FAT, METABOLISM, INSULIN RESISTANCE, AND AUTONOMIC NERVOUS SYSTEM ACTIVITY IN YOUNG LEAN WOMEN WITH EXCESSIVE BODY FAT

Nagai, N., Sakene, N., Nishida, M., Moritani, T.

Okayama Prefectural University, Japan

The dramatic increase in thinness or the decline in BMI values has been observed in young Japanese women (Takimoto et al. 2004), however, prevalence of latent obesity (normal weight with excessive body fat) have also increased and reached around 40% (Takahashi et al. 2002) of twenties who have altered their food intake from a low-fat, balanced Japanese diet to a high-fat, Westernized diet for several decades (Yoshiike et al. 1996). This study, therefore, investigated the effect of a low-fat, Japanese food-based diet on body fat, metabolism, insulin resistance, and autonomic nervous system (ANS) activity, while controlling for physical activity in free-living young women.

Eleven young lean women with excessive fat (21.7±0.8 yrs; BMI, 21.0±0.5 kg/m2; body fat, 29.8±0.7 % [mean±SEM]) received a low-fat, Japanese food-based diet (20% fat, 60% carbohydrate, and 20% protein, 5000 kJ/day) for 2 weeks at laboratory. Body fat, waist circumference, resting metabolic rate, insulin resistance, and the ANS activity were measured at baseline and 2 weeks. Insulin resistance was calculated using a HOMA-R (homeostasis model assessment for insulin resistance). The ANS activities were assessed by means of power spectral analysis of heart rate variability, and we evaluated a low frequency component (LF power, 0.03-0.15 Hz) as an indicator of the sympathetic nervous system activity (Akselrod et al. 1981, Moritani et al, 1993, Nagai et al. 2003).

Results demonstrated that significantly improvements ($p < 0.001$) were observed for body fat (-1.7 ± 0.2 kg fat mass), waist circumference (from 72.2±1.1 to 68.5±1.0 cm), fasting glucose (from 90.4±2.7 to 83.7±1.8 mg/dL), fasting insulin (from 5.9±0.5 to 3.3±0.4 μg/mL), HOMA-R (from 1.3±0.1 to 0.7±0.1), and glycoalbumin (from 14.4±0.2 to 13.9±0.2 mg/dL). Fat oxidation (from 45.6±5.4 to 65.3±5.5 mg/min) as well as LF power (from 5.7±0.2 to 6.1±0.2 ln ms2) significantly increased ($p < 0.05$), and serum triglyceride (from 68.4±5.9 to 47.8±3.2) significantly decreased ($p < 0.01$), suggesting increased overall lipid metabolism in the body.

In conclusion, despite a short-term and modest energy restriction, a low-fat, Japanese diet can contribute to significant decreases in body fat and waist circumference and improve the insulin resistance. In addition, overall lipid metabolism was enhanced. Our results provide evidence that a proper nutritional intervention may be useful in regaining desired body composition among young lean women with excessive fat, thus possibly preventing the future metabolic syndrome.

REFERENCES

Takimoto et al. Am J Pub Health 94: 1592-1595, 2004

Takahashi et al. Jpn J Phys Anthropol 7: 213-217, 2002 [in Japanese]

Yoshiike et al. J Epidemiol 6: S189-S200, 1996

Akselrod et al. Science 213: 220-222, 1981

Moritani et al. J Sport Med Sci 7: 31-39, 1993

Nagai et al. Obes Res 11: 25-32, 2003.

CALCIUM INTAKE AND BONE HEALTH STATUS AMONG YOUNG FEMALE ATHLETES

Hamzah, S., Mohd Ali, M.

University of Malaya, Malaysia

The effects of physical activity on bone have been extensively reviewed (1). Since physical activity, particularly high impact, is associated with greater bone density (2), one might expect that female athletes need not worry about the possibility of bone loss. However, identification of a syndrome of disordered eating, amenorrhea and reduced bone density (3) overshadows this positive aspect of physical activity and may contribute to a greater consideration for adequate calcium intakes in female athletes. The aim of this study was to determine the associations between calcium intake and bone health status among young female athletes who are either state or national level representatives. A total of 48 female athletes aged between 14 to 19 years old from 9 different types of sports were studied. Parameters measured were weight, height, body fat percentage and body mass index (BMI). Calcium intake was determined through a Food Frequency Questionnaire. Bone health status was assessed using Quantitative Ultrasound Sonometry, which measures Broadband Ultrasound Attenuation (BUA, dB/MHz) at the calcaneus. The mean weight and height of the subjects were 53.15 ± 9.83 kg and 161.21 ± 6.89 cm respectively. The body fat percentage was 17.16 ± 5.08% and BMI was 20.34 ± 3.14 kg/m3. The mean calcium intake was lower than the Recommended Nutrient Intakes for Malaysia (4). The mean BUA of bone health status was 97.38 ± 15.56 dB/MHz and the mean T-score was 0.67 ± 1.25. According to the WHO (5) classification, 87.5% of the subjects have normal bone health status (T-score >-1.0) and 12.5% were classified as osteopenic (-2.5≤T-score ≥-1.0). Data from each sport showed a significant relationship between daily calcium intake and BUA among the gymnasts ($r=0.23$, $p<0.05$). This group had the lowest mean calcium intake and BUA. However, there was no significant relationship between calcium intake and BUA in the rest of the sports. In conclusion, low calcium intake was associated with low bone health status especially among the young girls who trained in sports in which low body weight is emphasized for athletic activity or appearance. A proper dietary intake and training practices are needed to prevent low bone mass leading to stress fractures.

Reference

1. Suominen H (1993). Bone mineral density and long term exercise. Sports Med 16:316-330

2. Dook JE, James C, Henderson, NK & Price RI (1997). Exercise and bone mineral density in mature female athletes. Medicine and Science and in Sports and Exercise. 29:291-296

3. Loucks AB (1987). Micronutrients (magnesium, zinc and copper): are mineral supplements needed for athletes? International Journal of Sports Nutrition 4:89-103

4. Recommended Nutrient Intakes for Malaysia (2005). National Coordinating Committee on Food and Nutrition, Ministry of Health.
5. WHO (1994). Assessment of fracture risk and its application to screening for postmenopausal osteoporosis: a report of a WHO Study Group. Geneva: World Health Organisation.

Poster presentation (PP)

PP2-09 Motor Learning 1/1 - "Exhibition Hall"

THE EFFECT OF AUGMENTED FEEDBACK ON THE FOOTSTEPS LEARNING

Berchicci, M., Bertollo, M.
Faculty of human movement science, Italy

Among the different variables known to affect learning in physical practice context, augmented feedback following the completion of the response is considered to be one of the most important (Schmidt & Lee, 1999) and a necessary phase that the learner must go through in order to reach the autonomous stage where movement control is more or less automatic (Masters and Maxwell, 2001). These observation are discussed in view of the benefits and pitfalls of augmented feedback in relation to task context and instructional condition (Badets & Blandin, 2004).
101 volunteers, aged from 16 to 31 years (M=23; sd=3,76) were required to perform complex skill by "all music dance". It was originally composed by an electronic game in which the player had to follow the luminous arrows sequence on the screen with the dance mat controller. No participants had prior experience with the performance on the task. The software assigned a score in function of spatial and temporal precision. Scoring could see on video during the practice.
The protocol is composed by three phases:
In the test phase, three different footsteps sequences in order of difficulty were performed by all subject after a baseline test.
During second phase, the participants was divided into two homogeneous groups:
 one group (56 participants) acquired a footsteps movement with normal vision of performance and results in real time (with augmented feedback);
 another group (45 participants) performed the complex skill without augmented feedback.
The latter group performed the task on posters that reproduced the arrows like the original, so participants didn't knew knowledge of performance (KP) and knowledge of results (KR). Both group exercised thrice in each footsteps sequences.
In the last phase all subjects reproduced the footsteps sequences on mat controller.
The test refers to the score obtained from the first experience and the re-test refers to the score obtained from the last phase.
One ways ANOVA 2 groups (with and without augmented feedback) revealed that the augmented feedback encourage skill learning (F=(1,99)116,42; p=.000) (Wallace and Hagler, 1979). In fact learners who practiced with augmented feedback showed a further performance improvement relative to the end of practice, like as report in literature (Wulf, Shea and Park, 2001).

MECHANICAL EFFICIENCY AND MUSCULAR CONTROL VARIATIONS IN CYCLING BY USING DIFFERENT TRAINING INFORMATION PROCDURES

Pozzo, R., Neuman, K., Plaino, L., Schwirtz, A.
University of Medicine Udine, Italy

Introduction. The efficacy of cycling concerns the biomechanical relationship between the cyclist and the bicycle as well as the muscle activity patterns. Tangential crank force can increase (pushing) or decrease (breaking) the propulsion total net torque. Subjects show various capacity of motor and sensory cues to match the biomechanical demands especially in the transition between extension and flexion. The aim of this study was to investigate the effectiveness of different training information procedure to improve the biomechanical efficiency of pedaling.
Methods. Tangential and radial crank forces were recorded at 100 Hz by a special system (Powertec). EMG (Biovision) of principal muscles (RF, VM, BF, TA, GAS, SO) was made according to the SENIAM guidelines. RMS and IEMG values were calculated. 2-D kinematics of the legs were calculated via video analysis (SIMI). Two groups of cyclists participated in the experiment (PC= 6 professional , NC= 6 sport students). Subjects complete pedaling items with 70 b/min cadence, 1 minute duration and under four loading conditions (100, 150, 200, 250 W), 3 minutes rest between loads and no fatigue. Items were carried out in the following sequence: I-1) actual technique, I-2) repeat first item receiving visual information on the shape of the tangential force after each previous load, I-3) pedaling with online visual feedback on the shape of the tangential force for the left and right leg separately, I-4) repeat all the loading steps without information. After two days subjects were required to repeat item I-4. Results. Most of the subjects reveal a breaking action of the legs during the upwards phase crank. This negative effect was more pronounced at 100W load. After I-2 no substantial variations on the tangential force were observed for both groups. Some subjects modified the force profile, but not necessary increasing the efficiency. During online feedback, all subjects were able to modify correctly the force curve and to obtain an increased biomechanical efficiency. During item I-4 the new technique was well reproduced and different kinematics and EMG adaptations between groups, with respect to the I-1 technique, were depicted. NC have greater and PC lower knee extension, while the flexion was the same as in I-1. Ankle extension angle was reduced in PC for all the loads, while in NC it was lower for 100W and greater for 250W loads. Ankle flexion showed similar values with respect to I-1, but was greater in NC (75° vs 65°).Some muscles showed identical variations for both groups, TA increased and VM and SO decreased activity. GM decreased significant only for PC and RF increased for PC and decreased for NC. BF showed no clear tendency. After two days, most of the subjects were able to reproduce the new acquired force patterns. In order to obtain a comprehensive view of this locomotor adaptations, especially for long duration effort, analysis of the metabolic efficiency should complete this approach.

ENHANCED VARIABILITY AND ACCURACY OF TENNIS SERVE

Moreno, F., Menayo, R., Fuentes, J.P.

Universitiy of Extremadura , Spain

Variability is a natural feature of the behavior or organism. Evidences reveal that there are not two movements identical, even trying to repeat exactly the same. The invariance of movement has been interpreted even in contrasting theoretical frameworks, as a reflection of the order of biological motion and the essential window into theoretical approaches to action (Newell and Slifkin, 1998). Actually, some studies suggest that compensatory variability can be observed in performers who are skilful at exploiting the high dimensionality offered by the degree of freedom of the movement system (Davids et al., 2003).

This study analyzes the relationship between variability showed by tennis players executing a service and accuracy obtained from the boll bounce after the service. There is a saying tennis that you are only as good as your serve. The ability to hold serve at higher levels of competition is usually what determines how far a player can progress competitively in the game. As with other strokes, good technical executions of the core elements of the motion are a prerequisite for effective and consistent serving.

Twelve intermediate-level tennis players participated in the experiment. Kinematic variables (position, velocity, acceleration, angles and timing) were measured from the serves performed in different variability task constraints. For variability purpose, perturbations were induced in serve movements as constraints; the players were required to perform serves with different ball weight, racquet weight, velocity requirements and from different positions and orientations near to their preferences. Also the players served as usual.

Kinematic data were collected by a Polhemus Fastrack located on the forehand at 120hz with a accuracy of 0.08 centimetres in position and 0.15 grades in angle.

A video camera was used to record the ball bounce in order to measure de precision of the serve. Ball velocity in the serves were recorded by and Sport Radar SR-3600.

The correlations between kinematic variables, precision and velocity have helped to identify variables which determine the server performance. How perturbations induced in the task modified kinematic patterns are described in this study. Perturbations affect variability but this changes observed in the variables analysed must be interpreted in relation with the spatial and temporal precision. The results suggest alternative theories far from noise un-functional interpretation about variability, and functional role of variability is revised in order to enhance the performance of the serve.

Davids K, Glazier P, Araujo D, and Bartlet, R. (2003) Movement systems as dynamical systems: the role of functional variability and its implications for sports medicine. Sports Medicine; 33: 245–60.

Newell KM, Slifkin AB. (1998) The nature of movement variability. In: Piek JP, ed. Motor behavior and human skill: a multidisciplinary perspective. Champaign, IL: Human Kinetics, 143–60.

IMPLEMENTING COMPUTER SIMULATION IN GYMNASTICS TRAINING

Heinen, T.

German Sport University Cologne, Germany

Computer simulation can be seen as a safe and effective tool for optimisation and further development of sport specific movements (Glitsch, 2001). Especially models of the whole body seem to be useful to understand existing movements or make prognostic statements about new imaginable movements in sports. There are several interesting attempts to use multibody modelling and simulation in gymnastics (e.g. Arampatzis & Brüggemann, 1998; Yeadon & Mikulcik, 1996). New developments in modern computer technology have oppened possibilities to simulate and animate such model systems almost in real-time and therefore utilize them for the training process. According to the mentioned aspects we constructed an interactive simulation system that can be implemented in the training process in gymnastics. The systems consists of two modules: 1.) a module for movement analysis and 2.) a module for movement simulation on the basis of a particularly developed 16-segment model of the human body. The first module is based on a simple optical method for movement analysis. The second module uses the data from the first module as well as anthropometric measurements of the gymnast as input. After a validation procedure has been performed the system is arranged in such a way that the trainer or the gymnast has the ability to manipulate essential aspects of the movement and study the effects of these manipulations on the movement outcome. The system was used (and validated) so far with rotational movements on the high bar as well as somersault and twisting movements on the floor and trampoline with regard to the optimization and further development of existing gymnastic techniques. For example in rotational movements on the high bar it can be shown under which conditions the free hip circle to handstand can further be developed to difficult flight elements (e.g. free hip circle to tkatchev) and new imaginable dismounts from the high bar and which coordination patterns of joint torques will be necessary to perform these movements. The developed system may also be coupled with special forms of psychological training. The gymnast can understand the movement by exploring for example the same movement under different initial conditions. Early experiences emphasises that gymnasts who regularly use the system are faster in learning new skills. Last but not least it can be stated that new methods to understand the structure of gymnastic skills seem to be an essential resource to optimise gymnastic techniques.

Arampatzis, A. & Brüggemann, G.P. (1998). A mathematical high bar-human body model for analysing and interpreting mechanical-energetic processes on the high bar. Journal of Biomechanics, 31, 1083-1092

Glitsch, U. (2001). Computersimulation in der Biomechanik. Sankt Augustin: Academia.

Yeadon, M.R. & Mikulcik, E.C. (1996). The control of non-twisting somersaults using configuration changes. Journal of Biomechanics, 23, 1341-1348.

ERRORS IN JUDGING "OFFSIDE" IN FOOTBALL AND THE ROLE OF EXPERTISE

Catteeuw, P., Gilis, B., Helsen, W.

Katholieke Universiteit Leuven, Belgium

According to different studies (1,2), the flash-lag effect (FLE) may account for the errors that ASR make, not only in real life situations, but also in computer animations (3). The FLE is defined as a moving object that is perceived as spatially leading its real position at an instant defined by a time marker (in the particular case of judging offside the moment the ball is passed). The first aim of the present study was to examine the impact of the movement of the second last defender on the FLE. The second aim was to examine if international FIFA ASR can better deal with this perceptual problem than national ASR.

FIFA ASR (n=54), who were all potential candidates for the World Cup 2006, and Belgian ASR (n=34), who were all active in matches of the professional league, had to assess 2 sets of 32 computer-based offside situations. In these animations, the position of the attacker relative to the offside line was experimentally manipulated. For the onside positions, the attacker was either 20 or 10 pixels behind the offside line or on the offside line. For the offside positions, the attacker was 10 pixels ahead of the offside line. Furthermore, the movement of the defender was also manipulated. The second last defender was either standing still at the moment the pass was given, or he was moving in the opposite direction of the attacker (as often is the case in matches).

First, the results clearly showed a better performance (P<.048) for the FIFA ASR (70.6%) compared to the Belgian ASR (64.2%). Second, significantly more errors were made in situations where the attacker was on the offside line than 10 pixels behind the offside line. In situations where the attacker was 10 pixels behind the offside line, significantly more errors were made than 20 pixels behind and 10 pixels ahead of the offside line. These results support previous findings (3) and clearly support the flash-lag hypothesis. Finally, situations with a static defender (74.9%) were assessed more correctly than situations with a dynamic defender (61.4%) (P<.0001). FIFA ASR better assessed situations with a static (75.9%) as well as with a dynamic (65.3%) defender than Belgian ASR (static 65.3%, dynamic 55.2%).

Interestingly, FIFA ASR made fewer errors in onside situations than Belgian ASR, particularly in onside situations with a static defender. In situations with a dynamic defender, the FLE was still clearly present, also in FIFA ASR. In conclusion, when the second last defender and the attacker were moving opposite, the FLE enlarged the difficulty of judging offside. Future research is needed to examine if there are other ways outside the game using video simulations and computer animations to let ASR master the offside situations during a match in a better way.

(1) Baldo MVC, Ranvaud RD, Morya E (2002). Perception 31: 1205-1210

(2) Helsen W, Gilis B, Weston M (in press). Journal of Sports Sciences

(3) Gilis B, Helsen W, Catteeuw P (under review). Journal of Sport & Exercise Psychology.

MUSCULAR STABILITY OF THE GOLF SWING AND THE PROPORTIONAL DURATION MODEL

Fernandes, O., Barreiros, J., Cabri, J., Pezarat-Correia, P., Hoolthuis, A.

Faculty of Human Movement, Technical University of Lisbon, Portugal

Purpose: The main purpose of the present study was to investigate the proportional duration model in the golf swing. In this model the temporal structure of muscle activity remains constant, despite different overall duration of the movement. Temporal structure of swing was assessed by means of peak activity of several shoulder and arm muscles.

Methods: Three low-handicap golfers (handicap lower than five) performed sixteen golf swings with a pitch iron. Trials were ranked according to their duration and two trials with the longest and shortest duration were selected for analysis. A three axis accelerometer (1000 Hz) fixed at the back of the golf club head informed about movement start and ball contact time. One camera (300 Hz) was focused on the ball to detect movement start. Surface EMG was recorded from 12 muscles of the dominant upper limb: p. clavicularis (AD), p. acromialis (MD) and p. scapularis (PD) of the deltoideus, pectoralis major (PM), latissimus dorsi (LD), infraspinatus (IS), vastus lateralis (VL) and long portion (LP) of triceps brachii, biceps brachii (BB), brachioradialis (BR), wrist flexors (WF), and wrist extensors (WE). The EMG signals were sampled at 1000 Hz, full wave rectified, low pass filtered (second order Butterworth filter at 12 Hz) and normalized in amplitude using the EMG of the maximal voluntary contraction as a reference. Peak activity of each muscle was calculated and the correspondent time (ms) was then recalculated as a percentage of the overall swing duration. Six muscles were selected for posterior analysis: BB, IS, LD, WF, VL and PD. Absolute time of peak activity and relative position (percentage of overall swing duration) were calculated.

Results: The six muscles demonstrated peak activities at significantly different absolute timings (Friedman Test, p=0.03 for short swings; p=0.02 for long swings). The same temporal sequence in the EMG peak activities was found, regardless the condition and the subject. When considering the absolute timing of the swing, all muscles observed were active at different times, the slowest swing having later activation. However, when normalizing these activation times to the percentage of the total swing time, these differences disappear. The time normalization did not reduce inter-individual differences. Differences between subjects were markedly noted in IS which demonstrated different strategies of follow-through preparation. On the contrary, LD activation timing was very similar in all subjects, both in the short and long duration swings.

Conclusion. It is hypothesized that some muscles' activities are scaled to a fixed proportion of swing duration. If this is the case, then an EMG approach, when analyzing the temporal aspect of muscle activity, using a proportional duration model must account for muscle specificity in a particular action.

TIMING THE GOLF SWING IN THREE DIFFERENT CONDITIONS

Barreiros, J., Cabri, J., Diniz, A., Bruno, P.M.

Faculty of Human Movement, Technical University of Lisbon, Portugal

Purpose: Timing refers to the coordination of a sequence of actions in the downswing to obtain the greatest possible club head speed. It implies adequate downswing sequence and acceleration, at the right moment, i.e. at ball impact. The purpose of the present study was to verify the temporal stability of different swing phases under varying conditions of speed and amplitude.

Methods: Three low-handicap golfers (handicap lower than five) performed various golf swings with a pitch iron, under three different conditions: (1) full swing, (2) swing at reduced speed (target speed of 90% of the full swing speed), and (3) swing at reduced speed (90% of the full swing speed) but with reduced backswing amplitude. Four trials in each condition were selected for analysis. Swing speed in all conditions was controlled using radar. A three-axis accelerometer (1000 Hz) fixed at the back of the golf club head informed about movement start, end of backswing phase, time of maximum acceleration and ball contact time. Two cameras (300 Hz), one in a sagital plane and one focused on the ball, provided additional information about those moments. Three phases were characterized in terms of absolute duration (ms) and relative duration, as a percentage of overall duration: (1) backswing, (2) forwardswing, (3) acceleration phase. Two aggregated phases were also considered for analysis: (4) duration of downswing (2+3), and (5) overall swing duration (1+2+3). The follow-through phase was not analyzed.

Results: A Friedman Test showed slight higher club head speeds in the full swing condition (p=0.09) and significant longer overall swing duration in the reduced speed condition (p=0.05). No significant differences were observed between trials in the three conditions (p>0.10). Furthermore, an exploratory analysis suggested no statistical differences in absolute duration and relative duration between conditions in the four swing phases. However, when individually analyzed, all subjects demonstrated some differences in absolute duration of specific phases in different conditions. For instance, in one subject a variation of 13% in backswing duration between the full swing and the reduced speed condition was observed. But, in another subject, a variation of 33% in the duration of acceleration phase of downswing was

observed. In general, these variations in some phases are substantially reduced in relative duration analysis. Subjects tend to keep a uniform relative duration of the swing phases between conditions. This trend was observed in all three subjects.

Discussion: Despite their similar experience and handicap, subjects evidenced important differences in their swing temporal structure. The observed variations in phase duration between conditions are strongly reduced in a relative duration analysis. This result offers limited support to a temporal scaling hypothesis in golf swing. Individual differences strongly recommend within subject analysis.

THE EFFECTS OF VARIABILITY OF PRACTICE ON LEARNING A NOVEL MOTOR SKILL

Lyons, M., Al-Nakeeb, Y., Moreton, J., Duncan, M.

Newman College of Higher Education, United Kingdom

Introduction

Research has shown that varied practice scheduling may affect learning and performance of motor skills. However, despite the acknowledged importance of practice no coherent picture has emerged as to what type of practice variability is most effective in learning skills. Magill and Hall (1990) found that blocked practice produced better learning results than random practice. However, Ota (1999) found that variable practice conditions were more effective than constant practice. According to Shea et al. (2000) little research has examined the benefits of spacing practice across days especially with respect to learning motor tasks, hence this warrants further investigation.

Methodology: Thirty College students participated in a novel dart-aiming task. They were randomly assigned to three groups; group one performed four blocks of 30 trials in one session, group two performed 2 blocks of 30 trials on two consecutive days, group three performed one block of 30 trials on four consecutive days. A total of 120 trials were performed by each participant. The target contained four concentric circles, with the centre circle having a diameter of 5cm. Each of the other circles increased by 4cm in radius. Four points were awarded for a hit on the centre circle. The score for each concentric circle radiating out from the centre decreased by 1 point.

Results: A three by four ways repeated measures ANOVA indicated no group by condition interaction. There was however, a significant ($p = 0.027$) within-subject effect over the blocks of trials. The mean values over the 4 blocks of trials were 33.80 ± 1.49, 38.53 ± 1.87, 37.20 ± 1.52 and 38.13 ± 2.05. The post hoc indicated a significant ($p = 0.010$) difference between the first and second block. There were no other differences observed.

Discussion: Initial findings indicated that the variability of practice did not affect learning of this task. This disagrees with memory consolidation theory. There was a significant improvement ($p = 0.010$) between the first two blocks of trials across all three groups. No further improvement was evident in subsequent blocks. While spacing practice over two days is beneficial, there is no evidence that further improvement occurs thereafter. Future investigation should examine contextual interference effects and whether longer inter-session intervals impact on learning.

References: Magill, R.A., & Hall, K.G. (1990) Human Movement Science 9, 241-289

Ota, D., Vickers, J.M. (1999) International Journal of Volleyball Research 1, 18-24

Shea et al. (2000) Human Movement Science 19, 737-760.

COORDINATION MEASUREMENT IN PRESCHOOLERS - TRADITIONAL VS DYNAMICAL SYSTEM MODEL

Serbetar, I., Kranjcina, Z., Kurtanjek, M.

Teachers College Petrinja, Croatia

INTRODUCTION: Coordination data were gathered on basis of two different approach. First, children were measured in «traditional» motor tasks where the outcome was measure of time how fast can child accomplish complex motor task while the second task was from dynamical system perspective. The authors were interested if there are any connections between variables from two models.

METHODS: The sample comprised from 23 children in the age of 5-yrs.

«Traditional» coordination motor tasks were taken from the battery MOT 4-6 (Zimmer, Volkamer, 1984). They were: crawling under the bench, running after rolling, crawling with the ball, walking back through hoops and rolling the ball around the hoop. «Dynamic pattern» movement tasks were composed of isolated cyclical flexion-extension movement of the wrist and the ankle on the both sides according to the isodirectional and nonisodirectional mode. During isodirectional coordination, both limb segments were moved in same direction, while during nonisodirectional coordination segments were moved in opposite direction. The movement were paced by metronome on frequency of 1 Hz whereby full movement cycle was completed on every second beat. Movement was controlled visually and correctly performed cycles were counted.

RESULTS: Since analysis of variance didn't revealed any significant differences between boys and girls, further analysis were done with mixed group. Distribution of MOT 4-6 data was normal while in nonisodirectional coordination mode normality curve was significantly flat. Correlations between two test batteries were very low and insignificant. Accordingly, canonical correlational analysis failed to establish association between subsets of data.

T test applied on variables of hand-foot rhythmic coordination showed that significant differences exists between all variables in that subtest ($T = 4.75 - 8.60$, $p < .001$). Children performed poorly in nonisodirectinal mode on both side, which can be explained developmentally although there are also evidence from many studies (Amazeen & Amazeen, 1998; Serbetar & Sertic, 2004.) that in-phase mode is much more stable than the anti-phase mode. Children simply could not maintain or even started the movement, and anti-phase heavily switched into in-phase. Young children have week coordination regime (Fitzpatrick et al. 1996) and lack of connections establishing between the data from two measurement models confirmed again well known fact that the problems of movement coordination are extremely difficult to explain and resolve.

REFERENCES

1. Amazeen, P., G., Amazeen, E., L. (1998). Breaking The Reflectional Symmetry Of Interlimb Coordination Dynamics. Journal of Motor Behavior, 30 (3).

2. Fitzpatrick, P., Schmidt, R. C., Lockman, J.J. (1996). Dynamical Patterns in the Development of Clapping. Child development. 67, no. 6.

3. Serbetar, I., Sertic, J. (2004). Inter-limb Coordination of Children Aged Ten. Teachers College, Petrinja.

EXAMINATION OF A MODEL OVER SELF-CONTROLLED MOTION-LEARNING

Bund, A., Ferwagner, D.

Technical University of Darmstadt, Germany

Introduction: Self-controlled motion-learning occurs, if the learner has control over at least one component of the learning process (e.g. the use of learning hardware). The few studies on this topic show a consistent pattern. This is what the pattern says: In short-term, especially in the time when things just learned are still only being exercised, there are no significant differences between the self-controlled learning groups and the non-self-controlled learning groups in their performance skills. Nevertheless in longer-term, in a retention test, the self-controlled groups show significant better skills than the externally-controlled groups. Until now there is no conclusive explanation for this phenomena. Bund and Wiemeyer (i.R.) assume in a model, that while learning self-controlled the motivational and cognitive processes have an antagonistic effect: A higher learning motivation is compensated by a higher cognitive demand. Only in the retention test, when there is no more self-controlling necessary, the advantage of this form of exercise shows. The following learning-experiment was used to check this model with empirical means.

The learning experiment: Students of difference faculties (N=48, M=23,67 years) had to learn a baseball specific target-throw with the non-dominant hand. A learning-phase of 100 throws in two days was followed after 4 days by a retention test with 20 throws. Target misses (MRE) and quality of the movement execution as dependent variables were determined.

The model examination took place through constitution of the following groups of learners: 1) self-controlled feedback; 2) externally controlled feedback (parallel group to 1); 3) self-controlled feedback with additional demotivation notice; 4) externally controlled feedback with additional demotivation notice (parallel's group to 3). From the model the hypothesis can be derived, that the groups 3 and 4 show worse exercise achievements than the groups 1 and 2, while in the retention test the self-controlled groups of 1 and 3 come off well better than the external regulation groups 2 and 4. The following reports only the results on the target misses.

Results and discussion: All groups of learners improved their achievement during the exercise course(day: $F(1,44)=9.24$, $p<.01$; Block: $F(9,396)=11.56$, $p<.01$). In the process group specific effects stepped on (day x group: $F(3,44)=4.59$, $p<.05$). The post-hoc analysis gives a reference for smaller target misses of the groups 1 and 2 in relation to the groups 3 and 4 on the second exercise day (group: $F(3,44)=5.22$, $p<.05$). In the retention test group 1 improved their achievements better as the groups 2 and 4 ($F(3,44)=6.14$, $p<.01$).

These findings refer to back the acceptance of the model.

ERRORS IN JUDGING "OFFSIDE" IN FOOTBALL AND HOW TO BETTER DEAL WITH IT

Gilis, B., Helsen, W., Catteeuw, P.

Katholieke Universiteit Leuven, Belgium

Several authors proposed the flash-lag effect to explain the errors made by assistant referees (ASR) both in real life (1,2) as well as in computer animations and video clips (3). The most important aim of this study was to examine if offside decision-making in computer animations can be improved with specific instructions and appropriate feedback.

Belgian elite ASR (N=20), who were all involved in professional football, had to assess computer-based offside situations. In these animations, the position of the attacker relative to the offside line was experimentally manipulated. Specifically, for the onside positions, the attacker was 20 and 10 pixels behind the offside line as well as on the offside line. For the offside positions, the attacker was 10 pixels ahead of the offside line. In a first exposure, the participants had to assess a first set of 32 animations. After a 5-minute break they had to assess a second set of 32 similar animations. Eighteen months later, the same ASR had to assess the same animations of set 1 (control condition). Then instructions were given to explain the impact of the flash-lag effect. The animations were shown again and paused at the moment the ball was played. The ASR were provided with their own responses, so that they could compare their answers with the correct ones. Afterwards, they had to assess the animations of set 2 (experimental condition). Six weeks later, a retention test was done with the animations from the experimental condition.

First, the results showed less errors when the attacker was 10 pixels ahead of the offside line than 10 pixels behind the offside line. An equal number of errors was found when the attacker was 10 pixels ahead of the offside line and 20 pixels behind the offside line. This can be fully explained by the flash-lag effect.

More important was to see whether offside decision-making improved with specific instructions. First, no difference was found between set 1 (63.3%) and set 2 (64.8%) of the first exposure. It can be concluded that there is no difference between these 2 similar sets of animations. Second, an improvement was found for the control condition (71.1%). This can be explained by the repeated exposure to the same situations. Third, the better performance in the experimental condition (78.1%) compared to the repeated exposure in the control condition showed that instructions and feedback lead to better decision-making in computer animations of offside situations. Fourth, no differences were found between the experimental condition and the retention test (79.8%). Future research is needed to investigate the relationship between offside decision-making in computer animations and during actual games.

1. Baldo MVC, Ranvaud RD, Morya E (2002). Perception 31: 1205-1210.

2. Helsen W, Gilis B, Weston M (2006). Journal of Sports Sciences (in press).

3. Gilis B, Helsen W, Catteeuw P. Submitted to Journal of Sport and Exercise Psychology.

THE RELIABILITY OF EUROFIT SHUTTLE RUN TEST ON FIVE-YEAR-OLD CHILDREN

Gundersen, K.T., Fiskum, T., Estil, L.

North-Troendelag University College, Norway

The Shuttle run test is a part of the EUROFIT motor fitness test battery, which is recommended for children from the age of six. In Norway the test is also a part of a test battery recommended from the age of four. Even if some reliability studies of the Shuttle run have been made, no reliability studies for specific age groups as young as five years old has been reported. For younger children less or different motivation may influence the test results and reduce reliability. Two studies were carried out in two different kindergarten groups. In the first study (n = 7) the test was carried out in accordance with the standards in the test manual, while the test procedure was changed in the second study (n = 9), in attempt to reduce the influence of motivational variables. The test was scored in accordance with the manual, but in attempt to decrease small sources of error two alternative scoring procedures, involving data reduction, was tried out. The results showed no significant correlations between first and second test in any of the alternatives in study 1 or study 2. It was concluded that for five-year-olds the Shuttle run test is not a reliable measurement when the sample of subjects is small.

Poster presentation (PP)

PP2-10 General I (Physioth./Rehab./Traumat.) 1-2 - "Exhibition Hall"

EFFECTS OF EXERCISE TRAINING ON THE ENDOTHELIUM FUNCTION IN PATIENTS WITH CHRONIC HEART FAILURE

Karatzanos, L., Chatzimichail, E., Karaseridis, A., Anagnostakou, V., Sakellariou, D., Tasoulis, A., Avdikou, M., Pappas, C., Vasiliadis, P., Roussos, C., Nanas, S.

University of Athens, Greece

Exercise training has been an important means of rehabilitation in patients with chronic heart failure (CHF). Furthermore, exercise training has been found to induce favourable effects on endothelium function. This study was designed to investigate the effects of exercise training on endothelial function in CHF patients.

Sixteen stable CHF patients [(Μ±S) 57.2±9.4 years, VO2peak: 15.7±6.4 ml/kg/min] participated in an exercise training program for 12 weeks, 3 times/week. Participants were randomly assigned to either aerobic (AG, n=7) or combined group (CG, n=9), which included aerobic and strength training. Aerobic exercise was performed in interval type on cycle ergometers. Strength training involved exercises for various muscle groups of the legs, the shoulder zone and the arms. Both regimes were of the same duration. The endothelial function was assessed at the beginning and the end of the program with 'flow-mediated dilation' at the right brachial artery (Welsch et al., 2002). The diameter of the artery was evaluated with ultrasound before and after 5-min occlusion. Variable was the difference of the artery diameter in absolute (DDabs) and relative (DDrel) values.

In concern to DDabs, the whole cohort was improved significantly from 4.1±1.7 to 5.7±5.7 mm ($p<0.05$). The CG (from 3.6±1.7 to 6.2±1.6 mm) tended to improve more the AG (from 4.9±1.6 to 5.0±1.2) ($p=0.06$). In relation to DDrel, the whole cohort tended to improve significantly (from 9.1±4.2 to 12.3±3.2 %, $p=0.8$). The CG (from 7.7±3.5 to 13.3±3.8 %) also tended to improve more than the AG (from 11.0±4.5 to 10.9±1,7 %) ($p=0.07$).

Exercise training seems to affect favourably endothelial function in CHF patients. A combined regime of strength and aerobic regime may be more effective than a regime mostly aerobic. These findings need to be further investigated in a larger cohort.

Welsch, M., Allen, J., and Geaghan, J. (2002). Stability and reproducibility of brachial artery flow-mediated dilation. Medicine and Science in Sports and Exercise, 34, 960-965.

AN ADAPTED EXERCISE PROGRAM IMPROVES PERFORMANCE OF ELDERLY PERSONS WITH MENTAL DISABILITIES

Peters, C., Schoenfelder, F., Ohanian, J., Zalfen, B., Wacker, E., Michna, H.

Technical University of Munich, Germany

Introduction

Rehabilitative and preventive effects of adapted physical activity are very important for elderly people to age healthy and to keep independency. Therefore, we developed an exercise program for elderly handicapped persons with mental disabilities. Furthermore, we wanted to ascertain if training may improve physical performance or quality of life.

Methods

In co-operation with the Federal Association of Lebenshilfe in Freising/Germany 7 male and 21 female persons (52 +/- 9,4 years old) with mental disabilities were engaged under the following conditions: minimum age of 40 years, capability to follow simple instructions and non-activity in other sports.

An exercise intervention was implemented over 11 month and split up in 5 emphases: balance and gait, internal and external perception and relaxation, force of the upper and lower extremities, coordination of eye and hand movement and endurance. Participants were divided into 4 groups and instructed once a week during 60 minutes with basic exercises and games. To evaluate training effects before and after the intervention endurance performance (2-minute-walk), keeping balance, traction and pressure-force of the arms, leg-force (3-chair-rise), reaction-time on a visual sign, tapping (number of footsteps during 30 seconds), peak expiratory flow and activities of daily living were examined.

Results

Participants improved significantly in most of the tested parameters: the distance accomplished during the 2-min-walk increased significantly (74,7 +/- 32,8 to 99,3 +/-49,8 m), balance-time enhanced (from 48 +/-22 to 60 +/-23 sec) ($p < 0.05$) and the amount of footsteps during 30 seconds raised (from 58,3 +/-30,2 to 72,1 +/-27,5) ($p < 0.05$). Furthermore, the time needed to rise 3 times from a chair decreased (from 17,0 +/-8,9 to 9,5 +/-6,0) ($p < 0.05$) and reaction-time shortened (from 1,91 +/-1,19 to 1,39+/-0,75 sec) as well as peak expiratory flow augmented from 298 +/-132 to 359 +/- 134 l/min ($p < 0.05$). Only a slight decrease was found in traction-force and pressure-force.

Discussion

Although other studies observed positive effects of controlled exercise with training three times a week for periods of several weeks in similar populations (1, 2), performance of our cohort improved significantly in most tested parameters by training only once a week. Feed back of the participants in regard to lesson contents was also positive. For elderly people with mental disabilities we can conclude from our findings that even with moderate exercise once a week general fitness may be improved.

Literature

1. Carmeli E, Bar-Chad S, Lotan M, Merrick J , Coleman R: Five clinical tests to assess balance following ball exercises and treadmill training in adult persons with mental disabilities; J Gerontol A Biol Sci Med Sci

2. Tamar H, Hsieh K, Rimmer J: Attitudinal and psychological outcomes of a fitness and health education program on adults with down syndrome, Am J Mental Retard.

ASSESSMENT OF STATIC AND DYNAMIC BALANCE OF FEMALE VOLLEYBALL ATHLETES WITH ERROR SCORING SYSTEMS

Enangelodimou, A., Athanasopoulou, E., Tsipropoulou, A., Barzouka, K., Athanasopoulos, S.

National and Kapodistrian University of Athens, Greece

Introduction: Maintaining postural stability is a complex process. The neural system receives afferent information from the visual, vestibular and somatosensory system, integrates them and coordinates the appropriate musculoskeletal responses, so that balance is achieved. The majority of injuries in the lower body of athletes in volleyball are due to loss of balance, during the landing phase. Injuries, incomplete rehabilitation or insufficient training can all have an effect on sports performance causing kinetic dysfunctions.

Purpose: To assess the dynamic balance of female volleyball athletes; to correlate this balance with injuries of the lower body and the playing position; to investigate static balance in single-leg stance on the dominant leg, on the non-dominant and tandem stance and in three different conditions: open eyes, closed eyes, closed eyes with head extension (3*3=9 stance variations); the extent to which static balance is affected by lower body injuries; the relationship between errors in static and dynamic balance tests.

Method: In the study 27 female volleyball athletes participated. Their somatometric characteristics and lower body injuries were recorded. The assessment of dynamic balance was performed through an error-scoring system test with "multiple single-leg jumps". The static balance was assessed using also a balance error scoring system, according to which the number of predefined errors was recorded in the nine stance variations.

Results: The statistical significance of errors between the two injury groups (major injuries N=13 and moderate-minor-none N΄=13) was 0.069 (p=0.05), indicating a trend between injuries and balance errors in the dynamic test. No statistical differences were found when comparing the playing position of the three groups with the total number of errors in the dynamic balance test as well as with the individual landing and balancing errors. Significant differences were found when comparing the errors in the three conditions of afferent information, in both injury groups. The t-test between the two groups, in each of the 9 conditions, showed no significant differences. In contrast, the t-test of the errors in the three stance conditions, regardless of afferent information, showed statistical difference between the tandem stance and the other two conditions (p=0,05).

Conclusion: These results indicate that the balancing mechanisms were not affected by the magnitude of the lower body injuries or that the latter were restored, taking into account that in every stance condition the same balancing strategies were recruited in both injury groups. The proprioceptive deficits were probably insignificant and did not affect the balancing ability. Even if significant deficits existed, these were counterbalanced by increased proprioceptive information from the anatomic structures of adjacent joints of the injured areas or from other mechanisms in the central nervous system.

CHRONIC EFFECTS OF COMBINED EXERCISE TRAINING ON RESTING METABOLIC RATE IN MEN SUFFERING FROM CORONARY ARTERY DISEASE

Bento, T. 1, Santa-Clara, H. 1, Almeida, J. 1, Fernhall, B. 2

1 Faculty of Human Movement, 2 University of Illinois, Portugal

Aging is generally associated with a decline in resting metabolic rate (RMR) partially due to an age-related loss of fat-free mass (FFM). Exercise is believed to have beneficial effects on preservation of FFM and reduction of fat mass (FM). In cardiac rehabilitation these variables are of extreme importance since one of the major goals is to contribute to reduction of risk factors that contribute to progression of coronary artery disease.

The purpose of this study was to determine the effects of 2 years of a combined aerobic- and weight- training (CAWT) exercise program on RMR and body composition of men suffering from coronary artery disease (CAD). Twenty-three (23) patients, enrolled in a cardiac rehabilitation program, aged 40- to 72 years participated in a combined aerobic-and weight- training for 2 years. Subjects performed 30 minutes of aerobic exercise 3 days/week and weight training was performed 2-3 days/week, on non-consecutive days. All variables were evaluated before and after the application of the exercise program. RMR was measured by indirect calorimetry and body composition was determined from dual energy x-ray absorptiometry. There were no significant changes in absolute or relative RMR (pre, 0,13 L.min-1; post, 0,14 L.min-1, p>0,05 and pré, 1,69 mL.kg-1.min-1; pós, 1,85 mL.kg-1.min-1), and CAWT exercise program resulted in a significant decrease of respiratory quotient (pré, 0,86 +/- 0,0 VCO2/VO2; pós, 0,81 +/- 0,05 VCO2/VO2, p<0,05). There were no changes found in FFM values (whole body: pre, 55,8 +/- 4,5 kg; post, 55,2 +/- 5,0 kg; or trunk region pre, 27,2 +/- 2,6 kg; post, 26,6 +/- 2,6 kg) . These results suggest that combined exercise training contributes to maintenance of RMR values, preservation of FFM and FM (whole body and trunk region) and decrease in respiratory quotient revealing a significant increase in fat oxidation. This type of exercise training appears to be effective for reduction of the CAD risk factors associated with increasing FM.

THE EFFECTS OF REHABILITATION PROGRAM ON LUMBAR EXTENSION MUSCLE STRENGTH, BONE MINERAL DENSITY IN OPERATION PATIENTS OF LUMBAR DISK HERNIATION

Gi Duck, P., Sung-Bum, J.

Namseoul Univ. Keimyung University, Korea, South

The purpose of this study is to evaluate the effects of rehabilitation program on lumbar extension muscle strength, bone mineral density in operation patients of lumbar disk herniation.

Subjects was divided in to 4 group(control group, exercise therapy group, exercise therapy group+kinesio taping and aquatic rehabilitation group) from 32 operation patients of lumbar disk herniation.

The patients were treated with exercise therapy, exercise therapy+kinesio taping and aquatic-rehabilitation for 12 weeks and the effects on body composition, lumbar extension muscle strength, bone mineral density have been evaluated.

The body composition, lumbar extension strength, bone mineral density will be organize the statistical treatment. SPSS 12.0 statistical program will be utilize.

The changes of body composition

The body weight, fat mass and %body fat was significantly lower in aquatic rehabilitation group as before and after applying(p<.05). And lean body mass was significantly higher in exercise therapy, exercise therapy+kinesio taping and aquatic rehabilitation group as before and after applying(p<.05).

2. The changes of lumbar extension muscular strength

The lumbar extension muscular strength from 0° lumbar flexion angle was significantly higher in exercise therapy, exercise therapy+kinesio taping and aquatic rehabilitation group than control group(p<.05). And the lumbar extension muscular strength from 12° 24° lumbar flextion angle was significantly higher in therapy+kinesio taping group than control group(p<.05).

The lumbar extension muscular strength from 30°, 48°, 60°, 72° lumbar flexion angle was significantly higher in exercise therapy, exercise therapy+kinesio taping group than control group(p<.05). But the lumbar extension muscular strength from 36°, 48° was significantly higher in therapy+kinesio taping group than aquatic rehabilitation group (p<.05).

3. The changes of bone mineral density

The bone mineral density of pelvis, lumbar, total was significantly lower in aquatic rehabilitation group as before and after applying(p<.05).

To conclude, Applying of exercise therapy, exercise therapy+kinesio taping and aquatic rehabilitation program for operation patients of lumbar disk herniation will be effectively appeared to improvement of lumbar function and decreasing of pain. Especially, exercise therapy+kinesio taping program component program will be applied to improvement of lumbar function and decreasing of pain has effective much bigger. And aquatic rehabilitation program effectively appeared to positive effects blood lipid factor and bone mineral density. For this example of research operation patients of lumbar disk herniation reformed program the severe effect of evidence with the patients diagnosis establishment basis.

In short, in such a case of applying lumbar disk herniation for the operation patient I think this would be more help for the sake of health and rehabilitation for everyone.

PROGRESSIVE EXERCISES IMPROVED MOTOR PERFORMANCE OF THE ARM IN CHRONIC EPICONDYLITIS

Pienimäki, T., Kauranen, K., Tarvainen, T., Siira, P., Vanharanta, H.

Finnish Institute of Occupational Health, Oulu, Finland

Chronic epicondylitis causes a worsened function of the arm noted in clinical, pain, muscle strength and also in motor performance which has been showed. The aim of this study was to investigate the effects of progressive exercises on motor performance of arms in epicondylitis.

Fifty-three patients, 19 males, 34 females, mean age 42 years, with chronic epicondylitis and 53 healthy controls participated the study. After clinical examination, motor performance (MP) of the upper extremities was tested in the patients and controls using the Human Performance Measurement System/Basic Elements of Performance (HPM/BEP)-device (HPM Inc., Arlington). Reaction times (RT), speed of forward (FWD) and lateral (LAT) movement, accuracy (ACC) and coordination (COORD) as a result of speed of movement and accuracy (% of correct hits) were taken for analysis. Because epicondylitis causes bilateral decrease in MP, each patient had a gender and age ( 2 years) matched control from a sample of 200 healthy persons to help evaluation. Maximal isometric grip strength (GS) was tested with a dynamometer (New-Test, Oulu), pain thresholds (PPT) with a dolorimeter (FS-Products, Hyvinkää) on humeral epicondyles and the arcade of Frohse, pain using a questionnaire (PQ) with VAS and pain drawing (PD). The measurements were taken before and after the the 8 weeks´ four-step progressive home exercise program, which was trained and controlled by a physiotherapist.

The rehabilitation resulted in significant improvements (p<0.01) in all PQ scores, PD and manual tests, in 35 % increase of PPTs of epicondyles (p=0.003), 12 % for those of Frohse´s arcade (ns), 20 % in GS (p<0.001). The patients reached 86-97 % in RTs, 56 % in FWD, 67 % in LAT, 109 % in ACC and 99 % in COORD of the values of controls. 37 % of the patients showed decrease in MP, 27 % had a moderate and 36 % a good improvement in MP items. The good result in RTs was associated with negative palpation (p=0.015) and improved GS (p=0.02), in FRW and LAT with improved manual tests (p=0.02), PD (0.013) and sleep disturbance (0.005), ACC with improved manual tests (p=0.007) and COORD with improved GS (p=0.03). Declined MP showed a poor result.

Progressive exercises used in this study resulted in improved MP of the arms. The associations between MP and other measures show that good RTs require painless elbows in palpation, a good LAT or FRW negative manual tests and a good COORD significantly improved GS. It remains unclear which is the optimal rehabilitation to good response in MP levels. Improvement in MP was lesser than in other measures because all patients did not response. According to the results the rehabilitation of epicondylitis must also include coordinative exercises besides the normal stretching strengthening programs and pain relief.

REFERENCES 1) Pienimäki et al. Arch. Phys. Med. Rehabil. 78;10:1092-5, 1997. 2) Kauranen et al. Perceptual and Motor Skills 82:515-25, 1996.

CONVENTIONAL INCREMENTAL EXERCISE TEST PROTOCOL UNDERESTIMATES PEAK OXYGEN UPTAKE DURING STIMULATED CYCLE ERGOMETRY IN PARAPLEGIA

Berry, H., Perret, C., Hunt, K., Grant, S., Saunders, B., Allan, D., Kakebeeke, T.

University of Glasgow, United Kingdom

Introduction

Incremental exercise test (IET) protocols for determination of peak oxygen uptake (VO2peak) during stimulated cycle ergometry in paraplegia have been designed [3] in accordance with those for volitional cycling where VO2 increases approximately linearly with exercise work rate until the highest VO2 is attained [1]. Maximal incremental stimulated-cycling tests, however, terminate when stimulation saturates and power plateaus or even falls. The VO2 value at this point is taken as VO2peak for the test. Subjective observations during stimulated cycle training sessions suggest, however, that higher VO2 values are achieved during training than during an IET. The aim of this study was to compare the VO2 attained during a stimulated cycle training session at maximum possible resistance with the peak value achieved during an IET, to determine if the IET VO2 represents the subject's highest VO2 for this exercise modality.

Methods

3 motor-complete paraplegic subjects (2 male, 1 female, lesion levels T7-T9) were monitored during a stimulated cycle training session (10 min warm-up with minimum resistance, 50 min pedalling against maximum possible resistance to maintain 50 rpm). Cardiopulmonary responses were recorded and compared to those of a corresponding work rate and cadence controlled IET.

Results

Training session VO2peak was 118-127% of that measured during the IET. Average VO2 during the last 15 min of the session was 103-112% of the peak IET value. VO2peak was attained after 40-53 min of exercise during training and after 10-13 min during the IET.

Discussion

The fact that the training sessions elicited both a higher peak and mean VO2 than the IET peak value indicates that the IET value underrepresents peak VO2 for this exercise modality. A possible explanation for these findings may be that the slow aerobic responses of SCI subjects result in an inability to attain a representative maximum in an IET. During stimulation, both anaerobic and aerobic motor units are progressively and synchronously recruited in a non-selective manner [2] to meet the incrementing reference power demand. The recruitment of anaerobic motor units is likely to promote fatigue before the aerobic mechanisms have had time to operate maximally.

Conclusion

The VO2 value at stimulation saturation during an IET does not represent the peak VO2 attainable by an individual during stimulated cycle ergometry. Investigation of IET tests with longer durations at each power level and/or continuation after stimulation saturation may be worthwhile as these amendments may elicit higher VO2 values.

References

[1] American College of Sports Medicine, (2000) ACSM's Guidelines for Exercise

Testing and Prescription

[2] C.M. Gregory & C.S. Bickel, (2005) Physical Therapy, 85(4):358–364.

[3] K.J. Hunt, B. Stone, N.O. Negard, T. Schauer, M.H. Fraser, A.J. Cathcart,

C. Ferrario, S.A. Ward, and S. Grant, (2004) IEEE Trans Neur Sys Rehab Eng, 12(1):89–101.

ROLE OF PHYSICAL EXERCISES IN REHABILITATION PROGRAMME OF MULTIPLE SCLEROSIS

Rusu, L., Vasilescu, M., Paun, E., Dragomir, M., Danoiu, M., Ciocanescu, D., Diaconescu, D.

University of Craiova, Romania

Multiple sclerosis(MS) can go to severity stadies if the rehabilitation programme begin to later.Also is important to inlcude in rehabilitation programme physical exercises. The aim of this study is to present the role and efficency of physical exercises in rehabiliattion programme, and also the role of a good assesment during this programme.

Material and method: The study including 20patients with age between 20-55years. They are in different stadies of MS but 17 patients are in first stady. Assesment of subjects including: clinic evaluation(fatigue, muscle force, mobility, coordination, balnces, ROT, optic nevrite), assesment of spasticity using Ashworth sclae(0-5), muscle spasm scale, neuromusucular function including gait and ADL activities. Also we evaluated muscle fatigue using EMG parameters like amplitude and frequency and assesment of effort capacity because we measured VO2max consumption. Rehabilitation goals are: decrease spasticity, increase effort capacity using aerobic exercises, increase muscle force , mobility and flexibility, increase balances. We used RIC method that include 120 exercises and that have 3 principles: intensity, constant and personalised programme. Programme has the next structure: aerobic exercises, manual stretching, passive mobilisation, active movements from all posture, global movements form ADL activities, balances exercises using Bobath posture and Bobath ball, The RIC method has first phase that has analytic exercises, second phase for integration the first motor aquisition and skills, third phase for improvement automatic movement and increase the balance during gait at orthostatic posture. Programme has been applied 5days/week, during 45min, during 3months, after that we made a new evaluation.

Results: After 3month we observd the increase of fatigue resistance and effort capacity that are most important aspects in rehabilitation of MS patients. Also we observed that VO2max increase form 30% to 60%, mobility increase with 10%, spasticty goes from level 3 at level 1, muscle force, balance and stability have a good evolution and muscle fatigue are at minim level. EMG parameters, index of muscle fatigue show us a good evolution.

Conclusions: Apply each day the kinetic rehabilitation programme at MS patients, between 2-4clock p.m., improve the resistance at fatigue, increase effort capacity and help to development the muscle force and mobility. Also complex rehabilitation programme can help patients to functional improvement for development ADL activities and to be independent for long time.

References:

1.HCFA Resident Assessment Protocol: Falls. RAI version 2.0 Manual. Oct 1995. C-54 to C-57. Spasticity Study 2.Group: Spasticity: Etiology, Evaluation, and the Role of Botulinum Toxin Type A. Muscle & Nerve 1997; 6 (Suppl): S1-S231.

3.Zafonte RD, Elovic E, Grabois M, eds: Spasticity and abnormalities of muscle tone. In: Garrison SJ, Grabois M, Hart KA, Lehmkuhl DL. Physical Medicine and Rehabilitation: The Complete Approach. 1st ed. Blackwell Science; 2000:848-56.

FUNCTIONAL ELECTRICAL STIMULATION FOR CYCLING OF PARAPLEGICS: INDIVIDUAL ADAPTATION OF THE CLINICAL ENVIRONMENT IN HUNGARY

Szecsi, J., Fincziczki, A., Laczko, J., Klauber, A.

Semmelweis University, Faculty of PE and Sports Sciences, Budapest, Hungary, Hungary

Introduction: At the beginning of 2003 the first German feasibility study of Functional Electrical Stimulation (FES) propelled cycling with 7 completely paraplegic patients was started at the Neurological Department of the University of Munich. In spring 2005 the pilot investigations were extended to the Rehabilitation Department of the MAV Hospital in Budapest. To fully benefit from the well known advantages of leg propelled FES-cycling, paraplegic patients need to exercise not only at the hospital or laboratory of Munich, but also in other institutes like the Hungarian rehabilitation centres, and also at home with home-trainers that they either own themselves or their health insurance provides. Thus there is a practical and economical need to fit rapidly a diversity of devices to different patients at different locations.

Goal: The goal of our study is to extend the measurements in Hungary with the realization of their individual features and different devices, by finding a convenient method for fitting of patient characteristics and device parameters in Hungarian clinical environments.

Methods In the experimental part of this work we extended one of the commercially available tricycles by adding a torque-measuring sensor (ATI, USA) and changing the pinion gear and the drive chain, transforming the tricycle to a torque measuring testbed for determination of the individual torque profiles (drive profile) of the six stimulated muscle groups (quadriceps, gluteus, hamstrings) of the patient. Further, mechanical simulations were performed to characterize tricycles and ergometers used in FES-cycling by means of specific load profiles. These profiles are dependent on the rotational speed, and the geometrical-, inertial- and frictional properties of the respective tricycle (ergometer).

Results: By comparing the drive profile of the individual patients and the load profile of the device it was possible to determine whether the patient is capable of FES cycling on a particular device, and if yes, to deduce an optimal stimulation pattern. In subsequent validation test series of the 7 untrained complete paraplegic subjects and the 3 Hungarian subjects on the pool of different tricycles and the er-

gometer we noticed in 2 of the 10 subjects a kilometre plus FES-cycling capability, the 2 spastics of the subjects presented a strong acute spastic reducing capability, and 7 patients showed a fluid cycling gait with covered distance in the range 400-1800 m.

Conclusion: The study formed a practical fitting method of the technical system (load) to patient (drive). It builds on a physiological model, informing the physician or physiotherapist about the actual physical condition of the patient. We tried this method with 3 patients in the MAV hospital. One of them was in especially good condition, 3 years after the accident. Since our method has been introduced in Hungary, this patient used the tricycle in laboratory environment and in open air, in the city traffic.

CONTROL OF CYCLE ERGOMETER TRAINING INTENSITY BY MEANS OF BLOOD LACTATE CONCENTRATION DETERMINATION DURING CARDIAC REHABILITATION

Traninger, H., Harpf, H., Harpf, L., Harb, S., Tscheppe, G., Wonisch, M., Hofmann, P.

Institute of Active Exercise Therapy Eggenberg, Graz, Austria

Introduction: Training intensity must overreach a certain threshold but training effect is higher with increasing intensity. On the other hand, too high effort can be hazardous and must be avoided. Therefore, defining the optimal exercise intensity remains a difficult task. Furthermore, progression of training intensity during a several months lasting training program is necessary to force adaptive processes.

Aim of the study was to proof lactate steady state tests as a method for the validation the training intensity during cycle ergometer training in CHD patients.

Methods: Before starting the training program 105 patients (100 male, 5 female) performed a symptom limited incremental cycle ergometer test to define the individual training intensity. The target intensity for training was set at 75 – 85 % of the heart rate (HR) at the heart rate threshold. To control the chosen intensity a lactate steady state (LSS) test was performed in each patient. Within one 30 minutes endurance exercise training, capillary blood was collected before exercise (La1), in the 5th (La2), 15th (La3), and 25th min (La4) as well as at the end of the test (La5) (BIOSEN C_line sport)

Results: 72 out of 105 patients presented a lactate steady state (Laststst) with a constant La concentration between La3 and La5 (changes in La <0,5 mmol.l1). 21 presented a significant decrease (Ladecr) between La3 and La5 (change > 0,5 mmol.l1 (p=0,001), and 12 patients showed a significant increase (Laincr) between La3 and La5 greater that 0,5 mmol.l1 (p=0,001). The maximal La concentration at the end of exercise (Ladecr: 2,4+1,0; Laststst: 2,5+1,1) was significantly higher in the Laincr patients reaching 5,0+2,0 mmol.l-1. The intensity of training load was not significantly different between groups (Laststst: 59,4+10,8 %Pmax; Laincr: 65,5+8,3 %Pmax; Ladecr: 60,9+ 9,4 %Pmax). Average heart rate during training load was not significantly different between groups (Laststst: 76,2+9,2 %HRmax; Laincr: 79,3+7,9 % HRmax; Ladecr: 77,7+8,0 % HRmax).

Discussion: Physical exercise is one of the most important cornerstones in cardiac rehabilitation. A very important task is to prescribe and to control the intensity of exercise training. Guidelines for exercise training intensity prescription have a wide range which makes it difficult to choose an individual target training intensity. Even with a very sophisticated individual determination of training intensity using the heart rate turn point method giving comparable %Pmax exercise load an overexertion may occur.

Conclusion: The same %Pmax and %HRmax target training load may lead to overload during exercise training in CHD patients. The control of exercise intensity by means of La measures may be recommended on basis of these results.

References:

1) Leon A S, Franklin B A, Cota F, Balady G J, Berra K A, Stewart K J, Thompson P D, Williams M A, Lauer S. Cardiac Rehabilitation and Secondary Prevention of Coronary Heart Disease. Circulation 211 (2005): 369 – 376.

THERAPEUTIC PHYSICAL TRAINING EFFICIENCY IN AN ORTHOPEDIC SANATORIUM FOR CHILDREN

Kovalenko, T.G., Shklyarenko, A.P.

Volgograd Stat University, Russia

The increase in the number of children and adolescents suffering from scoliotic disease progression (SD) is a serious problem in our society.

This research was carried out from 1992 till 2002 in the local specialized sanatorium for children (Guelendgik town). The approved system of therapeutic physical training helped to increase human organism tolerance towards negative consequences of scoliotic disease progression. According to the anthropometrical research, in the main group positive changes in bearing were combined with body length tachyauxesis by 1,7% in the "sitting position" in comprising with "standing position". In the control group this index is equal to 0,8%. As for the indexes of flexibility and muscle-strengthening endurance, there are no differences between the groups. The examined patients of the main group had positive adaptative changes in cardiovascular, respirator and nervimuscular systems and by the end of the treatment they had a rising lung-capacity, back-strength, muscle-strengthening tolerance back strengthening by 49 sec relative to the physical efficiency (0,4 W/h). In the control group these indexes of course cure rate efficiency were much lower. A decrease in asymmetry level (24%) in the main group was due to rising motion coordination during therapeutic physical training (in gymnasium using orthopedic balloons, in swimming-pools) with the help of special techniques. As for the control group, this index declined by 11% during the therapeutic physical training. Overall effectiveness of bearing correction by the approved physical training techniques in the control group was marked by visual defection adjustment of body constitution. Objectively, it was characterized by reducing of the coefficient average value of body deformation by 2,9 standard units, subjectively, by a positive cosmetic changes in self approval. Shoulder girdle, horizontal scapula evident asymmetries were removed, as well as angles between shoulder girdle and neck, waist triongle and body deviation from the long body axes. Less positive results in bearing correction were due to the torsion decrease in the form of costal humpback. Girls from the control group didn't have positive bearing cosmetic changes during therapeutic physical training.

Cure rate of complex sanatorium therapy was much more efficient when therapeutic exercises were combined with muscle-strengthening exercises using exercise machines and exercises in the water. In the average increased dynamic of back strength after using conventional techniques during therapeutic physical training was 7,2 kg (9%). When patients, besides therapeutic exercises, trained at exercise machines and in the swimming-pools their strength gains were 17,2 kg (29%). Strength index efficiency tripled during the therapeutic physical training. Contractibility and spine stability increased by 12-15%. Long and intensive muscle tension, functional back and stomach muscle capacity grew as well.

AEROBIC FITNESS IN PATIENTS WITH ATRIAL FIBRILLATION BEFORE AND AFTER AV NODE ABLATION SURGERY

Brickley, G., Mullan, P., Beale, L., Dholakia, H., Lloyd, G., Siberbauer, J.

University of Brighton, United Kingdom

Atrial fibrillation (AF) compromises cardiac output and may lead to a reduction in aerobic fitness. Typically patients have breathlessness and palpitations on exertion. Treatment for AF may involve medication and/or surgery. Qualitative research suggests that AV node ablation surgery may improve quality of life. However there is limited information concerning improvements in cardiac function and aerobic fitness following the intervention. The aim of the present study was to determine the changes in cardiac output and aerobic fitness 3 months after AV node ablation surgery in patients with AF.

Methods: Seven patients (5 males 2 females; age: 75± 8.3 y; mass 84.7± 26.5 kg) with existing AF, volunteered to take part in the study. Each subject completed an incremental exercise test on a recumbent exercise bicycle (Tunturi F530, Finland) to exhaustion. Echocardiographic readings were recorded at rest and peak exercise using a commercially available Vingmed system 5 (General Electric, Norway). Three to five consecutive beats of sinus rhythm were measured and the average taken. Images were analysed offline (EchoPAC 6.4.2). Breath by breath expired air was collected via Oxycon Pro (Jaegar, Germany) and analysed using a 5 second rolling average.

Results

Peak cardiac output decreased from (mean± SE) 6.25 ± 0.76 to 5.25± 0.57 L.min-1 post-ablation but this was not statistically significant (t=1.48, p>0.05). There was no significant change in peak oxygen uptake PRE: 1.23± 0.13 to 1.12 ± 0.24 L.min-1 POST and peak Ve 42 ± 5.4 to 41± 4.9 L.min-1.

Discussion

Patients with existing AF have a limited aerobic fitness and cardiac output. AV node ablation surgery does not appear to have altered key markers of cardiac function and aerobic fitness. The small change in cardiac output did not appear to alter peak oxygen uptake. The lack of change may be due to poor existing aerobic conditioning but does not appear to result in further deconditioning. Pacing of the heart was not altered following surgery and more evidence is needed to determine if device therapy may improve cardiac function. Future studies should consider aerobic training conditioning following AV node ablation surgery.

CLINICAL-BIOLOGICAL PARAMETERS IN REUMATHOID ARTHRITIS PATIENTS WITH COMPLEX REHABILITATION PROGRAM

Dragomir, M., Matei, D., Dragomir, M., Traistaru, R.

University of Craiova, University of Medicine, Craiova, Romania

Aim

The objective of this study is to analyse the importance of the correlations between the clinical and biological parameters in the case of rheumatoid arthritis with complex rehabilitation program.

Material and Methods

We observed 54 pacients with rheumatoid arthritis during 2 years, aged between 50 and 69 (an average of 62,55) and the sex proportion F/M=8/1; 8 pacients are entered in the functional class Steinbrocker I, 36 in class II and 10 pacients in class III. The goals of rehabilitation include pain relief, increased range of motion and strength and endurance, prevention/correction of deformities; we used the following methods: education and therapeutic exercise programs, therapeutic modalities, splints and orthotics, assistive device equipment, joint protection and energy conservation techniques and occupational therapy. For each pacient different biological parameters were established: the CRP- reactive C protein, the RF- rheumatoid factor, ESR-erythrocyte sedimentation rate, the titre of the antiCCP- cyclic peptide citrulinated antibodies and of the ANA- antinuclear antibodies. The activity level of the illness was established with : DAS28, the evaluation of the morning stiffness(minutes), of the PAN, SAN-number of painful and swollen joints and of the pain(with VAS 10mm). The results were analised with the medical statistics programme SPSS.

Results

An important correlation was underlined for the functional class towards the anti CCP, RF titre and betwen SAN and the ESR and CRP values. The starting age and the period of the illness proved to be well correlated to the functional class and also the ANA values towards the RF or the oldness of the illness towards the anti CCP and RF. On the contrary, a weak correlation of the morning stiffness towards the ESR and the CRP or towards the RF and anti CCP values was noticed. The activity level of the illness DAS didn't correlate to the SAN, the RF values or the anti CCP.

Conclusion.

The significant correlation between the parameters analised in our study enables the supporting of the necessity for paying a considerable attention to rehabilitative treatment in cases with RA since people who receive this kind of treatment are more likely to be able to be lead an active life and are enabled to participate in work, social and self-care activities. Our results confirm the literature date that exercising for fitness is as important for people with arthritis as for anyone else. If everyone respects the kinetic principles of the rehabilitation program, that are associated with the correct pharmacological treatment, all patients have optima prehension and adequate quality of life.

MEDICAL REHABILITATION PROGRAM FOR PATIENTS WITH CERVICAL MUSCULOSKELETAL SYNDROME

Dragomir, M., Dragomir, M., Traistaru, R., Matei, D.

University of Craiova, University of Medicine, Craiova, Romania

Aim.

Cervical musculoskeletal syndrome (CMS) is one of the pathological conditions what is characterised through stiff neck, headache and chronic neck pain, with or without shoulder-arm pain. These aspects can generate restriction of cervical spine functions and can lead to impairment, disability and handicap. The problems associated with neck pain have medical, social and economic aspects, so benefit from rational management of CMS is expected.

Our study is an attempt to prove the importance of team approach and management / pharmacological, physical and masso-kinetic – in control of CMS.

Material and Methods.

We studied (between October – December 2005) a group of 48 patients (males = 30, females = 18), with mean age of 35,3 years (SD = 13,3), suffering from CMS. The essential means in diagnosis of CMS include elicitation of the history, physical and radiological examinations and laboratory tests. All patients performed the 3 week outpatient rehabilitation program (educational sessions, pharmacotherapy, electrotherapy, physical training), after functional analysis. Each patient was asked to score pain intensity on a 10 point visual analogue scale (VAS) and to fill the adapted Sickness Impact Profile (SIP) at entry into the study (Time 1), after 3 weeks (Time 2) and after 10 weeks (Time 3). Adapted SIP consists of 14 items rated on a three – point 0 – 2, the total score ranges from 0 to 28 (higher scores indicate a greater impact on health changes on daily life).

Results.

The mean scores of VAS and SIP at Time 3 were better (VAS=1,8, SD=0,6; SIP=6,4, SD=1,6) than the mean scores at Time 1 (VAS=4,2, SD=2,4; SIP=18,4, SD=8,2) and at Time 2 (VAS=2,6, SD=1,8; SIP=12,4, SD=6,2). This aspect reflects improvement in pain status and individual's perceptions of physical and psychosocial functioning.

Conclusions.

The successful treatment of CMS including a multidisciplinary approach has a major clinical importance and it's relevance to the overall quality of life. A co-operation between specialists is preferable to one that is merely schematic or limited to one speciality alone. If medical therapy aims at the relief of pain and stiffness in the neck and arms, the cervicothoracic stabilisation requires training and coordination of the muscles in the neck area.

Rehabilitation program is the best method for maintain or perform the unit between all structures of cervical area.

1.Lagattuta F.P., Falco F.J, Physical Medicine and Rehabilitation 1996 W.B.Saunders

2.Vaillant J.,Kinesitherapie Scientifique 1996; 352, 1996, 6 – 11.

EFFECT OF EXERCISE-INDUCED FATIGUE ON ELDERLY KNEE´S POSITION SENSE

Ribeiro, F., Oliveira, J.

University of Porto, Faculty of Sport, Portugal

Background: Aging is accompanied by marked decline in functional performance. Coordination is one component of functional performance that declines during the aging process, in part due to the deterioration of proprioception. Proprioception could also be impaired by physical and mental fatigue.

One of the methods most commonly used to assess proprioception include the determination of joint position sense (JPS). However, to our knowledge no studies have been conducted so far to assess the effects of local fatigue loads on elderly's proprioception.

Purpose: The purpose of this study was to describe the effect of exercise-induced fatigue on elderly knee's position sense.

Methods: JPS was measured at rest and after local fatigue loading of the knee extensor and flexor muscles. Participants in the study were sixteen volunteers males (mean age±SD: 69,81±3,92yrs).

JPS was evaluated by the technique of open-kinetic chain and active knee positioning. Five trials were recorded with a video camera. At a convenient time later, target and response positions of the knee were determined by computer analysis of videotape images of the joint using the Ariel Performance Analysis System software (Ariel Dynamics, CA:USA).

JPS was reported using three measures: absolute error (AAE – defined as the absolute difference between the target position and the response position), relative error (ARE – defined as the signed arithmetic difference between a test and response position) and variable error (VE – determined as the standard deviation from the mean of the relative errors).

The local load applied to the lower extremity consisted of 30 maximum concentric repetitions of the knee extensors and flexors on the isokinetic dynamometer (Biodex System 2) at an angular velocity of 120.s-1 (2.09rad.s-1).

Results: Peak torque of knee muscles significantly decreased from rest (flexors: 41,21±18,94Nm; extensors: 96,99±30,51Nm) to the fatigue (flexors: 31,80±14,61Nm; extensors: 66,47±18,22Nm).

After local load to the knee significant increase of absolute angular error was detected (2,56°). Exercise-induced fatigue had exacerbated the over-estimation of the test position (3,03°) (directional bias in the extension movement). However, the reliability and accuracy to estimate knee angles as showed by the variable error (standard deviation of relative error) is similar in both moments.

Conclusions: This study had showed that exercise-induced muscle fatigue significantly alters knee JPS in old age adults.

Poster presentation (PP)

PP2-11 Biochemistry 1/1 - "Exhibition Hall"

COMPARISON OF THE BLOOD REDOX STATUS BETWEEN LONG-DISTANCE AND SHORT-DISTANCE RUNNERS

Jamurtas, A.Z., Theodorou, A., Stavrakoudi, A., Kostaropoulos, I.A., Nikolaidis, M.G., Ikonomou, G.V., Makrygiannis, V., Papadopoulos, G., Kouretas, D.

University of Thessaly, Greece

Exercise increases the production of reactive oxygen species, which may damage a number of cell constituents. Organisms have developed a sophisticated antioxidant system for protection against reactive oxygen species. Our aim was to compare the adaptive responses of antioxidant mechanisms and the blood redox status of two groups of athletes, long-distance and short-distance runners. Thiobarbituric acid reactive substances, catalase activity and total antioxidant capacity was measured in serum, while reduced and oxidized glutathione as well as their ratio were determined in blood hemolysates. Serum catalase activity ($P < 0.001$), was found three times higher in long-distance compared to short-distance runners (25.4 vs. 8.9 μmol ∙ min-1 ∙ mL-1, respectively), whereas no differences were observed between the two groups in the other markers. Catalase activity was also correlated significantly with maximal oxygen consumption in long-distance runners. In conclusion, we report here that long-distance and short-distance runners exhibit similar blood redox status judged by several oxidative stress indices, except for the much higher activity of catalase in long-distance runners. This different effect of the two training modules on catalase activity of long-distance runners might be partly due to the high oxygen load imposed during their repeated prolonged exercise bouts.

INCREASED OXIDATIVE STRESS INDICES IN THE BLOOD OF CHILDREN SWIMMERS

Kouretas, D., Gougoura, S., Nikolaidis, M.G., Kostaropoulos, I.A., Koukoulis, G., Jamurtas, A.Z.

University of Thessaly, Greece

Despite the wealth of information regarding the effects of exercise on redox status in adults, no study has investigated the effects of chronic exercise on redox status in children. Τherefore, the aim of the present study was to determine the blood redox status of children athletes and compare it with that of age-matched individuals. Seventeen swimmers and twelve non-athletes participated in the present study. All participants were subjected to a maximal oxygen consumption measurement and their diet was recorded for three days before the blood sampling. Reduced glutathione (GSH) was lower by 37% in swimmers compared to non-athletes ($P < 0.01$), oxidized glutathione (GSSG) was not different and their ratio (GSH/GSSG) was lower by 43% in swimmers compared to non-athletes ($P < 0.01$). Thiobarbituric acid-reactive substances concentration was not significantly different between swimmers and controls. Catalase was barely not significantly lower in swimmers ($P = 0.08$). Finally, total antioxidant capacity was found lower by 28% in swimmers compared to controls ($P < 0.05$). In conclusion, we report that children participating in swimming training exhibit increased oxidative stress and less antioxidant capacity compared to untrained counterparts and suggest that children may be more susceptible to oxidative stress induced by chronic exercise.

SALIVARY IGA RESPONSE TO SEVERAL SPORT ACTIVITIES (TREKKING, CANYONING AND ASCENSION TO THE ANETO MOUNTAIN) DURING A WEEK IN THE SPANISH PYRENEES

Teixeira, A.M., Santos, A.M., Oliveira, M., Rosado, M.F., Martins, M., Cunha, M.R.

Faculty of Sport Sciences and Physical Education, University of Coimbra, Portugal

Salivary IgA has been used as a marker for the mucosal immune system status and may decrease after periods of intense exercise (1). Altitude also seems to negatively affect some immunological parameters (2). The aim of this research was to study the salivary IgA (sIgA) response to three different exercise activities at altitude, and to evaluate the recovery time needed to restore the initial sIgA concentration and secretion rate levels.

Eighteen subjects (12 male and 6 female, aged between 20 and 38 years old) participated in the study. Saliva samples were collected as follows: twice on the event day, before breakfast and 2h after the event has finished; a last sample was collected 24h after this collection. Nine collection points were analyzed.

A mountain trekking activity, fulfilled on the 1st day, was accomplished in 4h30min for a 11200m itinerary, with a positive altitude difference of 339m, at an average speed of 2,8Km/h; the mountain climbing activity, fulfilled on the 3rd day, was accomplished in 10h for a 11000m route, with a positive altitude difference of 1340m, at an average speed of 1,1Km/h; the canyoning activity, fulfilled on the 5th day, was accomplished in 6h for a 7000m up itinerary plus the canyon descent, with a positive altitude difference of 230m. On these activities the heart rate registers were as follows: for the trekking activity the average heart beats per minute were 120+14.8hbm-1 and the maximal heart rate average was 181.3+11.1; for the mountain climbing activity the average was 132.7+ 12.9 hbm-1 and the maximal heart rate average was 178.9+2.6; for the canyoning activity the average was 95.8+11.2 and the maximal heart rate average was 155.5+9.9.

Salivary IgA concentration and secretion rates showed statistically significant decreases 2h after the mountain trekking activity, 2h after the mountain climb event (Aneto, 3404m) and 2h after the canyoning descent. 24h hours after these activities sIgA values had not yet recovered, and were still significantly different from the initial values. Recovery was only achieved on the morning of the 3rd and 5th days. This represents a gap of time greater than 40h between the term of the activities and the final collection time points. Day four was a resting day and this caused some differences as higher sIgA values were obtained in the following morning. In the last day, 24h after the canyoning descent, sIgA values were still decreasing and were significantly lower than the ones obtained 2h after that event.

Both the long time duration and high intensity of the activities performed were reflected in the decrease of the sIgA levels. Recovery between tasks took longer than 24h. At altitude, monitoring of the sIgA levels may be of some importance in order to preserve mucosal immunity and to prevent upper respiratory tract infections.

1. Gleeson, M. et al. Exercise Immunology Review, 10:107-128, 2004.

2. Mazzeo RS. Exercise Immunology Review, 11:6-16, 2005.

PLASMA PHOSPHOLIPID FATTY ACID COMPOSITION IN SERBIAN ELITE BASKETBALL AND FOOTBALL PLAYERS

Tepsic, J., Arsic, A., Blazencic-Mladenovic, V., Mazic, S., Malicevic, S., Dikic, N., Glibetic, M.

Institute for Medical Research, University of Belgrade, Serbia and Montenegro

Plasma fatty acid (FA) composition reflects dietary fat intake and endogenous fatty acid metabolism. There are no enough data that describe the effects of high impact professional sports activities on endogenous fatty acid metabolism. The aim of this study was to determine plasma phospholipid FA status of the players who are members of two professional teams: 20 basketball (B) and 20 football (F) players, and to compare the results with data obtained from untrained control group (C). All players were lean (BMI< 25), normolipemic and not on any specific diet. Fourteen lean (BMI< 25), normolipemic, untrained male subjects were included in the study as a control group.

The plasma phospholipid fraction was isolated by thin layer chromatography and fatty acid methyl esters were analyzed using gas chromatography. All results were expressed as means ± SD and analyzed using unpaired Student's t- test, accepting an alpha level of significance ($p<0.05$).

Our results showed that the percentage of total polyunsaturated FA (PUFA) and n-6 PUFA is significantly higher ($p<0.05$) in B group compared to C group. Also the percentages of dihomo-γ-linolenic acid (20:3 n-6) and of arachidonic acid (20:4 n-6) are significantly higher ($p<0.05$) in B group compared to C group.

The percentage of 20:3 n-6 is significantly higher ($p<0.01$) in F group compared to C group. There is no significant difference in total PUFA and 20:4 n-6 between F group and C group, nor there is any significant difference in total SFA, MUFA and n-6 PUFA between sportsmen and control group.

Total monounsaturated FA (MUFA) are significantly lower ($p<0.05$), whereas total PUFA, n-6 PUFA and 20:4 n-6 are significantly higher ($p<0.05$) in B group compared to F group.

Alteration in the percentage of dihomo-γ-linolenic acid indicated that the activity of Δ5 desaturase is increased in basketball players and decreased in football players compared to control group. However, low content of MUFA shows decreased activity of

Δ9 desaturase in basketball players compared to football players. Our results suggest that the type of professional physical activity, such as football, may lead to unfavorable changes in plasma phospholipid fatty acid composition. On the contrary, professional physical activity of basketball players appears to have favourable effect on plasma phospholipid fatty acid profile, possible to their high content of PUFA.

EFFECT OF CHRONIC VOLUNTARY WHEEL RUNNING ON LIPIDS INVOLVED IN THE SIGNALING OF APOPTOSIS IN RAT SKELETAL MUSCLE

Tsalouhidou, S. 1, Petridou, A. 1, Bühlmeyer, K. 2, Michna, H. 2, Mougios, V. 1

1 Aristotle University of Thessaloniki, Greece, 2 Technical University of Munich, Germany, Greece

Exercise modulates several factors that may alter apoptosis in a variety of tissues, although little is known about whether it actually affects apoptosis, especially in skeletal muscle. Two phospholipids, cardiolipin and sphingomyelin, and a second messenger in the sphingomyelin-signaling pathway, ceramide, play important roles in the apoptotic process (1,2). However, there are few studies on the effect of exercise on the content of skeletal muscle in these compounds. The purpose of this study was to examine the content and composition of cardiolipin, sphingomyelin, and ceramide after chronic exercise in rat skeletal muscle.

Eight male Sprague Dawley rats exercised ad libitum for 12 weeks in cages equipped with a wheel, while eight counterparts were housed in plain cages. Upon completion of the training period, animals were decapitated and their gastrocnemius medialis muscles were removed. Lipids were extracted and separated by thin-layer chromatography for the analysis of cardiolipin, sphingomyelin, and ceramide. The fatty acid composition of these lipids was determined by gas chromatography. Differences in concentrations and fatty acid profiles were examined through the nonparametric Mann-Whitney U test, because not all parameters displayed normal distribution, as examined by Shapiro-Wilk test. The level of statistical significance was set at 0.05.

The cardiolipin, sphingomyelin, and ceramide contents of gastrocnemius were not different between trained and untrained rats. Linoleate (18:2ω6) was the most abundand fatty acid of cardiolipin, whereas sphingomyelin and ceramide contained mainly stearate (18:0) and palmitate (16:0). The trained group had a lower percentage of cis-vaccenate (18:1ω7) and a marginally higher percentage of docosahexaenoate (22:6ω3) in cardiolipin (P=0.06). Additionally, the trained group had a marginally higher percentage of 16:0 in ceramide (P=0.06) and a marginally lower percentage of the same fatty acid in sphingomyelin (P=0.08).

Our data suggest that chronic wheel running did not affect the muscle concentrations of three lipids involved in apoptosis. This is in accordance with the findings of the relevant studies on cardiolipin (3,4). Data on sphingomyelin and ceramide are mixed, including increases, no differences, and decreases with training (4-6). Also mixed are the data regarding the fatty acid composition of sphingomyelin and ceramide (5,6) whereas there are no data regarding the fatty acid composition of cardiolipin after training. We are currently investigating the relationship of our findings with apoptosis.

References

1. McMillin JB & Dowhan W (2002) Biochim Biophys Acta 1585:97-107

2. Gulbins E (2003) Pharmacol Res 47:393-399

3. Therriault DG et al. (1973) J Lipid Res 14:54-60

4. Gorski J & Piotrowska MJ (1999) Eur J Appl Physiol 79:421-425

5. Dobrzyn A et al. (2004) J Physiol Pharmacol 55:305-313

6. Helge JW et al. (2004) Exp Physiol 89:119-127.

THE "DOPING DESIGNER STEROIDS" NORBOLETHONE, DMT (AND THG) ARE ANDROGENS (AND A PROGESTIN)

Michna, H., Selg, P.J., Nishino, T.

Institute of Public Health Research, Germany

The so-called designer steroids were detected in a still growing list of Olympic record holders and prestigious athletes. The compound class belong to the list of forbidden steroids prohibited by the IOC and moreover these compounds have never been marketed as a pharmaceutical. In fact, the biological and toxicological activities are unknown. Thus, we set out to completely endocrine pharmacologically characterize the three steroids.

Besides conceiving various chemical possibilities to access structurally modified steroids like Norbolethone, Desoxymethyltestosterone DMT or Tetrahydrogestrinone (THG), we characterized their hormonal potential using modified industrial standard methods like Hershberger and Clauberg assays. The synthesis of Norbolethone, for example, starts with Norgestrel and its nickel-catalyzed hydrogenation (17α-alkine) resulting in Norbolethone. Norgestrel is a totally synthetic progestational agent used in certain birth control pills. There are various chemical possibilities to access structurally modified steroids like Norbolethone beginning with its total synthesis. Originally developed by a US pharmaceutical company in 1966, the project was abandoned a few years later because of unacceptable adverse side effects. Norbolethone is mainly toxic, caused a lot of bleeding disorders and too many androgenizing side effects.

DMT (17α-methyl-5α-androst-2-ene-17β-ol) is an anabolic steroid, which was initially synthesized and patented in 1961 (Huffman MN 1961). The synthesis of DMT starts with epiandrosterone, a natural reduction product of testosterone that is excreted in urine. Epiandrosterone will be reacted with p-toluenesulfonyl chloride and trimethylpyridine to remove the hydroxyl group at C-3 of the steroid ring system. After elimination of hydrochloric acid, a pair of olefin isomers form: the 3-ene and 2-ene. Reaction of these intermediates with methyllithium adds a methyl group to C-17 and converts the keto group there to a C-17 hydroxyl group, resulting in DMT and its isomer. DMT is a potent anabolic compound and therefore it should be considered as a toxic drug. No (anti-)gestagenic, (anti-)estrogenic or (anti-)glucocorticoid potency could be detected.

The synthesis of THG starts with gestrinone and its nickel-catalyzed hydrogenation (17-alkine) resulting in THG. By modifying the 17-position, THG becomes orally active. THG is a very strong anabolicum with an increased risk of liver damage and the incidence of general side effects usually caused by steroids. THG, like other anabolic steroids, exerts androgenic and progestational effects in the standard assays to predict activity in humans.

Norbolethone and DMT exert mainly androgen-anabolic effects, whereupon THG was identified to additionally induce progestational modulations. Therefore, these compounds may induce severe biomedical side effects and must be considered as perilous drugs, especially when used for doping purposes.

THE RESPONSES OF PROGLYCOGEN AND MACROGLYCOGEN TO EXERCISE AND RE-FEEDING: ARTEFACT OF GLYCOGEN EXTRACTION?

Fournier, P.A., Barnes, P.D., James, A.P.

The University of Western Australia, Australia

Nearly 75 years ago, muscle glycogen extracted with acid was shown to exist as an acid-soluble (ASG) and acid-insoluble (AIG) pool. It was only in the early 90's that these differences in acid-solubility were allegedly explained on the grounds that AIG and ASG correspond to proglycogen (PG) and macroglycogen (MG), respectively. Since then, their responses to exercise and diets have been extensively studied using a homogenisation-free acid extraction protocol to separate these pools of glycogen, with AIG being not only the largest pool, but also the most responsive to changes. Our goals were to determine (a) if it is suitable to use such a homogenisation-free acid extraction protocol, (b) if the AIG fraction corresponds to proglycogen, and (c) if AIG accounts for most of the changes in muscle glycogen content in response to exercise and re-feeding. In order to meet these goals, we have optimised a homogenisation-dependent protocol of muscle glycogen extraction, and compared the effect of extraction protocol on the patterns of response of ASG and AIG to changes in total glycogen levels. To this end, a group of 6 young male participants (24.3 ± 2.5 years) were required to cycle for 60 minutes at 70% peak rate of oxygen consumption on a front access cycle ergometer before being fed a carbohydrate-rich diet (10.9 ± 0.6 g per kg body mass) for the next 24 hours. Before exercise and after 0, 2 and 24 hours of recovery, muscle biopsies were taken for glycogen extraction. We found that the homogenisation-dependent extraction of muscle glycogen resulted in a yield of 75.3 ± 2.8% ASG as opposed to 12.7 ± 1.7% ASG using a homogenisation-free protocol. Moreover, there was little evidence that AIG corresponded to proglycogen, since gel chromatography of AIG and ASG fractions displayed similar elution profiles of high molecular weight glycogen, although a small trail of lower molecular weight glycogen was found in the AIG fraction. Exercise caused a fall in total glycogen levels, which increased significantly within 2 hours of recovery and attained above pre-exercise levels after 24 hours. The patterns of response of ASG and AIG to exercise and re-feeding were markedly affected by the protocol of glycogen extraction, with AIG accounting for most of the changes in total glycogen when muscles were extracted using a homogenisation-free protocol. In contrast, ASG accounted for all the changes in total glycogen using our extraction protocol, with AIG remaining at low and stable levels. In conclusion, this study suggests that (1) the homogenisation-free acid extraction of muscle glycogen underestimates the proportion of ASG, (2) AIG does not correspond to a low molecular weight pool of glycogen, and (3) ASG rather than AIG is the glycogen pool most responsive to changes, thus raising doubts about the physiological significance of the findings of most of the previous studies that have examined the responses of AIG and ASG to exercise and dietary manipulation.

IMPACT OF IN VITRO ANOXIA-REOXYGENATION ON RESPIRATORY PARAMETERS OF HEART MITOCHONDRIA ISOLATED FROM IN VIVO DOXORUBICIN TREATED AND ENDURANCE TRAINED RATS

Ascensão, A., Ferreira, R., Oliveira, P.J., Magalhães, J.

Faculty of Sport Sciences, University of Porto, Portugal

It has been described that endurance training (ET) protects cardiac mitochondria after in vivo treatment with Doxorubicin (DOX), an effective broad-spectrum antineoplastic drug characterized by a dose-dependent cardiotoxicity. ET also limits heart mitochondrial dysfunction induced by in vitro anoxia-reoxygenation (AR) and Ca2+ addition. However, the role of ET against AR effects on mitochondria isolated from previously DOX-treated rats has never been explored so far and is the purpose of the present study.

Twenty-four male Wistar rats were randomly assigned into four experimental groups (n=6 per group): saline control (C), DOX administrated i.p. in a single dose of 20 mg.kg-1, 14wks endurance running trained (T) and trained plus DOX (T+DOX). Respiratory parameters (state 3, state 4, ADP/O and respiratory control ratio- RCR) and oxidative damage markers (carbonyl groups and malondialdehyde) were determined in isolated mitochondria before and after 1 min anoxia followed by 4 min. reoxygenation. Levels of heat shock protein 60 kDa (HSP60) were measured before A-R in isolated mitochondria.

Under basal conditions (before A-R stimulus), DOX per se induced a decrease in state 3 respiration and in the RCR and ET improved state 3 and RCR ($p>0.05$). AR significantly impaired the respiratory rates in state 3 and state 4 as well as RCR and ADP/O in C group ($p>0.05$). However, in heart mitochondria isolated from DOX-treated rats no significant changes were observed after AR in RCR and ADP/O, whereas both state 3 and state 4 decreased ($p>0.05$). State 3 and RCR were significantly impaired after AR in T group. State 3 decreased significantly in T+DOX after AR. Significant oxidative modifications of mitochondrial proteins and phospholipids were found in DOX group before AR and only in C group after A-R ($p>0.05$). Basal levels of mitochondrial HSP60 were significantly higher in DOX, T and T+DOX groups than in C (2.5-fold, 2-fold and 1.9-fold increase, respectively).

We therefore conclude that in vitro AR did not further impair the functional respiratory parameters of heart mitochondria isolated from sedentary DOX-treated rats. Thus, ET did not represent additional advantageous contribution for mitochondrial respiratory function against AR in DOX-treated rats. We hypothesize that probable molecular adaptation associated with DOX treatment may also act to further prevent AR-induced mitochondrial dysfunction.

CELL-FREE PLASMA DNA RESPONSES TO RESISTANCE EXERCISE OVERTRAINING: COMPARISON WITH OTHER INFLAMMATION MARKERS

Margonis, K., Fatouros, I., Destouni, A., Jamurtas, A.Z., Kouretas, D., Mastorakos, G., Vrettou, C., Kanavakis, E., Mitrakou, A., Taxildaris, K.

Democritus University of Thrace, Greece

Introduction

Overtraining or overexertion may lead to performance deterioration (1), various physiological maladaptations, and acute breakdown and repair of skeletal muscle that can be described in terms of an acute inflammatory response (2). Currently there is no single biological measurement that is diagnostic of the overtrained status. Cell-free plasma DNA is altered both quantitatively and qualitatively in a variety of inflammatory conditions (tissue injury, cancer, and trauma) (3) and its concentration has been correlated with the severity of injury in trauma and stroke patients (4). In this study we aimed to investigate plasma DNA response as an inflammation marker to a chronic resistance exercise protocol of progressively increased training volume and compared it with conventional indices used for monitoring and quantification of exercise-induce muscle damage.

Methods

Seventeen men (21.3±2.3 yrs) participated in a 12-wk resistance training consisting of 5 separate training periods (T1 through T4, 3 wk/period) of progressively increased training volume (2 d/wk, 2 sets/exercise, 10-12 reps/set, 70% 1RM in T1; 4 d/wk, 4 sets/exercise, 6-10 reps/set, 75-85% 1RM in T2; 6 d/wk, 6 sets/exercise, 1-6 reps/set, 85-100% 1RM in T3; 2 d/wk 2 sets/exercise, 10-12 reps/set, 70% 1RM in T4). Subjects performed 8 resistance multi-joint exercises. Blood samples, collected at baseline (T0) and 96 hours following the last training session of each period, were analyzed for plasma DNA, C-reactive protein (CRP), creatine kinase (CK), and uric acid (UA). Data were analysed by ANOVA repeated measures ($p < 0.05$).

Results

Plasma DNA (GenEq/mL) increased ($P < 0.05$) following T1 (143.5±22.9), T2 (289.9±41.1), T3 (605.7±116.4) compared to rest (31.4±13.8) and returned to baseline thereafter. There was a difference ($P<0.05$) between periods (T2 vs. T1, T3 vs. T2) in plasma DNA values. CRP (mg/L) increased ($P<0.05$) by 300% and 400% after T2 (3.364±1.07) and T3 (4.8±1.04) respectively compared to baseline (0.84±0.17) with no differences between T2 and T3. CK (U/L) increased only following T3 (368.1±44.0 vs. 102.6±19.1). UA (mg/L) increased following T2 (51.2±3.7) and T3 (66.6±5.8) compared to baseline (39.1±4.0) with T3 being more effective ($P<0.002$). Performance increased after T2 and declined thereafter.

Discussion

Results of the present investigation demonstrate that plasma DNA is increased following chronic excessive resistance exercise stress in proportion to training load suggesting that plasma DNA could be a sensitive marker for monitoring and quantification of overtraining-induced muscle inflammation. Cell-free plasma DNA appears to me a more sensitive marker of exercise training stress compared to other inflammatory markers.

References

1. Kreider R et al. (1998) Overtraining in Sport. Champaign (IL): Human Kinetics 47-66.

2. Smith LL (1991) Med Sci Sports Exerc 23:542-551

3. Lam NY et al. (2003) Clin Chem 49:1286-1291

4. Rainer TH et al. (2003) Clin Chem 49:562-569.

DOSE-RELATED EFFECTS OF PROLONGED NAHCO3 INGESTION DURING ENDURANCE EXERCISE

Fatouros, I., Douroudos, I., Gourgoulis, V., Jamurtas, A.Z., Tsitsios, T., Hatzinikolaou, A., Margonis, K., Mavromatidis, K., Taxildaris, K.

Democritus University of Thrace, Greece

Introduction

NaHCO3 ingestion results in increased plasma bicarbonate [HCO3-] levels, a decline in plasma hydrogen [H+] concentration during exercise (1) as well as in enhanced endurance performance (2). Although several studies examined the ergogenic short-term effects of induced alkalosis following NaHCO3 ingestion during endurance exercise, there is only limited information regarding the effects of prolonged NaHCO3 administration of different dosage levels. Therefore, the purpose of the present study was to investigate the effects of two different levels of prolonged NaHCO3 ingestion on extracellular buffer concentration, acid-base balance and performance during an acute bout of short-term, high-intensity exercise.

Methods

Twenty-four men (22 + 1.77yrs, 77.5 + 7.8 kg, 1.79 + 6.6 cm, and a VO2max of 51.03 + 7.53 ml/kg/min) participated in the present study. Subjects were randomly assigned to one of three groups (8/group): control (C, sugar-free mixed fruit placebo), moderate ΝaHCO3 intake (MI, 0.3 gr/kg/d), and high ΝaHCO3 intake (HI, 0.5 g/kg/d). Participants consumed either placebo or ΝaHCO3 for 6 days. pH, HCO3, PO2, PCO2, and lactate in arterialised blood as well as time to exhaustion were determined prior to and immediately following an endurance exercise test (prior to and following the supplementation period) at 75% VO2max to exhaustion. Data were analysed by ANOVA repeated measures ($p < 0.05$).

Results

Time to exhaustion increased ($p < 0.05$) after supplementation only in HI (53.1 + 12.2 to 64.4 + 9.09). ΝaHCO3 ingestion elicited an increased blood lactate (mM) response ($p < 0.05$) following exercise in MI (5.3 + 0.7 to 6.1 + 0.75) and HI (5.3 + 0.6 to 6.4 + 0.4). Resting pH (7.4 + 0.02 to 7.45 + 0.03 in MI and 7.412 + 0.01 to 7.46 + 0.01 in HI) and [HCO3-] (25.7 + 1.01 to 29.78 + 2.7 in MI and 25.81+ 1.3 to 32.35 + 3.1in HI) increased ($p < 0.05$) following ΝaHCO3 ingestion. However, ΝaHCO3 ingestion did not induce any changes in acid-base balance parameters following exercise.

Discussion

Results of the present study indicate that prolonged ΝaHCO3 ingestion may improve endurance performance as previously shown with ΝaHCO3 ingestion of shorter duration (3). Nevertheless, acid-balance status changed only at rest but not during exercise suggesting that the ergogenic effect of ΝaHCO3 may be related to other physiological adaptations. It appears that this ΝaHCO3 effect on acid-base balance at rest and endurance exercise performance is dose-related with higher intakes being more effective.

References

1. Galloway SD et al. (1996) Eur J Appl Physiol 74: 384-389.

2. McNaughton L et al. (1999) Eur J Appl Physiol 80: 64-69.

3. Potteiger J et al. (1996) Int J Sports Med 17 : 7-11.

Poster presentation (PP)

PP2-12 Molecular Biology 1/1 - "Exhibition Hall"

ENDURANCE TRAINING IN HYPOXIA HAS A SPECIFIC GENE EXPRESSIONAL TIME-COURSE AND SIGNATURE

Schmutz, S., Däpp, C., Wittwer, M., Vogt, M., Hoppeler, H., Flück, M.

University of Bern, Switzerland

Hypothesis: Ambient hypoxia makes up an additional stimulus to endurance exercise and activates a gene expressional program which supports mitochondrial biogenesis, myogenesis and capillary neo-formation. This would be reflected by differences in the acute adjustments of the muscle transcriptome in response to a single bout of endurance exercise in hypoxia compared to an analogous single bout in normoxia. Similarly, different steady state adaptations of the transcriptome are expected in response to six weeks of training.

Methods: 5 untrained subjects underwent six weeks of endurance training in normobaric hypoxia (4000m above sea-level) on a bicycle ergometer. A 30-minutes near-maximal bout of exercise in normobaric hypoxia was performed in the untrained as well as in the six weeks trained state. Biopsies from the vastus lateralis muscle were taken before and 1, 8 and 24 hours after both single bouts of exercise. The muscle biopsies were processed for morphometric and gene expressional analysis including 220 selected transcripts. Results were compared to the published alterations in response to endurance training in normoxia (Schmutz et al, Pflugers Arch 451(5): 678-87, 2006).

Results: Endurance training in hypoxia increased the mitochondrial density (86%; $p<0.05$). Similar to six weeks of training in normoxia, the transcript levels of genes involved in the mitochondrial respiration and protein turnover were upregulated. Specificity of training in hypoxia was seen on the molecular level by and upregulation of the transcripts involved in angiogenesis and cell regulation inducing a myogenic response. The generalized gene response to a single bout of exercise in hypoxia in the untrained and in the trained state was different compared to the response in normoxia ($p<0.0001$).

Conclusions: The muscle gene expressional response after endurance exercise in hypoxia is different from that in normoxia. Hypoxia provokes additional steady state level adaptations of the transcriptome. These observations are in line with earlier findings concerning specific muscular adaptations to endurance exercise in hypoxia compared to exercise in normoxia (Vogt et al, J Appl Physiol 91(1): 173-82. 2001).

DNA DAMAGE AND OXIDATIVE STRESS INDUCED BY EXHAUSTIVE EXERCISE IN THE ELDERLY: THE EFFECT OF ANTI-OXIDANT SUPPLEMENTATION

Pittaluga, M., Caporossi, D., Morreale, F., de Perini, A., Fantini, C., Sgadari, A., Tavazzi, B., Parisi, P.

IUSM - University of Sport and Movement Sciences, Rome, Italy

Introduction

Increased sensitivity to DNA damage related to aging can be triggered by the oxidative stress caused by exhaustive exercise (EE) (1,2), the extent of which may be influenced by antioxidant diet content. Among exogenous antioxidants, anthocyanins are known as strong ones. Although there exist data on the effects of such supplementation on DNA damage with and without EE (3,4), little is known about the interplay of these factors in the elderly.

Our aim was to investigate the effect of a 4-week supplementation with red oranges (Citrus sinensis, Sanguinello cultivar), rich in anthocyanidine-3-β-glucosyde, on the DNA damage caused by EE-induced oxidative stress in elderly subjects.

Methods

Plasma levels of 8-OHdG and the rate of micronuclei (MN) in lymphocytes, both reflecting DNA damage, as well as some markers of oxidative stress, were evaluated before, 30' and 24hr after a bout of EE in 15 elderly (69.0±5.1yr) healthy and well-trained subjects. EE was performed on a cycle ergometer (initial load of 25W; increments of 15W/3') and was carried out until volitional fatigue was attained or max HR was reached. EE was performed and blood samples were collected at baseline, and after 4 weeks of supplementation with red orange juice (ROJ).

8-OHdG levels were measured by immunoassay method (8-OHdG ELISA kit, JAICA, Japan). MN rates on 1000 binucleated cells were evaluated on Cytochalasin B blocked lymphocytes. Determination of malonilaldeide (MDA), ascorbic acid (AA), oxidized (GSSG) and reduced glutathione (GSH) was performed by HPLC analysis.

Results

At the baseline, we found no significant response to EE, both for 8-OHdG and MN. After supplementation, both basal and 30' levels of 8-OHdG were unchanged, whereas a significant rise was observed after 24hr (1.89±0.43 ng/ml before vs 3.15±0.1 ng/ml after supplementation, $p=0.032$). Conversely, no change after supplementation was observed for MN.

Considering the absolute changes from baseline to 30', ROJ supplementation determined a significantly lower reduction of AA (-1.09 vs -6.551, $p=0.005$), GSH (-1.324 vs -2.735 $p=0.039$) and a much lower increase of MDA (0.007 vs 0.02; $p=0.001$).

Discussion

Our data demonstrate that ROJ supplementation guarantees a higher redox potential, preserving the depletion of AA and GSH induced by exercise, thereby reducing some markers of oxidative stress (i.e., MDA).

Regarding the DNA damage, our results suggest that supplementation could implement the base excision repair activity, as demonstrated by the rise of 8-OHdG, whose plasma level reflects the amount of damage repaired. The lack of a change in MN frequency after EE could also depend on this effective DNA-repair activity, considering that it represents the expression of a stabilized genotoxic damage escaped from the DNA-repair machinery.

1. Gianni P et al (2004): Exp Gerontol. 39(9):1391-400

2. Polidori MC et al (2000): Int J Sport Med. 21:154-7

3. Riso P et al (2005): J Agric Food Chem. 53(4):941-7

4. Morillas-Ruiz J et al (2005): Eur J Appl Physiol. 95(5-6):543-9.

NEUROTROPHIC FACTORS AND REGULATION OF THE MUSCULAR SYSTEM: THE EFFECTIVE ROLE OF NERVE GROWTH FACTOR ON PROLIFERATION, SURVIVAL AND DIFFERENTIATION OF MYOGENIC CELLS

de Perini, A., Fantini, C., Pittaluga, M., Bonini, S., Parisi, P., Caporossi, D.

University of Sport and Movement Sciences (IUSM), Rome., Italy

Introduction

The skeletal muscle exhibits a remarkable capacity to adapt to physiological demands such as in growth, training, and injury, largely through to a small population of cells, the satellite cells, that in response to specific stimuli become activated, proliferate, and express myogenic markers.

The satellite cell population not only has a remarkable capacity for muscle regeneration but may have clinical applications in the treatment of devastating and deadly diseases such as muscular dystrophy. Denervation is able to produce a form of disuse atrophy that includes myofiber degeneration and is accompanied by distinctive changes in the myonuclei and quiescent satellite cells. So we focused on the importance that neurotrophic factors could have in the molecular mechanisms that regulate the muscular system.

Lead by a therapeutic purpose, the goal of our study was to verify the effective role that Nerve Growth Factor could have on proliferation, survival and differentiation of myogenic cells in order to improve the clinical course following nervous lesion and chronic muscular atrophy.

Methods

We performed an in vitro protocol utilizing L6C5 rat skeletal myoblasts, which retain a remarkable ability to differentiate in culture and in which the susceptibility to cell death induced by free radicals has been already characterized by our group. L6C5 myoblasts were exposed to different concentrations of exogenous NGF (10, 20, 100ng/ml), with or without the H2O2 pulse treatment (100-400μM for 1hr) in order to analyze the influence of the neurotrophic factor on cell proliferation and survival.

Results and Discussion

Our results show that NGF (100ng/ml) determines an increase in myoblasts proliferation up to 12 hr from the beginning of cell culture (68% increase vs NGF free cultures), while the growth rate seems to decline after 24/48 hr from the seeding.

We demonstrate that NGF does not interfere with the mitogenic effect determined by low doses of free radicals (H2O2 1-10μM), and that it can improve the cellular survival when L6C5 myoblasts are exposed to cytotoxic doses of H2O2,. In the treatment with H2O2 50μM, the number of viable cells is 32% over the control when NGF 20ng/ml is added to the culture.

On the other hand, NGF does not seem to protect skeletal myoblasts from oxidative-stress-induced apoptosis. Since spontaneous apoptosis has a major role during skeletal myoblast fusion and myocyte formation, we will discuss the effect of exogenous NGF treatments on the expression of genes involved in muscle differentiation or resistance to apoptosis.

References

1.Erck C et al., (1998); J Cell Physiol 176:22-31

2. Davies, KJA, (1999); IUBMB Life 48:41-47

3. Hawke TJ and Garry DJ, (2001); J Appl Physiol 91:2414

4. Seidl K et al., (1998); J Cell Physiol 176:10-21.

MOLECULAR SIGNALLING IN HUMAN SKELETAL MUSCLE IN THE RECOVERY PERIOD AFTER ENDURANCE EXERCISE

Mascher, H., Garver, J., Andersson, H., Nilsson, P.A., Ekblom, B., Blomstrand, E.

University College of Physical Education and Sports, Stockholm, Sweden, Sweden

Introduction

Following physical exercise there is an increase in protein turnover. The majority of studies are conducted on resistance exercise, there is less known about the effects on protein turnover following endurance exercise. Most studies are carried out using the stable isotope technique or measurements of arteriovenous balance of amino acids that are not metabolised by muscle. To obtain a better understanding of the mechanisms behind these changes in protein turnover, it is necessary to study the molecular signalling inside the muscle. Components of the insulin signalling pathway including Akt, mammalian target of rapamycin (mTOR) and downstream kinases are believed to be important during initiation of protein synthesis (1,2).

Methods: Six healthy men, mean (+/- SE) age 23 +/- 1 yr and maximal oxygen uptake (VO2 max) 3.9 +/- 0.2 l/min participated in the study. The subjects performed cycling exercise at 75% of VO2 max during 1 h. Muscle biopsies from the vastus lateralis were taken before, immediately after and 30, 60, 90, 120 and 180 min after exercise. Phosphorylation of Akt on Ser 473, mTOR on Ser 2448, p70S6 kinase on Thr 389 and GSK-3 on Ser 21/9 was measured in muscle homogenates with Western blot technique using phosphospecific antibodies.

Results: Insulin levels decreased during the cycling exercise, increased 15 min after exercise but decreased again to 30% below resting value. Muscle glycogen content decreased from 380 to 84 mmol/kg dw during exercise and increased slightly to 134 mmol/kg dw at 3 h recovery. Akt phosphorylation was increased 400% at 1 h after exercise and remained elevated for another hour ($p<0.05$) but returned to initial level 3 h post exercise. The phosphorylation of mTOR was increased approximately 300% directly after, 30 min and 2 h into the recovery period ($p<0.05$). No change in p70S6 kinase phosphorylation was found. GSK-3 alpha phosphorylation at Ser 21 peaked at 1 h (about 250%) and was still elevated 3 h after exercise ($p<0.05$). GSK-3 beta phosphorylation at Ser 9 was increased at all time points after exercise ($p<0.05$).

Discussion: The results suggest a possible stimulatory effect on initiation of protein synthesis in the recovery period following an endurance exercise bout. The increase in phosphorylation of Akt and GSK-3 could be related to an increase in glucose uptake and glycogen resynthesis. However, together with the increase in mTOR this could also lead to an activation of the eukaryotic initiation factor eIF2B and thus initiate translation.

References

1. Bodine, S. C., T. N Stitt, et al. (2001). Nat Cell Biol 3(11): 1014-9.

2. Ohanna, M., A. K Sobering, et al. (2005). Nat Cell Biol 7(3):286-94.

Acknowledgements

The study was supported financially from the Swedish National Centre for Research in Sports and from the University College of Physical Education and Sports, Stockholm, Sweden.

PRACTICAL FEASIBILITY OF SPORTGENOMIC INVESTIGATION IN THE FUTURE

Dekany, M., Gyore, I., Nemeskeri, V., Gogl, A., Ekes, E., Pucsok, J.M

National Institute of Sports Medicine, Hungary

Accomplishing of human genome project have started many studies towards the identification of genetic profile of physical performance. Genetic markers that are exclusively associated with elite athletes have not yet been identified. Potential candidate genes might be found in the renin-angiotensin system, which plays a key role in the regulation of cardiovascular physiology. Further investigation have shown strong association alpha-actinin 3 gene which encodes a protein of the Z disk of myofibers with muscle phenotype in athletes. We have studied the polymorphisms of the ACE (angiotensin I converting enzyme) in endurance athletes and in a well trained control group in some endurance phenotype.

The study population comprised 50 endurance athletes (mountain-bikers, triathletes, rowers, fencers, judo, shooters, karate) as well as 26 well trained control subjects. MVVex (expected maximal voluntary ventilation), VE (expiratory minute ventilation) and VO2max (relative aerobic capacity) were determined at rest and during the exercise test. The exhaustive treadmill or rowing step test was used to measure of the physiological parameters by the Jäger system. The mechanism of breathing was accomplished by Jäger Flowscreen-type spirometer at rest. Concentration of blood lactate was measured on the basis of NAD/NADH transformation by spectrophotometry. Genomic DNA was isolated from white blood cells. A khi-square test was used to compare the ACE I/D allele and genotype frequencies between athletes. Differences in age, body weight, body height and physiological parameters among the groups were tested with Student-type t probe.

Between of two groups arranging according to the VO2max/blood lactatemax ratio were significant differences in ACE allele (1. group: 54% I, 46% D; 2. group: 31% I, 69% D) and genotype (1. group: 31% II, 46% ID, 23% DD; 2. group: 0% II, 63% ID, 37% DD) as well. The ACE I allele is a genetic marker that might be associated with higher endurance efficiency and an adaptation level of the cardiovascular system. At the examination of the genotype besides the measuring of acute physical activity it is worth to take into consideration the long-term efficiency of endurance performance also, in the interest of understanding of the more accurate relationship.

Presumably the traditional examination of exercise physiology can be effectively complete an examination of molecular biology which based on genotype determination. The information of molecular biology and the exercise physiology could refer together to the selection of athletes in the future.

EFFECTS OF GENE VARIANTS ON CARDIOVASCULAR SYSTEM OF ATHLETES

Ahmetov, I., Linde, E., Mozhayskaya, I., Astratenkova, I., Prostova, A., Popov, D., Misina, S., Shikhova, J., Montgomery, H.

St Petersburg Reserch Institute of Physical Culture, St Petersburg, SSC RF Institute for Biomedical Problems, Moscow, Institute for Human Health and Performance, London, UK., Russia

Left ventricular (LV) hypertrophy occurs as an adaptive response to a physiological increase in cardiac work in athletes. Previous studies have shown that exercise-induced LV growth in healthy young men was strongly influenced by the PPARA intron 7 and ACE I/D gene variants [1]. Calcineurin B (CnB) is a regulatory subunit of calcineurin (key mediator of hypertrophic response of the heart) and 5I/5D variant of its gene is significantly associated with the presence of inappropriately high LV mass [2]. Suppression of PGC1 (PPARG coactivator 1) gene expression causes mitochondrial defects in myocytes and predisposition to heart failure [3]. We hypothesized that PGC1A Gly482Ser and PPARG Pro12Ala variants may influence structure and function of the heart of elite athletes. We have tested this hypothesis, together with using PPARA intron 7, ACE I/D and CnB 5I/5D genotypes and some physiological data, in the study of elite Russian athletes.

Eighty Russian athletes (all-round speed skaters and rowers; 43 males and 37 females) of national competitive standard were studied. PGC1A, PPARG, ACE, PPARA and CnB variants were determined by PCR and restriction enzyme digestion. Several physiological tests were performed to assess aerobic and anaerobic characteristics of the athletes.

No association was found between PGC1A and PPARG genotypes and any of cardiologic measures of athletes. However, among female rowers, PGC1A Ser/Ser homozygotes showed the greatest value of maximal voluntary contraction of knee extensors compared to Gly/Gly homozygotes (830±120 N vs 710±30 N; P=0.029). On the contrary, for male Gly/Gly homozygotes the anaerobic threshold occurred at 89±4% of VO2max; for heterozygotes and Ser/Ser homozygotes this value was estimated as 83±7% and 80±7%, respectively (P=0.002). These data suggest that the Gly482 and 482Ser alleles are associated, respectively, with aerobic and anaerobic metabolism. The I allele of ACE gene was associated with shorter duration of QRS complex (P=0.039), vertical position of the heart (P=0.045) and maximal values of resting heart rate (P=0.029) in female athletes. As expected, PPARA GC heterozygotes had the largest LV mass index compared to GG homozygotes both among male (110±21 g/m2 vs 70±12 g/m2; P=0.049) and female athletes (83±16 g/m2 vs 46±10 g/m2; P=0.012). Female GC heterozygotes also exhibited greater ventricular stroke volumes than GG homozygotes (80±4 ml vs 68±3 ml; P=0.033). Furthermore, LV mass was higher in female CnB 5I/5D heterozygotes (254±13 g vs 219±6 g; P=0.039) than in 5I/5I homozygotes. In conclusion, the PGC1A variant was associated with physical performance characteristics of athletes, whilst ACE, PPARA and CnB variants were associated with several cardiologic measures.

References

1. Jamshidi Y, et al. Circulation 2002; 105: 950-955.

2. Tang W, et al. Am Heart J 2005; 150: 845- 51.

3. Sano M, et al. The EMBO Journal 2004; 23: 3559-3569.

ACCELERATED GLIAL REACTIVITY TO STROKE IN AGED RATS CORRELATES WITH REDUCED FUNCTIONAL RECOVERY

Moraru, E., Rusu, L.

University of Craiova, Romania

Background and Purpose: Senescence is both a risk factor for stroke and an impediment to recovery. In the aftermath of cerebral ischemia, peri-lesional astrocytes and activated microglia form a glial scar that hinders the genesis of new axons and blood vessels in the infarcted region. Since glial reactivity is known to be augmented in the normal aging brain, we hypothesized that post-ischemic gliosis would be temporally abnormal in aged rats compared to young rats, and would correlate negatively with functional recovery from ischemic stroke.

Methods: Focal cerebral ischemia was produced by reversible occlusion of the right middle cerebral artery in 3 month- and 20 month-old male Sprague Dawley rats, and the functional outcome was studied at 3-, 7-, 14- and 28 days after surgery using a variety of neurologi-

cal and behavioral tests. At each time point, brains were removed, sectioned and immunostained for the microglial marker ED-1, the astrocytic marker glial fibrillary acidic protein (GFAP), the endothelial cell marker rat endothelial cell antigen (RECA) and the oligodendrocytic marker, chondroitin sulfate proteoglycan, (NG2)

Results On all neurobehavioral tests, aged rats were more severely impaired by stroke than were young rats, and aged rats also showed a diminished capacity for functional recovery. Histologically, in young rats there was a gradual activation of both microglia and astrocytes that peaked by days 14-28 with the formation of a glial scar. In contrast, aged rats showed an accelerated astrocytic and microglial reaction that peaked in the first week after stroke. We also noted a strong activation of oligodendrocytes at early stages of infarct development in all rats that persisted in aged rats. Evolution of astrocytic and microglial reactivity closely paralled the time course of scar formation in both young and aged rats and coincided with the stagnation in the recovery rate of aged rats.

Conclusions: These results suggest that a temporally anomalous gliotic reaction to cerebral ischemia in aged rats leads to the premature formation of scar tissue that impedes functional recovery to stroke. A better understanding of the effects of senescence on the plastic response of the brain to stroke is needed to develop effective new treatment strategies.

References:

1. Popa-Wagner A, Schröder E, Walker LC, Kessler Ch. (1998) ß-Amyloid Precursor Protein and Aß Peptide Immunoreactivity in the Rat Brain Following Middle Cerebral Artery Occlusion: Effect of Age. Stroke 29:2196-2202

2. Popa-Wagner A, Schroder E, Schmoll H, Walker LC and Kessler C. (1999b) Upregulation of MAP1B and MAP2 in the rat brain after middle cerebral artery occlusion: effect of age. J Cereb Blood Flow Metab. 19:425-434.

Poster presentation (PP)

PP2-13 Sociology 1/1 - "Exhibition Hall"

INEQUALITIES IN THE USE OF INDOOR AND OUTDOOR SPORT FACILITIES AMONG ADULTS

Serrano-Sanchez, J.A., Sanchis-Moysi, J., Dorado-García, C., Ara-Royo, I., Vicente-Rodríguez, G., Calbet, J.A.

University of Las Palmas, Spain

Background. Different kind of locations, such as natural spaces (beach, sea, mountain, etc), urban spaces (side-walks, city parks, shopping centres, etc), sport-indoor and sport-outdoor facilities, can be used during physical activity (PA). Public institutions spend a lot of money in building and maintaining sports facilities to promote participation in PA and sports. However, few comprehensive studies have been carried out to evaluate the use of different locations for PA. The objective of this study was to explore associations of sociodemographic, geographic, and anthropological variables with the utilisation of different locations for PA. Another aim was to determine the associations of the same variables with the accomplishment of public health recommendations for PA. Methods. A representative sample of the general population of Gran Canaria composed by 3000 adults (18-75 years-old) was interviewed at home. Participants were asked about frequency and duration of use of 8 sport-indoor, 9 sport-outdoor, 7 urban and 6 natural spaces for PA during the last 3 months. PA was assessed using the Minnesota Leisure Time Physical Activity Questionnaire, adapted for Spaniards (1). The use of the four types of locations for PA and the accomplishment of public health recommendations was declared as dichotomous dependent variables. A series of logistic regression analyses adjusted by age, gender, education, occupation, health status, BMI and number of inhabitants were applied. Results. Urban spaces were the most used for PA (64.4%; 95% confidence interval [CI]: 62.6-66.1), followed by natural spaces (26.4%; 95% CI 24.8-28.0%), sport-indoor (20.3%; 95% CI 18.9-21.8) and sport-outdoor (10.9%; 95% CI 9.8-12.1). Age (negatively), gender (male), education (positively), health status (positively) and BMI (negatively) were associated with the utilisation of indoor and outdoor sport facilities, as well as with PA. In contrast, the latter variables were not associated with the utilisation of urban spaces for PA. Associations between characteristics of population and the utilisation of indoor and outdoor sport facilities were stronger than associations between characteristics of same population with PA. Conclusions. Most health-risk groups (obese, elders, lesser education level, etc) of the population had a very low use of sport indoor and outdoor facilities, while these health-risk groups have less difficulty to meet the public health recommendations for PA by using urban spaces. This differential behaviour in the use of locations for PA is likely influenced by the physical design of sport facilities, the policies of access and others unknown factors. This information may be useful to enhance the utilisation of sport facilities and to increase the level of physical activity of the population.

1. R. Elosua, J. Marrugat, L. Molina, S. Pons, E. Pujol, American Journal of Epidemiology 139, 1197 (1994).

INFLUENCE OF PERFORMING SPORTS IN PUBLIC ON THE IMAGE OF AUSTRIAN POLITICIANS

Hotter, B., Nessizius, K., Kornexl, E.

University of Innsbruck, Austria

Introduction

Even though the sociological phenomenon of advertising various products using the image of amateur and professional athletes already has a long tradition in Austria, little research on this topic has been conducted so far (1). On average, at least once a week the Austrian newspaper Kurier presents an Austrian politician performing a sporty activity in public. Therefore, the subject of this study was to investigate what kind of image Austrian politicians create when using sports as a means of promoting themselves and their political parties.

Method

For this survey 280 students of the University of Innsbruck were interviewed; the random sample reflects the population: 51% (143) of the students were female, 49% (137) were male. The instrument used was the Semantic Differential, a method of a questionnaire always placing two opposite characteristics of a person (e.g. energetic vs. lazy) on the two ends of a scale (-3 to +3) (2). The interviewees were to respond according to their associations when seeing any kind of person – not necessarily a politician – performing sports in public and to choose one position on every scale of each of the 30 pairs of adjectives. Afterwards the results were applied to the image of Austrian politicians.

Results

Taking into account all mean values which are higher than both +1 and -1 and therefore show a clear enough tendency towards one quality, the image of people who are performing physical activity can be characterised as follows: enjoying life, sexy, optimistic, venturesome, funny, open-minded, social, successful, healthy, attractive, energetic, dynamic, powerful. All these qualities can directly be related

to the politician's image when he/she is the person performing sports. However, only if the public acknowledges his/her performance, the politician's image will be enhanced by his/her sportiness (3).

Discussion: In conclusion, the effect on the students of the University of Innsbruck when they see people practicing sports in public is exclusively positive and consequently creates a beneficial image for the active person whether he/she is a politician or not. When sporty appearance becomes part of a politician's image, the social acceptance of his/her political party definitely improves.

1 Weiß, Otmar / Russo, Manfred (1987). Image des Sports. Wien (Österreichischer Bundesverlag).

2 Osgood, Charles / Suci, George J. / Tannenbaum, Percy H. (1957). The Measurement of Meaning. Illinois (University Press).

3 Weiß, Otmar (1999). Einführung in die Sportsoziologie. Wien (WUF).

THE FITNESS CLUB: A BENTHAM'S PANOPTICON FOR A SELF-CARE?

Pereira, A.L.

Faculty of Sports Sciences - Universtiy Of Porto, Portugal

In his work Surveillance and Punishment, Foucault (1975) described the Bentham's panoptic as a penitentiary structure in which prisoners have a self-monitoring and sense of being always dominated for some invisible power. In this prison, one central tower surrounded by cells, that were kept under permanent observation from the tower, prisoners did not knew when they were being watched, but knew that at any moment that could happened. Thus, they were always in a conscious state of awareness. A few years later, Foucault (1988) developed a theory concerning self-care and self-government, highlighting the importance of technologies of the self: those which permit individuals to effect certain number of operations on their own bodies and souls, thoughts, conduct, and way of being, so as to transform themselves in order to attain a certain state of happiness, purity, wisdom, perfection, or immortality. Along these lines, the aim of our study was to discuss the fitness club: i) as a space that, in some circumstances and ways of inhabit it, may be compared to the Bentham's Panoptic; and ii) as a place in which practices might be included in the technologies of the self. Our data was collected in the course of a fieldwork in a fitness club and through twenty-seven in-depth interviews conducted with fitness activities participants. The interviews were submitted to analysis contents with the following categories: reasons to practice fitness activities, option for the type of fitness activities, frequency, and reasons to continue practicing fitness activities. Our data allows us to assert that fitness clubs are structures that constrain the individual's behavior for their own self-care. Bodies' dispositions are conditioned, turning them into docile-bodies. Indeed, there are some mechanisms in the fitness club that instigate a 'voluntary' action of self-control, i.e., just like in the panoptic, supervision and vigilance are incorporated by the fitness club's layout. Video cameras, glasses and mirrors are some examples of it. Additionally, apparatus like weighing machine, distinct ergometers and mirrors confirm the personal examination that also can be associated to self-governance. Finally, considering the given meanings for practice, fitness activities are able to discipline docile-bodies and also be integrated in the technologies to take self-care. Therefore, we might say that fitness clubs have some elements of the panoptic that allow a metaphor, and are places that instigate continuous and complex self-care, i.e., the Foucault's technologies of the self to a better body.

Foucault, M. (1975). Surveiller et punir. Paris: Gallimard.

Foucault, M. (1988). 'Technologies of the self', In L. Martin, H. Gutman, P. Hutton (Eds), Technologies of the self: a seminar with Michel Foucault. Massachusetts, The University of Massachusetts Press: 16-49.

DECISION-MAKING PROCESSES IN SPORTS CLUBS

Nagel, S.

Technical University of Chemnitz, Germany

In sports clubs, there are a number of trends at the moment, e.g. the differentiation of the sports activities, such as mass or health sports, or the engagement of paid employees. But we find these developments not in all sports clubs. Why do some sports clubs change their organizational structure and others not? As we cannot explain this phenomenon only with structure characteristics (e.g. number of members), it seems obvious to consider strategic decision-making processes, which have been hardly noticed in any research of sports clubs so far. Here, decisions in sports clubs will be analyzed on the basis of behavioural theories of organizational decision-making (e.g.: March, 1994; Simon, 1970). The „Garbage Can Model" seems especially suitable as a heuristic framework. This model has been developed for the analysis of decisions in universities (Cohen, March & Olsen, 1972). Sports clubs as nonprofit-organizations are also distinguished by inconsistent and ambiguous goals, lack of the ability of measuring success, unclear technology as well as fluid participation of members in the decision-making processes. The central idea of the „Garbage Can Model" is the assumption that decision-making processes in organizations are not a sequence of logical steps but consist of four „streams": (1) problems, (2) solutions, (3) participants and (4) choice opportunities. These four streams are more or less independent and the organizational decision-making has a random quality.

How are decisions made in sports clubs? The empirical analysis of this question is based on 20 case studies (Nagel, Conzelmann & Gabler, 2004). 62 strategic decision-making processes in sports clubs were studied in detail. Regarding the „Garbage Can Model" the following results can be emphasized: (1) The reason for decision-making processes in sports clubs are normally not the organizational goals, but often certain problems. Frequently, the interests of some club members are the starting point of an organizational change. (2) Mostly, only a few participants which are involved in the activities of the clubs play an active role. (3) In general, sports clubs try to achieve conjointly solutions which consider the interests of all members. (4) Decisions in sports clubs are especially made in certain committees, but also on an informal level. (5) Decision-making in sports clubs usually last a period of at least several months.

References: Cohen, M. D., March, J. G. & Olsen, J. P. (1972). A Garbage Can Model of Organizational Choice. Administrative Science Quarterly, 17 (1), 1-25.

March, J. G. (1994). A Primer on Decision Making. How Decisions Happen. New York: The Free Press.

Nagel, S., Conzelmann, A. & Gabler, H. (2004). Sportvereine – Auslaufmodell oder Hoffnungsträger? Die WLSB-Vereinsstudie. Tübingen: Attempto.

Simon, H. A. (1970). Administrative Behavior. A Study of Decision-Making Processes in Administrative Organization (2nd ed.). New York: Macmillan.

Poster presentation (PP)

PP2-14 General II (Ethics, History, Law, Communication, Economics) 1/1 - "Exhibition Hall"

WEB BASED CONTENT MANAGEMENT SYSTEM TO ACQUIRE, STORE AND USE DIAGNOSTIC DATA

Seifriz, F., Mester, J.

German Sport University Cologne, Germany

Introduction

The demand of central data storing requires a right system controlled access on the fastened data holding systems. The advantage of web based systems is the small requirement of software on the client site. Only a web browser is needed. The claim of this project is to develop a web based interface for a content management system (CMS) to use centralised data collections (Bang 2004).

Methods

The base of this project is the content management system of IBM in the version 8.2. The data entry is made with dynamic PDF forms which transfer only the form data over a secure HTTPS connection to the CMS. It is possible to attach to each measurement files of any types (i.e. raw data, graphics or videos). With the help of a C++ application DImport (Ruppert 2005) results of measuring devices can be directly transmitted into the CMS (SFTP). Due to data privacy protection only the diagnostic data are stored in the CMS. Personal data are stored in an external database. The authentication is based by a LDAP system and the authorization is integrated in the web application.

Results

In the first test phase the approach to realise the web based access with PDF forms proves to be advantageous. This is caused by the simplicity to create and the prevalence of the PDF file format. The online and offline entry data is the same so the user needs only a short period of vocational adjustment.

References

Bang, A. (2004). Datenbankmanagementsystem im Sport.

UNDERSTANDING THE BACKGROUND CONDITIONS OF INTENTIONAL MOVEMENTS IN SPORT: A STUDY OF SEARLE'S 'BACKGROUND CAPACITIES'

Moe, V.F.

Sogn og Fjordane University College, Norway, Norway

This paper discusses the problem of how to understand the background conditions that enable and constrain the performance of intentional movements in sport from a philosophical perspective. With background conditions I mean, generally, those conditions that are underlying and sustaining the performance of every intentional movement, and moreover, which remain in the background in the sense that they are not something that the performer is consciously or explicitly aware of while he/she is performing. The aim of the paper is to reveal essential structures of intentional movements' background conditions, and moreover, to reveal how these structures work. To reach this aim I take up the philosopher John Searle's (1983, 1992, 1995) logical analysis of the "Background" and discuss how his account for it can be used to illuminate the background conditions of intentional movements in sport. The Background (with a capital B) names a technical term in Searle's philosophy. It is intended to provide the proper grounding for intentional states in general. Searle defines "the concept of the 'Background' as the set of nonintentional or preintentional capacities that enable intentional states of function" (1995: 129). He divides the structure the Background into a "deep" and a "local" part. The "deep Background" refers to what is common to all human beings, whereas the "local Background" refers to what is characteristic for human beings within a "cultural practice". Also, Searle believes that the distinction between "how to do things" and "how things are" cuts across both the deep and the local Background (1983: 144), and he argues that the Background works in a causal way. I have divided the paper into three parts. First I review the essential characteristics of how the Background is structured. Then I consider some examples that take up how the Background works in relation to the acquisition of skilled motor behavior in sport. Finally, I critically examine how Searle's account for the Background may illuminate essential features of the background conditions of intentional movements in sport.

Searle, J. (1983). Intentionality: An essay in the philosophy of mind. Cambridge: Cambridge University Press.

Searle, J. (1992). The rediscovery of the mind. Cambridge: MIT Press.

Searle, J. (1995). The construction of social reality. New York: Free Press.

TECHNIQUE TRAINING IN SPORTS WITH MODERN DIGITAL TECHNOLOGY

Engelmeyer, E., Mester, J., Seifriz, F.

German Sport University Cologne, Germany, Germany

Introduction

Modern digital devices allow new concepts for learning movement skills in sports and technique training. In the spectrum of stand-alone PCs and Laptops on the one hand and powerful server clusters on the other a great number of different presentations modes for improvement of the individual movement skills are available. Looking at this necessity of continuous updating and revising of the curriculum of federations the universities are challenged to offer research based services for the development and digital learning materials. The advantages of e-learning material are used to illustrate play situations, technique training, -analysis, -description and tactics in sport. The digital curriculum in general can cover a wide range of topics including technique/tactics, sports medicine, biomechanics, training and psychology. Whereas traditional printed materials could only be delivered when the last chapter was submitted, in the line of the digital production different modules can be made available as soon as they are ready. The content follows the concept of "blended learning" is represented through different materials: computer based training, interactive images, print version, video pack and interviews.

Method

The method of production is based on the universities true strengths, i.e. the combination of research and education with many skilled students who are already able or can be qualified in using the proper software tools in the area of image and video processing, authoring tools, databases and 3D-animations etc. In cooperation with the scientific staff in the field of training and movement science in the so-

called Sport-el Factory it is possible to consolidate the expertise with the scientific research of training and evaluation. This combination assures a competitive production of high standard learning material.

The wide range of soft- and hardware packages allows for use within the online campus, existing Knowledge Nuggets and Full Web Lectures. Regarding the hardware architecture currently 25 high-end servers with 4.5 Terabytes are in use. It is therefore possible to build up a blended learning concept around the Multimedia Curriculum and enhance the learning material with current, innovative and scientific findings.

For copy protection purposes a sealing program (Sealed Media) is used which enables us to combine document protection and control with the existing applications without detracting from the user experience. To get access to the digital curricula users have to identify themselves to a license server. This makes it possible to define and control the usage of every file on the CD-Rom independently of the acquisition of the material. The admission to the license server and not the property of the material is the key to get access to the material.

TECHNOLOGY ENABLES INTELLECTUAL CAPITAL MANAGEMENT AT THE GERMAN SPORT UNIVERSITY COLOGNE

Wigger, U., Mester, J.

German Sport University Cologne, Germany, Germany

Introduction

Today, it is clear that a university's Internet portal and services are important for its positioning and profile with students, researchers and the larger public. As international leader in its market segment, the German Sport University Cologne (GSU-Cologne) aims to bring its „intellectual capital" closer and more targeted to its various customer groups.

Concept and Methods

To optimize support for research and education, leadership at GSU-Cologne decided to pursue the development of an integrated "Intellectual Capital Management" System (ICM). In addition to Technology Capital – store-and-retrieve technologies – three further types of capital are taken into account: Human – each individual's knowledge and capabilities, Structural – knowledge embodied, internalized, systemized and processed within the organisation, as well as Relational – referring to the university's wide set of economical, political and institutional relationships (Bueno et al., 2002; Leitner, 2004). Large software packages – such as IBM Lotus LearningSpace, Content Manager, WebSphere Portal and Workplace – enable the GSU-Cologne's Online Campus, numerous eLearning products, project rooms, team collaboration, web conferencing, the document and media archive as well as the electronic athlete's record system for capturing, storage, aggregation and statistical analysis of diagnostic data across research departments. A necessary basis for these services is integration of user directories for enterprise-wide identity and access management.

Results and Discussion

In the area of Technology Capital large investments have led to improvements in IT infrastructure and capacities. Since 2001, the growth of Human Capital has been supported by production and access to multimedia eLearning materials. In the future, it shall also be possible to have access to one's own HR and exam data as well as to perform searches across the university's knowledge bases. Structural Capital has been strengthened by the introduction of new organisational units and business models, such as CIO (Chief Information Officer) and CTO (Chief Technology Officer) positions, Sport-eL Factory, electronic athlete's records and ePublishing. Next to implement are the Online Shop and eCommerce models. Relational Capital exists in projects with other research institutions, sports clubs, national and international professional associations and shall be further supported by efficient communication and collaboration technologies.

Literature

Bueno, E.; Morcillo, P.; Rodriguez, J. (2002): Intellectual capital and scientific production of the Madrid Research Centers. Conference Proceedings: The Transparent Enterprise. The Value of Intangibles, http://www.iade.org/files/transparent1.pdf

Leitner, K.-H. (2004): Intellectual capital reporting for universities: Conceptual background and application for Austrian universities. Research Evaluation 13, 2, 129-140.

SPORTS AND COMPETITIVE SPORTS ORGANIZATIONS IN CHINA

Miao, J.

University of Sports, Shanghai, China

The paper presents the sports and competitive sports organizations in China and discusses perspectives for future developments.

The General Sports Administration coordinates and controls all the sports events and sports activities in the coutnry . There are three levels of sports organizations in the Chinese sports systems: state organizations, provincial organizations and regional organizations.

State organizations

The General Sports Administration is responsible for the development of sports in China.

The Pan-Chinese Association is a national organization which is responsible for the develpoment and spreading of mass spaorts.

The Chinese Olympic Committee is an independent organization which aims at promoting the Olympic movement in China.

Since 1998 the various kinds of sports have been organized in China by Administration Centres. However, not every sport can have its own Administration Centre, therefore similar sports are grouped together. This is a temporary ssolution and the plan fot the future is that every kind of sports will have its own Adminaistration Centre. Moreover, there are Special Sports Associations so that single sports kinds can have contact with similar sports associations at an international level more easily.

Provincial and Regional organizations

Every province and every region has its sports administration modelled on the General Sports Administration. The 33 provincial organizations promote the competitive sports as well as mass sports.The teams they maintain form the basis for the national teams. The athletes train in the provinces and they prepare themselves for sports events there. The regional administration functions as a link between leisure sports schools and competitive sports teams.

The perspectives for the development of sports in China are connected with the rapid social and financial development of the country. The change in Chinese polilics is leading to a new sports administration system, which unlike the old one will not be centralized. An additional factor that is going to contribute to the development of sports in China and to arouse the interest of the Chinese people in sports is the fact that China is going to be the host of the 2008 Olympics.

ANALYTICAL HIERARCHY PROCESSING (AHP) AS A MODERN TECHNIQUE FOR GROUP DECISION MAKING IN SPORT MANAGEMENT

Honari, H.

Allame Tabatabaei University, Iran

One of the major responsibilities of managers everywhere is decision making. With respect to bounded rationality of any individual reasoning power perhaps cooperation and participative group work is the only way to achieve a logical, structured comprehensive decision making especially in sport management. To days modern organizations and clubs are so big and complicated that their management is not possible with a single manager so that a manager is obliged to get help from the others in decision making and administration.

Up to now different methods in managing for the effectiveness of group decision making such as brain storming, Delphi method and nominal group technique have certain degrees of short comings in time, costs and intellectual. Meanwhile many techniques have been developed by social scientists to help leaders work with groups to reach decisions. Here are four of them that might introduce useful and wish to experiment with: Affinity diagrams, Interactive diagraphs, Interactive matrices, Collaborative negotiations.

AHP is modern technique which solves this problem to a greater extent. This method not only has the advantages of other techniques but because of its very nature of mathematical logic has the capacity of combining the qualitative and quantitative criterion for multiple choice comparisons.

The essence of AHP is based on the decision hierarchy tree. The group member should at first build the decision hierarchy. In this tree the first level is the level of objectives and the last level is the level of competing choices and the middle level is decision making factors.

In this paper the application of AHP in coordinating the decisions of group members has been introduces. AHP technique will help the top level decision maker to combine and coordinate optimal the decisions of multiple group members.

CHANGES IN SPORT FINANCING BETWEEN 2005 AND 2010 IN PÉCS, THE CAPITAL OF EUROPEAN CULTURE

Papp, G., Vass, M., Prisztóka, G.

University of Pécs, Hungary

In 2004, the Hungarian Parliament passed the Sport Act, and on 1st of May 2004, Hungary joined the European Union. These two events caused Pécs to elaborate its mid-term sport conception. Before the elaboration of the sport conception, by the means of SWOT analysis, we analyzed the sports of Pécs, their weak and strong points, the possibilities of its sports and the dysfunctions of their operation. By applying the results of this assessment, and considering the stance of the leading bodies of the European Union, we elaborated the sport conception of Pécs.

At present, in the European Union, there is no law harmonization related to sports. The Maastricht Agreement (1992) did not include any article on sports. A supplement of the Amsterdam Treaty (1997) included an "EU attitude toward sports". The European Sport Charta (1992) addresses the principles related to sports in a supplement of one of the recommendations of the committee of ministers of the European Council.

Since there are no common legal regulations, there are countries where legal regulations prohibit the government subsidization of professional sport clubs and associations. The measure of government subsidization in all the member countries is 0.4% of the GDP. In Hungary it is 0.2%.

In the European Union, related to the operation of sports, the following priorities can be found:

- The elite professional sports are less subsidized, but the development and maintenance of their institutes are supported by the government budget.
- Junior sport education and student sports, competitions, leisure time sports and sports for disabled are significantly supported.
- The European Union does not wish to introduce a general management of the sports in the member countries, but would like to provide them with the opportunity of preserving their national identity.
- The new member countries have an opportunity of gaining so-called temporary financing for their sports, which makes it possible for the elite sports to maintain their capabilities of functioning efficaciously, and, at the same time, the financing of the other preferred areas is gradually increased.

Our aim is to present the mid-term plans for financing the sports in Pécs by showing the local sport values. We regard it as significant to show Pécs, planned to be the Cultural Capital of Europe, as a model in its sport values and their financing in Hungary.

References:

1. Miege, Colin: Les organistain sportives el l' Europe INSEP, 2000.
2. Rydzy-Götz Marlis: ENGSO History of the European Non-Governmental Sport Organison 1966-2000. Frankfurt 2001.
3. Nádori László-Bátonyi Viola: Európai Unió és a sport (The European Union and the Sport) Budapest 2003.
4. Bödő László-Czerpán István-Herke Szabolcs-Németh Karola-Pap Dezső-Papp Gábor-Vass Miklós: Pécs város IV. Sportkoncepciója, (The 4th Sport Conception of Pécs), 2004.

15:15 - 16:45

Invited symposium (IS)

IS2-11 Blood and performance - "Athene"

BLOOD - THE LIMITING FACTOR OF AEROBIC PERFORMANCE?

Schmidt, W.

University of Bayreuth, Germany

In trained endurance athletes VO2max is essentially (70%) influenced by the O2-transport system which in turn is determined by the heart volume, blood volume (BV) and total haemoglobin mass (tHb). In this review the role of tHb and its particular effect on the O2-transport will be highlighted.

Cross sectional studies show that BV and tHb are increased by up to 80% in elite endurance athletes compared to untrained subjects. Linear regression analysis for tHb and VO2max of 572 differently trained subjects (r=0.864) reveals that VO2max is augmented by 4.3 ml/g tHb. In contrast to tHb no relationship between haemoglobin concentration ([Hb], r=0.171), hematocrit (r=0.094) and VO2max at sea level was found, indicating that under physiological conditions [Hb] is no primary performance limiting factor.

The effect of training on tHb is not yet satisfactorily clarified. After training periods lasting 3-6 weeks different erythropoietic responses have been observed, showing either no changes or augmentations of up to 5-10g/week. During a 9 months training period of marathon runners (3:37 ±0:23h) we found a significant increase in tHb of 7% (62g) which was accompanied by an increase in VO2max of 5%. Considering tHb during a complete training year of elite athletes no changes in rowers and a small increase in triathletes (3459g corresponding to 3.3%) were observed in the competition period. In a group of professional cyclists (n=12), however, we found a heterogeneous behaviour showing small increases (n=6) and strongly elevated values (n=6) after only 3 months of training (+110 12g corresponding to 10.8%). In the group with low erythropoiesis VO2max increased only moderately by 2.5% while the athletes with high red cell production reached 9% corresponding to 3.6 ml/g tHb. As the effect of training on tHb seems to be of relatively low impact, we assume that mainly genetic predisposition is responsible for the extremely high values determined in elite athletes.

Depending on duration and altitude of exposure the hypoxic environment may stimulate erythropoiesis. Major effects were found in elite endurance athletes born and living at altitude (2600m) showing 11% higher tHb values than comparable athletes from sea level. Conventional altitude training camps of 3-4 weeks duration at similar altitudes augment tHb in the mean by maximally 6%, while the live-high train-low concept has no effect on tHb when the daily hypoxic periods are below 10h. Regarding manipulation with blood or EPO the increase in tHb is assumed to be about 12%, which is correlated to an increase in VO2max of 3.3 ml/g tHb.

All data obtained from training and altitude interventions as well as from controlled anti-doping studies show that an increase in tHb of 1g is related to an improvement in VO2max by around 3ml/min.

BLOOD MANIPULATION AND AEROBIC PERFORMANCE

Berglund B., SE

Without abstract submission.

TOTAL HAEMOGLOBIN MASS - A PROMISING PARAMETER TO DETECT BLOOD MANIPULATION

Prommer, N.

University of Bayreuth, Germany

To counteract against excessive blood manipulations haematological upper limits were introduced during the past years in most endurance sports disciplines. Once an athlete exceeds these limits he is suspended temporarily from competition and a doping analysis is performed. This procedure, however, has the big disadvantage that changes in plasma volume can veil manipulations or lead to unwarranted sanctions towards the athlete. As the intention of every kind of blood manipulation is to increase total haemoglobin mass (tHb) it would be important and more reasonable to determine this key parameter directly. The aim of the project presented here was 1) to develop an easy manageable and fast method to determine tHb and 2) to evaluate whether tHb is a valid parameter to detect blood manipulation.

Objective 1: The commonly used and established CO-rebreathing method (Proccom) was optimised by changing the procedure of CO-administration and the breathing pattern.

IMPACT OF BLOOD QUALITY ON PERFORMANCE

Böning, D.

Charité - Universitätsmedizin Berlin, Germany

Gas transport and rheological properties of blood are decisive for performance. Both depend mainly on structure and function of the erythrocytes. Oxygen binding is influenced by hemoglobin type and 2,3-biphosphoglycerate concentration in the red cells; whereas the former only exceptionally is different from HbA1, the latter is slightly increased in endurance-trained subjects. During exercise the rise of temperature and acid concentration (CO2 and lactic acid) in the muscle vasculature attenuates oxygen binding to Hb thus improving O2 transport from blood into the fibres. The acid effect is stronger in endurance athletes than in sedentary subjects by unknown causes. High acid concentrations in the tissues are not detrimental for oxidative metabolism but can act like an oxygen pump from blood to cells; this mechanism is known for the fish swimbladder since long time.

CO2 transport is dependent on content and properties of non-bicarbonate buffers (especially Hb) in blood because the bulk of the substance is transformed to bicarbonate by reaction with the buffers. Only small amounts bind to Hb as carbamate and dissolve as gas. During hard exercise with acidosis caused by lactic acid reducing the bicarbonate content a sufficient arterio-venous CO2 difference can only be obtained by hyperventilation shifting the arterial point to the steep part of the CO2 dissociation curve.

Rheological properties depend on hematocrit, volume and stiffness of the red cells. During exercise a moderate, probably useful increase of hematocrit is caused by water shifts to the tissue. A rise above an optimal value is useless for oxygen transport because the high viscosity hinders blood flow. In athletic animals like horses hematocrit rises markedly during exercise by injecting erythrocytes stored in the spleen into the blood. But they possess very small erythrocytes easily passing through narrow vessels. Volume and stiffness of the red cells change also with cell age. Physical training leads to accelerated destruction of old erythrocytes with functional deficits thereby improving the average quality of red cells with regard to both rheology and gas transport.

Invited symposium (IS)

IS2-12 Nutritional interventions to improve post-exercise protein anabolism (sponsored by Lucozade Sport Science Academy) - "Innsbruck"

OPTIMIZING POST-EXERCISE PROTEIN SYNTHESIS: SPORTS NUTRITION IN ATHLETES

Tipton, K.

University of Birmingham, United Kingdom

The importance of postexercise nutrition has long been recognized. Nutrition following exercise is important, not only for athletes and other healthy exercising individuals, but perhaps even moreso for populations for which muscle hypertrophy is critical for health and function. The elderly, those recovering from illness and bedrest, astronauts and others benefit from information that optimizes nutritional and exercise practices.

The metabolic basis for muscle hypertrophy is the balance between protein synthesis and breakdown. Amino acids are taken up by the muscle and utilized for synthesis of muscle proteins. Muscle hypertrophy results only from positive net muscle protein balance over a given time period, i.e. muscle protein synthesis must exceed muscle protein breakdown. Thus, over a given time of training, periods of increased muscle protein synthesis and/or decreased muscle protein breakdown are necessary for muscle protein accretion due to resistance exercise training. At any given time, net muscle protein balance can be either positive or negative. The balance is determined by the combination of nutrition and exercise. Muscle protein accretion occurs only when the sum of the positive periods exceeds the sum of the negative periods.

Nutrition has been shown to influence the response of muscle protein balance following exercise. Resistance exercise will increase net balance, but ingestion of an amino acid source is necessary before positive balance results following exercise. Amino acid ingestion following exercise stimulates muscle protein synthesis resulting in net muscle protein balance and thus accretion of muscle proteins. The combination of resistance exercise and ingestion of an amino acid source results in greater net muscle protein balance than at rest.

The utilization of the ingested amino acids varies depending on the type of amino acids or protein ingested, other nutrients coingested with the amino acid source and the interaction of the timing of ingestion with the nutrients ingested. Thus, the timing of protein and food ingestion for optimal stimulation of muscle protein balance must be investigated further.

Results from acute studies demonstrating protein accretion are often assumed to indicate that the interventions being investigated would result in long-term gains in muscle mass. Results from longitudinal studies are usually quite difficult to obtain and interpret due to problems with control and design. Evidence that acute results do appropriately represent potential for efficacy in longer time frames is available and will be presented.

These results suggest that ingestion of a specific amount of amino acids may result in differential utilization for protein synthesis depending on the nutritional and exercise situation. Thus, recommendations of a specific protein intake for a group of athletes or individuals with varying diets, training regimens, ages, etc seems nonsensical.

OPTIMIZING SHORT-TERM RECOVERY: POST-EXERCISE PROTEIN INGESTION

Betts, J. A.

University of Bath, United Kingdom

Evidence supports that the ingestion of carbohydrate solutions over the 2-6 hours following prolonged exercise can facilitate the restoration of exercise capacity both through providing the fluid necessary for rehydration and through stimulating carbohydrate storage. The accrual of this evidence has now established many components of the optimal carbohydrate feeding strategy during recovery and further progress has therefore been sought through investigating the potential influence of other macronutrients. Specifically, many authors have reported that the addition of protein to a standard carbohydrate solution might accelerate the rate of muscle glycogen resynthesis when ingested following prolonged cycling. Given that, in general terms, exercise capacity is thought to correlate positively with pre-exercise muscle glycogen availability, there has subsequently been much speculation within the literature regarding a potential application for mixed carbohydrate-protein supplements in the rapid restoration of exercise capacity. While such an ergogenic benefit of specifically designed carbohydrate-protein recovery supplements has received some empirical support, most of the research conducted to date has not evaluated the efficacy of these supplements in comparison with carbohydrate/energy matched controls. However, it has recently been established that running capacity can be restored more completely within 4 hours of prior exercise when a carbohydrate-protein solution is ingested rather than ingesting the carbohydrate fraction alone. Importantly, this benefit did not persist when the carbohydrate concentration of the control solution was increased in order to match the carbohydrate-protein mixture for available energy content. In addition, converse to earlier findings regarding recovery from prolonged cycling, it did not appear that run time to exhaustion in the above study was extended as a consequence of increased muscle glycogen availability. The precise mechanisms through which additional protein might facilitate recovery therefore remain elusive, although it is clear that the capacity for exercise subsequent to recovery is not dictated exclusively by the availability of muscle glycogen. Other potential mechanisms of action include an increased provision of gluconeogenic substrate to the liver and/or an interaction of the ingested amino acids with the central nervous system. In summary, the inclusion of protein in post-exercise carbohydrate supplements would appear prudent, particularly when the time available for recovery is limited. However, the various physiological processes underlying this practical benefit remain poorly understood and therefore warrant further investigation.

NUTRITIONAL INTERVENTIONS TO IMPROVE POST-EXERCISE PROTEIN ANABOLISM

van Loon, L.J.

Maastricht University, Netherlands

Post-exercise carbohydrate and protein ingestion are essential to enable skeletal muscle reconditioning. The latter has resulted in the definition of recovery sports nutrition, but has also important implications for the efficacy of exercise interventions in the elderly and/or in those populations suffering from chronic metabolic disease. Nutritional interventions should be designed to augment the benefits of exercise training. The latter with the intention to prevent and/or treat chronic metabolic disease and impaired skeletal muscle function (insulin resistance, type 2 diabetes, sarcopenia). Main question is how important is nutrition in the post-exercise phase to the proposed benefits of exercise intervention. The role of nutrition in these populations will be underlined based on present literature and on speculations based on our understanding of the importance of recovery nutrition in the athlete.

Invited symposium (IS)

IS2-13 Measuring "real" breath-by -breath gas exchange - "St. Moritz"

BREATH BY BREATH GAS EXCHANGE: GETTING IT RIGHT

Capelli, C., Cautero, M., di Parmpero, P.

School of Medicine, University of Udine, Italy

Breath-by-breath (BB) alveolar VO2 transfer (VO2A) is the sum of the volume of the O2 exchanged at the mouth minus the changes of lung O2 stores: VO2Ai=VO2mi-?VO2si (Eq 1), where: i) VO2Ai and ?VO2mi are the volumes of gas transferred during the breath i at the alveolar and mouth level and; ii) ?VO2si are the O2 stores changes occurring over the same breath. VO2mi is the difference between the volumes of O2 transferred across the mouth and ?VO2si isgiven by: ?VO2si = VAi-1(FAi-FAi-1)O2+FAi?VLi (Eq 2), where VAi-1 is the end-expiratory alveolar volume before the onset of breath i, FAi and FAi-1 are the O2 alveolar fractions in the current (i) and previous (i-1) breaths and ?VLi is the lung volume change over breath i, which can be calculated assuming a net N2 transfer across the alveoli equal to 0: ?VLi = [VN2mi-(FAi-FAi-1)N2 VAi-1]/FAi-1N2 (Eq 3). In the algorithms yielding VO2Ai and ?VLi, only VAi-1 can not measured on a BB basis and it has been usually assumed equal to individual FRC (Auchincloss et al 1966, AU), an unwarranted assumption because it varies from one breath to the next. To circumvent this drawback, Grønlund (1984, GR) defined the respiratory cycle as the interval between equal expiratory FO2 values occurring at t1 and t2 in two succeeding breaths. Since FO2t1 is identical to FO2t2, (FAi - FAi-1)N2 VAi-1 becomes 0 and any assumption as to the value of VAi-1 is unnecessary. Hence, according to Gr, VO2Ai from t1 to t2 is: VO2Ai = ?V'FO2dt-FO2t1?VL (Eq 4), where V' is the respiratory flow whose sign depends on the respiratory phase, FO2t1 is the O2 fraction at t1 and ?VL is the lung volume change over the interval t2 to t1 = ?t. The integral in Eq 4, calculated from t1 to t2, yields VO2mi over ?t and ?VL reduces to: ?VL = VN2mi/FN2t1, where VN2mi is the N2 exchanged at the mouth measured from t3 to t1 and FN2t1 is the N2 fraction at t1 equal to FN2t3. Since t3 may not necessarily concur with t2, also the ?VL occurring from t2 to t3 have to be considered for calculating the total ?VL over ?t. By assuming that the algebraic sum of the CO2 and O2 volumes transferred from t2 to t3 is negligible, ?VL over this interval is obtained by integrating V'E from t2 to t3. Hence, the overall ?VL is given by: ?VL = VN2mi/FN2t1-?V'Edt (Eq 5) and V'O2A is calculated as the ratio of VO2Ai to ?t. AU and GR showed the same accuracy in estimating V'O2Ai; however GR turned out to be significantly more precise. The effects of using different VAi-1 values in estimating the time constant (?2) of V'O2A kinetics at the onset of step exercise were also evaluated by calculating V'O2A by means of GR and of AU with VAi-1 values ranging from 0 to FRC + 0.5 l. ?2 increased linearly with VAi-1 ranging form 36.6 s for VAi-1 =0, to 46.8 s for VAi-1 = FRC+0.5 l, whereas it amounted to 34.3 s with GR. Therefore, when using AU, the obtained ?2 depends on the assumed value of VAi-1.

OPTO-ELECTRONIC PLETHYSMOGRAPHY AS A MEANS TO MEASURE 'REAL' BBB ALVEOLAR GAS EXCHANGE

Aliverti, A.

Politecnico di Milano, Italy

The measurement of the rate of exchange of O2 between alveolar gas and pulmonary capillary blood (V'O2) on a breath-by-breath (BbB) basis is not simply accomplished by measuring the difference between the amount of O2 inspired and that expired at the mouth during a particular breath. This difference includes changes in amounts of O2 stored in alveolar gas that are not transferred to or from pulmonary capillary blood. Lung storage of these gases changes if inspired and expired volumes are different and if alveolar concentrations of these gases change during the course of the breath. To correct for these errors in the BbB measurement of V'O2 and V'CO2, which are not taken into account by commercially available devices, a continuous measure of absolute lung gas volume (VL) is required. In steady state conditions, in fact, the amount of gas remaining in the lung at end-inspiration will, on average, not vary, but this is clearly not the case in non-steady state conditions. At the onset of exercise, for example, expiratory muscle recruitment will lead to a sudden decrease in end expiratory lung volume, which in turn will induce a decrease in end expiratory lung gas stores and thus to an underestimation of alveolar O2 uptake. This problem has been recognized before and several studies have attempted to take into account estimates of changes in pulmonary gas stores. However, all these studies only estimated changes of lung gas stores because until shortly it was not possible to accurately measure actual absolute changes in lung volume on a BbB basis. A new method, Opto-Electronic Plethysmography (OEP) (Cala et al., J Appl Physiol, 1996), now allows measuring changes of the chest wall volume during breathing. By combining chest wall volume changes with measurements of vital capacity (VC) and functional residual capacity (FRC), it has become possible to accurately determine absolute lung volumes at any point during the breathing cycle.

The method has been validated in steady state conditions by comparing it with the gold standard, i.e. measurements of V'O2 by collection of expired gas in a Douglas bag (Aliverti et al, J Appl Physiol, 2004). More recently, we measured in parallel BbB oxygen uptake at the mouth and at the alveolar level in 7 subjects at rest and during on and off exercise transients and we found that by taking into account actual changes in alveolar oxygen stores BbB variability of oxygen uptake is reduced by about 24% (see Wust et al, abstract presend at this Congress).

Obtained data indicate that the proposed method is accurate. With this approach it is possible to partition the uptake of O2 at the mouth into the volumes exchanged between pulmonary capillaries and alveolar gas and changes in alveolar gas stores. It can be therefore very useful for analysing O2 kinetics particularly during non steady-state conditions, like on- and off-transients of exercise.

INTRA-BREATH ASPECTS OF BREATH-BY-BREATH GAS EXCHANGE MEASUREMENTS

Rocker, K.

Med. Clinic, Freiburg, Germany, Germany

Breath-by-breath gas analyses (BbB) usually refer to the balance of metabolic gas exchange. In BbB, oxygen consumption and carbon dioxide release are measured as with the conventional sample bag methods, but with higher temporal resolution. "Intra-breath" analyses go one step further, not only with regard to the temporal resolution, but also to the diagnostic approach. Morphometric and functional diagnostic aspects of the lung can be derived from mathematical interpretation of the exhaled breath gases at mouth within separate breaths. Graphical representative for this exhaled gas concentrations are so-called "expirograms". One prerequisite for the diagnostic use in exercise physiology is the classical subdivision of expirograms into four phases (I to IV). Phase III, the sloping alveolar plateau phase, is the most relevant shape aspect in expirograms if performing intra-breath analyses.

However, the physiological origin of this specific linearity of "phase III" is not clarified unambiguously so far. Thereby, linearity of phase III is crucial for several potentially worthful diagnostic methods. Two contrary and sophisticated principles were recently discussed as origin for the linear sloping characteristic of phase III: A branched-trumpet model of the lungs with sequential representation of a regular stratification to the mouth on the one side, and on the other side a uniform distribution of areas with different ventilation to perfusion ratios over the lungs. In the latter principle, the lung parts with higher ventilation and lower perfusion (and subsequently lower CO2 and higher O2 content) are exhaled systematically earlier than parts with lower ventilation and higher perfusion.

This lecture will revisit and discuss a third and much simpler explanation for the linearity of phase III, once described by Dubois and colleagues in the year 1952. Our results from both physical and mathematical modeling give evidence that this simple principle could be responsible for the course of expirograms on its own. The approach could simplify the diagnostic interpretation of intra-breath measurements especially if applied breath by breath.

Invited symposium (IS)

IS2-14 Development of interpersonal relations in sport - "Albertville"

PARENTAL SUPPORT AND TALENT DEVELOPMENT

Serpa, S., Barreiros, A.

Technical University of Lisbon, Faculty of Human Kinetics, Portugal

Research in sport psychology has reported the importance of the family influence along the athletes' career. Raising the youngsters in a sports environment, promoting positive emotional experiences, motivating for sports practice, giving emotional support, and adjusting their support to the different developmental phases are important parents' behaviours regarding the athletes' career. Parental support and influence are dynamic processes along the time, determined by the youngsters' developmental needs in what concerns sports participation. It is reported that the most successful athletes received higher levels of support and understanding than the less successful ones. The aim of this research was to study the parents' support to Portuguese young soccer players. Young talents were compared to non-talented players taking into account two phases of sports career (under-17 and under-19). Participants were 82 talented (participation in regional or national teams) and 129 non-talented players aged 13-18. The tool used was the Portuguese version of the questionnaire of parents' support – EMBU, 5-points Likert scale (Perris, Jacobson, Lindstorm, von Knorring & Perris, 1980) administered to the athletes. Results in the talented sample show high values of emotional support (fathers: 3.43; mothers: 3.56) and low levels of rejection (fathers: 1.19; mothers: 1.19), while over-protection has intermediate values (fathers: 2.28; mothers: 2.38). When we compare under-17 with under-19 players in the talented group, the older subjects perceive less rejection behaviours from their fathers and mothers, and more over protection from their fathers. Non-talented subjects reveal a similar distribution in emotional support (fathers: 3.12; mothers: 3.21), rejection (fathers: 1.33; mothers: 1.34), and over-protection (fathers: 2.21; mothers: 2.38). However, general comparison among talented and non-talented players show significant differences in the fathers' and mothers' emotional support (with higher values in the talented group), and lower rejection values in the talented group. When comparing talented and non-talented under-17 athletes, mothers' emotional support is the only variable where we find significant differences (higher values in the talents), while in the under-19 group, fathers' and mothers' emotional support, as well as mothers' rejection, is significantly higher in the talents. Thus, we may conclude that talented players receive more parents' support along the developmental process when compared with the non-talented players, and that perceived parents' influence changes along the years.

References

Perris, C., Jacobson, L., Lindstorm, H., von Knorring, L. & Perris, H. (1980). Development of a new inventory for assessing memories of parental rearing behaviour. Acta Psychiatrica Scandinavica, 61, 265-274.

THE EMOTIONAL SIDE OF COACH-ATHLETE RELATIONSHIP AS PERCEIVED BY SWISS MALES SWIMMERS

Antonini Philippe, R., Seiler, R.

Swiss Federal Office of Sports Magglingen, Switzerland; University of Bern, Institute of Sport, Switzerland

The relation between coach and athlete is often considered to be a decisive factor for performance in competitive sport. The mutual dependence is manifested in athletes' need to profit from the knowledge, competence and experience of the coach, and in coaches' need to transfer their competences and skills into performance and success. Research employing different methodologies and theoretical frameworks has shown that the quality of the professional and personal relationship between coaches and athletes has an impact on athletes' development and growth. The aim of this study was to investigate the quality of the coach-athlete relationship as perceived by the athletes. Participants were five male swimmers from the Swiss national swimming team who held international titles. A semi-structured interview schedule was employed to obtain qualitative data. The responses of the athletes were content analysed, utilising the three interpersonal constructs of closeness, co-orientation, and complementarity (Jowett & Meek, 2000) as a framework. The results show that the relationship comprised essential coach-athlete requirements and social relationship (closeness), communication and setting of objectives/goals (co-orientation), as well as acceptance and respect of roles (complementarity). It revealed that swimmers placed great importance in maintaining good relations with their coach. Notably, the results highlighted the existence of extremely profound and intimate feelings. The swimmers have come to know their coaches well, appreciate their efforts and respect their opinions,

and in the course of time the feelings were deepened into what some of them described as "more than a friendship". Thus, establishing a relationship based on strong feelings of respect, esteem and admiration seemed to be important to the swimmers. Overall, an "emotional relationship" developed between the coach and the athlete which included strong affective bonds and which can be compared to what Bloom, Durand-Bush, Schinke, and Salmela (1998) called the "human relationship". This part of the coach-athlete relationship may reflect the more personal and humanistic side of coaching in which coaches are perceived by the athletes to care about their welfare, interests, preferences, and needs. The results suggest that the emotional relationship or human relationship is an important facet because it promotes the professional relationship concerned with performance enhancement.

References

Bloom, G.A., Durand-Bush, N., Schinke, R.J., & Salmela, J.H. (1998). The importance of the mentoring in the development of coaches and athletes. International Journal of Sport Psychology, 29, 267-281.

Jowett, S., & Meek, G.A. (2000). The coach-athlete relationship in married couples: an exploratory content analysis. The Sport Psychologist, 14, 157-175.

FAMILY INFLUENCES ON CAREER DEVELOPMENT IN SPORT

Alfermann, D.

University of Leipzig, Germany

Scientists and practitioners alike claim that families play a prominent role in an athlete's career development. Likewise, the athletes themselves emphasize that the support and encouragement of their parents were of fundamental importance to their participation and success in sport. And even at the end of their career athletes often mention that the help of their family, particularly their parents, was most important in coping with career termination. Parents are often the primary socialization agents for getting children involved; they may initially act as the child's first coach, and they invest money, time, and emotional support in helping their children to climb the ladder of success. And in many cases, parents of athletes have been active athletes themselves. Besides the parents, siblings may also play an important part in fostering an athletic career.

In studies with adolescent athletes we asked for ways how parents and siblings encouraged the athletes' active involvement into their sport. From a social learning perspective parents' sport activity should have a modelling effect on their kids' activity. And in fact, more than three quarters of both parents were active in the past, and about two third of the parents were still active at the time of study, with fathers still being more often active than mothers. When it comes to introducing their kids into sport, parents and siblings were most often mentioned. Parents were most influential for both, boys and girls, with girls mentioning more often their siblings and less often their parents than boys. And last but not least parents were most important for emotional and instrumental support. Independent from age and skill level, parents gave emotional support, whereas instrumental support was decreasing in the course of an athlete's life. Dropouts from sport perceived less parental support than non-dropouts. And fathers were somewhat more inclined than mothers to put some pressure on their kids, whereas mothers tended more to give instrumental support.

The results of the different studies are summarized and discussed within the framework of the athletic triangle of athlete-family-coach.

Invited symposium (IS)

IS2-15 Eccentric exercise as novel training modality - "Berlin ABC"

THE POSITIVES OF NEGATIVES: ECCENTRIC TRAINING FOR FRAIL ELDERLY

Lindstedt, S.L., Marcus, R., Dibble, L., LaStayo, P.C.

Northern Arizona University and University of Utah, United States

Historically high-force lengthening (eccentric) contractions have been strongly associated with muscle damage and injury. Thus the consensus opinion has been that negative work leads to negative muscle and metabolic outcomes. Owing perhaps to that bad reputation, this mode of muscle use has received scant attention as an intervention to counter muscle wasting and mobility limitations associated with both aging, disease and metabolic abnormalities. In fact, lengthening muscle contractions have two well-documented properties that may make this form of muscle use ideally suited as an intervention. First, the magnitude of muscle force (and hence anabolic stimulus for muscle hypertrophy) is maximized during lengthening contractions. Second, the energy cost to produce these high-force contractions is minimal, a fraction of that required during isometric or shortening contractions. Thus even exercise-limited individuals could, in theory, benefit from high-force eccentric resistance training. We have tested this in several mobility-impaired, high fall-risk elderly populations afflicted with a variety of co-morbid (cardiovascular and neurologic conditions). Compliance is maximized as the training is relatively effortless; there is only minimal and transient muscle soreness. Whole muscle volume increases (15%) and fiber cross sectional area increases (25%-60%) are the result of the high force training along with significant improvements in strength (36%-60%), balance (7%-16%), gait (14%), 6 minute walk distance (8%-17%) and stair negotiating (21%) abilities and importantly at risk individuals improved their fall-risk profile. Additionally, when progressively applied, eccentric exercise amplifies the anabolic response (65% increase in IGF-1) and may improve insulin sensitivity. These data demonstrate that lower extremity eccentric resistance exercise can improve the anabolic mileau by increasing muscle size, function and performance without worsening metabolic impairments, and these muscle changes are accompanied by improved mobility in vulnerable elderly individuals plagued by physical inactivity and a limited exercise tolerance. Funding from NIH.

SLIMMER AND STRONGER - THE EFFECT OF ECCENTRIC EXERCISE IN THE ELDERLY

Däpp, C., Vogt, M., Klossner, S., Popp, A., Lippuner, K., Hoppeler, H.

University of Bern, Switzerland

Introduction

Loss of muscle strength and coordination is a consequence of aging and increases the risk for falling. Conventional heavy resistance training improves muscle strength but represents a safety risk for people with limited cardiovascular exercise tolerance. By contrast, eccentric muscle work (lengthening contractions) allows high-load muscular exercise training with low cardiovascular stress as com-

pared to shortening contractions. We hypothesized that eccentric ergometer training is superior to conventional strength training for gain in leg strength, muscle mass and muscular coordination in elderly subjects >75 years.

Methods

Forty-six elderly subjects (age 81.3±3.2 years, 30 females, 16 males) were randomized to an eccentric (ECT), a resistance (RET) training and a control (CTL) group. Each group followed two guided trainings per week for 12 weeks; each session lasting 45 min. ECT trained on an electronically braked eccentric ergometer where appropriate dosage of the eccentric target load had to be self-monitored on a screen by the subject. RET performed a high-intensity heavy resistance training (4 exercises with 2 sets of 8-10 repetitions each) on weight machines. CTL did not train physically but followed guided cognitive training sessions of the same duration. Pre- and post-intervention testing assigned the risk for falling (Timed Up&Go (TUG), Berg Balance Scale (BBS)), maximal voluntary contraction (MVC) of the legs and eccentric muscle coordination (dosage of the target load), while dual X-ray absorptiometry (DXA) determined the subjects' body composition.

Results

The training intervention caused a significant improvement for TUG in ECT (-0.5±0.1s) and RET (-0.7±0.1s), but not in CTL. BBS score was not changed in any group. Significant increases were recorded for MVC (+7.1±2.0%) and for eccentric muscle coordination (+66±11%) exclusively in ECT. Thigh muscle mass was not changed in any group, but interestingly, body and thigh fat were decreased exclusively in ECT by 5.3±1.7% and 8.0±2.0%, respectively.

Discussion / Conclusion

Eccentric ergometer training in elderly outperformed conventional resistance training concerning gain in leg strength and muscle coordination which resulted in comparable improvements in functional tests assessing the risk for falling. Unexpectedly, eccentric ergometer training positively influenced the subjects' body composition lowering their fat proportion. However, the cellular or molecular mechanisms behind this metabolic phenomenon remain speculative. Our results suggest that eccentric ergometer training may be a well-suited type of exercise for elderly to become slimmer and stronger, and to reduce the risk for falling.

THE IMPACT OF ECCENTRIC EXERCISE ON SELECTED COGNITIVE MEASURES IN THE ELDERLY

Buschkuehl, M., Hutchison, S., Daepp, C., Hoppeler, H., Perrig, W.J.

Institute of Psychology, Switzerland

There is a whole body of research showing that cardiovascular exercise has positive effects on cognitive performance measures in the elderly. However, little is known about the impact of eccentric exercise on cognition. In order to investigate this issue, we conducted an eccentric training study with 15 healthy elderly participants (Age: M = 81.2 years; SD = 3.5 years). Training took place twice a week for a period of 12 weeks; each session lasted 45 minutes. Before and after the training, several cognitive measures were administered, including tasks on memory, speed, executive functions and semantic knowledge. Furthermore, quality of life, daily activities, and locus of control were assessed with questionnaires. Besides a subjectively experienced improvement in quality of life, which was especially pronounced in the physiological domain, we also found enhancements in cognitive tasks that required abilities that were comparable to the ones used while performing the eccentric exercise, such as monitoring. These results show that eccentric training, like cardiovascular training, has a positive impact that goes beyond the improvement of physiological performance measures in the elderly.

Oral presentation (OP)

OP2-11 Physiology 7/10 - "Oslo"

THE EFFECT OF NSAID INGESTION ON SATELLITE CELL PROLIFERATION IN HUMANS IN RESPONSE TO A 36KM RUN

Mackey, A., Mikkelsen, K., Jørgensen, S., Kadi, F., Kjær, M., Langberg, H.

Institute of Sports Medicine, Denmark

It has been shown that exercise can enhance the satellite cell pool in humans, after both acute bouts of exercise (Crameri et al., 2004) and periods of long term training (Kadi et al., 2004). Satellite cells are critical for hypertrophy and the successful repair of damaged muscle. Consumption of nonsteroidal anti-inflammatory drugs (NSAID) is common practice among individuals participating in various sporting activities in order to continue training when faced with muscle soreness or injury. It has however been demonstrated that NSAID consumption can suppress the normal increase in muscle protein synthesis observed following exercise (Trappe et al., 2002). The aim of this study was to investigate the effect of NSAID consumption on the satellite cell response to an acute bout of exercise.

16 healthy well-trained men volunteered for the study which involved a 36km run and 4 muscle biopsies, obtained before the run and on days 1, 3 and 8 afterwards. Volunteers were randomly assigned into two groups to receive either NSAID (indometacin 100mg/day) or placebo from 4 days before the run until the final samples had been collected. The mean age of the NSAID group was 25 +/- S.D. 1 yr, and 26 +/- 4 for the placebo group. Satellite cells were visualised by immunohistochemical staining of microthin muscle cross-sections with a monoclonal antibody against neural cell adhesion molecule and counterstained with Mayer's Haematoxylin. Satellite cells were counted from a minimum of 200 fibres and expressed relative to the number of myonuclei.

VO2max testing showed similar aerobic capacities for the NSAID and placebo groups (59 +/- 6 and 63 +/- 6 ml/kg/min, respectively). Satellite cell analysis revealed a small but significant increase (from 4.10 +/- 0.79 to 5.13 +/- 1.08; p = 0.042, Friedman test) in the number of NCAM-positive cells in the placebo group on day 8 after the run, whereas no change was observed in the NSAID group (4.46 +/- 0.97 to 4.07 +/- 0.86). Using the Kruskal-Wallis test on normalised data, a significant group effect was observed on day 8.

The main finding in this study was an increase in the number of satellite cells (NCAM-positive) in vastus lateralis muscle following a 36km run in endurance trained men, and furthermore that this response was not observed in the group taking NSAID, suggesting that this type of medication may attenuate the proliferation of satellite cells in fit, healthy individuals under moderate muscle loading conditions. Given the prevalence of NSAID consumption among individuals participating in a wide range of sports, further work is warranted in this area in order to elucidate the precise function of NSAID with regard to muscle metabolism.

References

Crameri RM et al. 2004). J Physiol 558: 333-40.

Kadi F et al. (2004). J Physiol 558: 1005-12.

Trappe TA et al. (2002). Am J Endocrinol Metab 282: E551-E556.

THE DOSE-RESPONSE OF INHALED BETA2-AGONISTS ON ATHLETIC PERFORMANCE IN NON-ASTHMATIC COMPETITIVE ATHLETES

Sporer, B.C., Brooks, J., McKenzie, D.C.

University of British Columbia, Canada

Introduction

Salbutamol use in elite sport is increasing and there are concerns of over-use by non-asthmatics in order to gain a competitive edge. Although the majority of research suggests there is no performance enhancement in non-asthmatics, the dose-response effect on performance has not been evaluated in a homogenous group of trained athletes with a sport specific performance test. The purpose of this study was to determine the dose-response effects of inhaled salbutamol on time trial (TT) performance in competitive athletes.

Methods

Non-asthmatic, competitive, male cyclists and triathletes (n=37) came to the laboratory on 5 separate occasions. On day 1, athletes were screened for airway responsiveness using a eucapnic voluntary hyperpnea test (EVH). This test is commonly used to determine eligibility for use of a B2-agonist in international competition1. An incremental exercise test was performed to determine VO2max. During the last four visits, athletes performed a 20km TT on the Velotron Pro cycle ergometer 15 minutes post-inhalation of placebo, 200mcg (D2), 400mcg (D4), or 800mcg (D8) of salbutamol. All conditions were randomized and double blind. Metabolic data was collected during each TT. Repeated measures ANOVA was used to determine effects of dose on performance and physiological va1riables with post-hoc analysis done using Tukey's HSD test. For all statistical procedures alpha = 0.05. All values are mean (SD).

Results

Seven subjects had a positive response to the EVH test resulting in a 19% incidence. These subjects were excluded from the remainder of the analysis. The remaining subjects (n=30) had a VO2max of 67.1 (4.3) ml/kg/min with a peak power (PP) of 457 (31) watts (W). Three subjects were unable to complete at least one TT. There was no effect of dose on time (PT) (Pl=30.72 (1.06) min; D2=30.55 (1.03) min; D4=30.67 (1.06) min; D8=30.70 (1.04) min; p=0.16), mean heart rate (Pl=172 (9) bpm; D2=173 (10) bpm; D4=171 (9) bpm; D8=171 (10) bpm; p=0.52), or mean power output (Pmean) (Pl=306 (29) W; D2=310 (30) W; D4=307 (29) W; D8=307 (30) W; p=0.12). No differences were found with respect to mean VO2, VE, or ventilatory equivalent for oxygen (VE/VO2).

Discussion/Conclusions

The primary finding was that inhaled salbutamol, in doses up to 800mcg, has no performance enhancement effect in a 20km cycling time trial. This coincided with no observable difference in metabolic or ventilatory parameters during exercise. Additionally, incidence of exercise-induced bronchospasm in athletes not having previously been diagnosed with asthma was 19% when measured using an EVH test.

This study was funded by the World Anti-Doping Agency.

1. Anderson, S. A., K. D. Fitch, C. P. Perry, M. Sue-Chu, R. Crapo, D. C. McKenzie, and H. Magnussen. Response to bronchial challenge submitted for approval to use inhaled B2-agonists before an event at the 2002 Winter Olympics. Journal of Allergy and Clinical Immunology. 111:45-50, 2003.

THE EFFECT OF A BRIEF SPRINT INTERVAL EXERCISE ON GROWTH FACTORS AND INFLAMMATORY MEDIATORS

Meckel Y., Nemet D., Seraev M., Sagiv M., Eliakim A.

Zinman College of Physical Education, Wingate Institute, Netanya. Child Health & Sport Center, Pediatric department, Meir General Hospital, Sackler School of Medicine, Tel-Aviv University. , Israel

Introduction: The efficiency of exercise training depends on the intensity, volume, duration, and frequency of training, as well as on the athlete's ability to tolerate it. Recent effort to quantify the effects of exercise training on the athletes hormonal response suggest that exercise leads to a simultaneous changes of antagonistic mediators. The aim of the present study was to evaluate the effect of a brief sprint interval exercise session (four repetitions of 250m run at 80% of the maximal speed) on the balance between anabolic hormones [growth hormone (GH) IGF-I (insulin-like growth factor-I) axis], catabolic hormones (cortisol), and circulating pro-inflammatory cytokines like Interlukin-6 (IL-6).

Methods: Twelve healthy elite Israeli junior handball players (age range 17 - 20 years) participated in the study. Exercise consisted of four 250m runs on a treadmill, at a constant work rate of 80% of the maximal speed (calculated from the maximal speed of a 100m run), with three minutes rest interval between each of the 250m runs. Therefore, each participant ran in the same relative speed.

Results: Exercise led to significant increases in GH, IGF binding protein-3 (IGFBP-3) and testosterone, and to a significant decrease in IGFBP-1 levels. There were no significant effects of exercise on IGF-I and cortisol levels. In addition, exercise led to a significant increase in the testosterone/cortisol ratio. Exercise was associated with a significant increase in IL-6 levels. IL-6 remained elevated one hour after the end of exercise.

Conclusions: Changes in the anabolic-catabolic hormonal balance were found following a brief sprint interval exercise indicating that these markers may be used to gauge the training intensity of anaerobic-type exercise. Changes in the GH-IGF-I axis and testosterone/cortisol ratio suggested exercise-related anabolic adaptations, while increases in IL-6 may indicate its important role in muscle tissue repair following anaerobic exercise. The clinical use of these markers in the assessment of longer periods of anaerobic-type training still needs to be explored.

THE EFFECT OF LEUKOCYTE ACCUMULATION IN EXERCISED MUSCLES ON RECOVERY OF MUSCLE FUNCTION AFTER HIGH-FORCE ECCENTRIC EXERCISE IN HUMANS

Raastad, T., Paulsen, G., Fjeld, J.G., Hallén, J.

Norwegian School of Sport Sciences, Norway

We have previously shown a close relation between leukocyte infiltration in exercised muscles and recovery of muscle function after normal strength exercise and extreme high-force eccentric exercise (Raastad et al., 2003; Paulsen et al., 2003). The initial muscle damage during exercise seems to determine the number of infiltrating leukocytes which in turn seems to control the following recovery process. The recovery process may involve a secondary loss of force-generating capacity 1-3 days after exercise if a large infiltration is mani-

fested (Paulsen et al., 2003). Therefore, manipulating the inflammatory response by anti-inflammatory drugs could affect the recovery after exercise-induced muscle damage. The purpose of this study was to investigate the effect of a COX-2 inhibitor on leukocyte infiltration and recovery of muscle function after high-force eccentric exercise.

Seventeen students performed 70 unilateral maximal eccentric repetitions with the elbow flexors. The subjects were divided into a Celebra group (n = 8); receiving celecoxib (an anti-inflammatory drug; COX-2 inhibitor; 2 x 200 mg pr day for ten days), and a Placebo group (n = 9); receiving lactose pills. Medication started 1 hour before exercise. Infiltration of radioactive leukocytes was measured with a gamma camera, six and 20 hours after exercise. Maximal, voluntary, isometric torque was measured before and regularly for ten days after exercise.

Immediately after exercise isometric force-generating capacity was reduced by 48±4% in the Celebra group and 52±4% in the Placebo group (no significant difference between groups). The workout resulted in a gradual accumulation of labelled leukocytes in exercised from six to 20 hours after exercise, but the COX-inhibitor had no effect on the amount of infiltrating cells (82±29 % over control muscle in the Celebra group and 82±27 % over control muscle in the Placebo group, 20 h after exercise). Independent of groups, subjects experiencing large infiltration (more than 100% over control, n=5) had no recovery of force-generating capacity from 6 h after exercise to 72 h after exercise while subjects with moderate infiltration (42±5% over control, n=12) recovered by 45%. On individual level we observed a strong correlation between accumulated leukocytes 20 h after exercise and the force reduction observed in the placebo group ($r=0.85$, $p<0.01$) and in all subjects ($r=0.58$, $p=0.01$) 72 h after exercise.

Although the accumulation of leukocytes into exercised muscle not was reduced by the anti-inflammatory drug, we observed a tight relation between the extent of infiltration and the recovery of force-generating capacity the first days after exercise.

Paulsen et al. (2003) Force deficit after eccentric exercise is related to muscle leukocyte infiltration. 8th Annual Congress of the ECSS (abstract)

Raastad et al. (2003). Temporal relation between leukocyte accumulation in muscles and halted recovery 10-20 h after strength exercise. J Appl Physiol 95, 2503-2509.

Oral presentation (OP)

OP2-12 Training and Testing 4/7 - "Turin ABC"

20-HZ WHOLE BODY VIBRATION TRAINING FAILS TO COUNTERACT NEGATIVE EFFECTS OF 14 DAYS OF BED REST ON MUSCLE PERFORMANCE

Liphardt, A.M., Zange, J., Schmidt, A., Kleinöder, H., Heer, M., Mester, J.

DLR-Institute of Aerospace Medicine, Cologne,, Germany

The absence of mechanical loading e.g. in microgravity (µG) or immobilization leads, amongst others, to a decreased muscle performance (1). Bed rest in 6°-head-down-tilt (HDT) is a well-established model to simulate some of the physiological effects astronauts experience in µG (2). Similar to µG, immobilization in 6°-HDT bed rest leads to a lack of mechanical loading in the lower extremities. Although the negative effects on the muscular-skeletal system are known, training methods during space flight still need optimization.

Vibration training (VT) has been shown to improve muscle performance in training studies (3;4) with little time effort. Thus, it is hypothesized that VT will change the response of the body to bed rest with respect to skeletal muscle performance.

8 healthy male subjects (78.1 ± 9.5 kg; 179 ± 9.6 cm; 26 ± 5 years) performed 14-days of bed rest in 6°-HDT in the DLR-Institute of Aerospace Medicine. The study was carried out as a cross-over-design, consisting of two phases, each lasting 23 days. Each subject received VT in one phase and a control intervention in the other phase. Study phases were divided into three periods: a 4-day adaptation period, a 14-day intervention period in 6°- HDT bed rest and a 5-day recovery period. During the intervention period, all activities including eating, showering and weighing were carried out in the 6°-HDT position. Subjects were mobile in the adaptation period and the recovery period. Study phases were identical with respect to environmental conditions, study protocol and diet. The VT consisted of 5 x 1 minute whole body vibration twice daily on the Galileo 900 vibration plate (20 Hz / 2-4 mm). Isometric (maximal voluntary contraction (MVC)) and dynamic (power) muscle performance of the knee extensors and the knee flexors was measured at the last day of the adaptation period (day -1), the first day of the recovery period (R1) and the last day of the recovery period (R5).

MVC decreased significantly ($p < 0.001$) for the knee flexors during the bed rest intervention. However VT failed to counteract this effect. For the knee extensors no changes in MVC due to bed rest or VT could be observed. Power in both muscle groups decreased due to bed rest but the response did not change with the VT. MVC and power did not recover to baseline after the recovery period for both muscle groups.

The results indicate that loss in muscle performance after 14 days of immobilisation of healthy subjects in 6°-HDT with controlled diet is muscle specific. The applied training protocol failed to counteract negative effects on muscle performance. The chosen training regime may not have been intense enough to cause changes in the response of the body to bed rest.

(1) Fitts RH et al. (2000): J Appl Physiol 89(2): 823-39

(2) Kakurin LI et al (1976): Aviat Space Environ Med 47(10): 1083-86

(3) Jordan MJ et al. (2005): J Strength Cond Res 19(2): 459-66

(4) Cardinale M et al. (2005): Br J Sports Med: 39(9):585-589.

EFFECT OF CONCENTRIC AND ECCENTRIC RESISTANCE TRAINING, AND DETRAINING, ON THE RATE OF FORCE DEVELOPMENT OF HUMAN SKELETAL MUSCLE

Blazevich, A.J., Cannavan, D., Coleman, D., Horne, S., Aagaard, P.

Brunel University, United Kingdom

The ability of an athlete to achieve a high rate of force development (RFD) in the early phase of muscle contraction is important in sports where force application times are shorter than those needed to reach maximum. As the adaptations elicited by concentric and eccentric modes of resistance training are different, we hypothesised that they would have dissimilar effects on RFD; quantification of these differences is important for the optimisation of physical training interventions. Based on previous reports, we also expected that training-related increases would be greatest in the first few weeks of training and, perhaps paradoxically, that RFD should increase after training

cessation. Twenty-one subjects (10 men and 11 women, 18–32 yr) completed 10 wk (3/wk) unilateral concentric or eccentric maximal isokinetic knee extension training through 90 deg at 30 deg/s. Before (0 wk), during (5 wk) and after (10 wk) training, and after 14 wk of detraining, the subjects performed an isometric knee extensor test aiming for a maximal rate of force increase. The maximum RFD, relative RFD (to MVC; rRFD) and the integral of the force-time curve (contractile impulse) were measured in the epochs 30, 50, 100 and 200 ms after the initiation of contraction. The relative RFD was also calculated to the level of 1/6, 1/2 and 2/3 of MVC. Repeated measures MANOVA was used for analysis after log transformation of non-normally distributed data (alpha=0.05). Our results revealed an effect of training mode on only one of the 19 RFD variables (concentric group > eccentric group for RFD to 30 ms: 38% vs 12%); there was no effect of gender or pre-training isometric strength on RFD changes. When all subjects were pooled, there was a significant increase in RFD, rRFD and impulse in the first 30 ms, and an increase in impulse measured to 50 ms at 5 wk. After 10 wk, there were significant increases in MVC, RFD, rRFD and impulse calculated to 30, 50, 100 and 200 ms, as well as a reduced time to reach RFD to the level of 1/6 MVC. These improvements remained unchanged through 14 wk of detraining. Interestingly, subjects with less-than-median rRFD at 0 wk improved in all RFD measures (with most increases occurring by 5 wk; $p<0.01$), while subjects who had greater-than-median rRFD showed decreases in rRFD at 50, 100 and 200 ms and to 1/2 and 2/3 of MVC ($p<0.05$). In conclusion, our data provide further evidence that maximal strength training improves early-phase RFD irrespective of training mode, but also show that improvements occur largely in the first few weeks of training and are maintained through a prolonged (14 wk) period of detraining. A unique finding of the present study was that the increases in RFD were limited to those subjects who had the slowest rRFD prior to training, with those subjects with faster rRFDs showing no change, or a reduction, in RFD. Thus, the use of heavy resistance training to improve RFD might be best limited to individuals who have a slower rRFD.

LOADING CONDITIONS AND NEUROMUSCULAR ACTIVITY DURING "TURN MOVEMENTS" IN ALPINE SKIING AND IN A NEW SKI SIMULATOR

Pozzo, R., Consuelo, P., Casasola, S., Rejc, E., Canclini, A.

University of Medicine Udine, Italy

Introduction In alpine skiing the loading constrains make the legs to resist to high level of peak forces and vibrations. This loading conditions are not easy to be reproduced by means of standard strength exercise used in training protocols. The aim of this study is to verify the affinity of the turn movement carried out in a real giant slalom (GS) and on a new simulator (SS). The simulator used has two breech footboards which can rotate around their longitudinal axis and can vibrate with a frequency between 0 to 50 Hz. The athlete is tied with a waist belt from which two lateral cables and one directed to middle line of the feet are connected to a traction lever which is controlled by an external operator.

Methods Different methods have been used during GS and SS situation.3D-Kinematics: two videocameras (50 Hz) and dedicated SIMI-software. Dynamics: insoles with pressure cell sensors (PEDAR 100 Hz). Muscle activity: EMG by MEGA-electromyographer (1000 Hz) with 8 channels. In GS testing session, vertical and lateral forces acting on the subject's belt were recorded (100Hz) by means of load cells.

Results On the SS the joint variations show the same time phase for both legs, whereas in the GS the curves are time shifted. This is due by the different external constrains affecting the flexion phase. In GS the ski move laterally from each other causing the external leg to be much more extended with respect to the SS situation where the can only rotate in the frontal plane. Maximal knee flexion are consistent in the vibration exercise and reach a mean value of 110 deg and 85 deg for external and internal knee, whereas in GS the value are 96 deg and 60 deg respectively. Internal and external reaction forces show similar curve patterns in both situations GS and SS. Peak forces in GS and during SS, when the lateral traction cables are omitted and under different vibratory condition, were: highest values, 2500 N external and 1300 N internal, occurred during the 30 Hz vibration, while in the GS they reach 1400 N and 500 N respectively. Using traction cable, forces on the feet are 1100 N external and 300 N internal while lateral force acting on the hip is 700 N. So, lateral force constrains allows the typical distribution of the forces between legs. The EMG showed high similarity between the GS and SS conditions. For the BF, VM, and RF there is a linear tendency to increase the RMS values according to the augmented frequency of vibration. Maximum RMS values are observed during GS. Analogues considerations are founded for IEMG parameter.

According to these results new assumption can be made in order to improve the constrains of the simulator and make it more useful in training or in the rehabilitation.

BLOOD LACTATE CONCENTRATION AFTER SLALOM COURSE OF DIFFERENT LENGTH

Dolenec, A., Tomazin, K., Jereb, B., Strojnik, V.

University of Ljubljana, Faculty of Sport, Slovenia

In alpine skiing, most of the required energy for slalom skiing comes from an anaerobic glycolytic system (Andersen and Montgomery, 1988; Tesch, 1995). This causes that fatigue appear very soon. Following a race, blood lactate concentration averages 9 to 13 mmol/l (Andersen and Montgomery, 1988) so the fatigue is beyond anaerobic threshold. Fatigue beyond anaerobic threshold disturbs body balance (Nardone et al., 1997) and consequently slow-down learning processes. For technique training, fatigue should be kept at low level. Therefore the aim of this experiment was to find the level of fatigue that appears in slalom skiing after 15, 30 and 45 gates respectively to establish the proper distance for technique training. Eight alpine skiers (age 19 ± 1.3 years; height 182.4 ± 3.6 cm; weight 81.5 ± 4.4 kg) from the Slovenian national team volunteered in the experiment and gave their written consent. After the warm-up, the participants perform three runs on the same course. In random order they performed courses with 15, 30 and 45 slalom gates respectively. The end of the course was always in the same place. The rest between runs was at least 30 minutes. Before each run and three minutes after skiing we took blood samples from the ear lobe for blood lactate concentration analysis. T-test for dependent samples was used for testing differences. Before runs the lactat concentrations were 2.5 ± 0.88 mmol/l for 15 gates, 1.6 ± 0.58 mmol/l for 30 gates and 1.8 mmol/l ± 0.71 for 45 gates. The lactate concentration after skiing on 15 gates course was 2.6 ± 0.57 mmol/l and was significantly lower than after skiing on 30 gates course (4.5 ± 0.52 mmol/l). The highest lactat concentration was after skiing on 45 gates course (6.7 ± 0.99 mmol/l). Only skiing on 15 gates course caused fatigue that is under anaerobic threshold. Such a low level of blood lactate concentration should not significantly interfere neuromuscular function. Since the body balance is very important in learning process we can speculate that skiing on 15 gates course is suitable for learning skiing technique. Skiing on 30 and 45 gates course caused fatigue that is beyond anaerobic threshold and may not provide good physiological basis for learning skiing technique.

References: Andersen RE, Montgomery DL (1988). Sports Med 6:210-231

Tesch PA (1995). Med Sci Sports Exerc 27:310-314

Nardone et al. (1997). Electroenceph Clin Neurophysiol 105:309-320.

EFFECTS OF COLD WATER IMMERSION ON MARKERS OF RECOVERY, PERFORMANCE AND TRAINING QUALITY IN WELL-TRAINED TRIATHLETES

Rowsell, G., Coutts, A., Reaburn, P., Halson, S., Toone, R.

South Australian Sports Institute, University of Technology - Sydney, Central Queensland University, Australian Institute of Sport, South Australian Sports Institute, Australia

The use of ice baths and other forms of cold water immersion (CWI) has become a common practice with high level athletes who train regularly. It is thought that the use of CWI immediately post-training promotes faster restoration of performance capabilities and enhances subsequent training performance. However, to date, few studies have examined specific changes in performance and capacity to train following CWI. This study investigated the effects of CWI on submaximal and maximal performance, ability to complete a quality training set, perception of recovery, and changes in various biochemical markers of physiological stress and muscle damage. Seven male triathletes (age 28.6 ± 7.1 y, VO2 max 71.2 ± 4.6 mL/kg/min, mass 73.4 ± 10.2 kg) completed two trials in a counterbalanced cross-over design: an intensive running training session in the morning immediately followed by either CWI or CONTROL immersion and then an incremental cycling test and quality interval training set 9 h later. The morning run training session consisted of 7 x 5 min running intervals on the treadmill at 105% of their individually determined anaerobic threshold running speed with 2.5 min active recovery between each interval. On completion of the run session subjects consumed a recovery drink prior to immersion in either cold (10 ± 1° C) or control (34 ± 1 °C) for 5 x 1 min 'in' / 1 min 'out'. 9 h after the morning run session, subjects completed a series of cycling performance trials: 5 min at 1.5 W/kg, 5 min at 3 W/kg, 5 min maximal effort bout and 6 x 5 min with 1 min recovery as a high quality training set. Power output, heart rate (HR), blood lactate (BLa), rating of perceived exertion (RPE) and VO2 were monitored throughout. Resting plasma concentrations of interleukins 1, 6 and 10, fatty acid binding protein, myoglobin, lactate dehydrogenase and creatine kinase were also determined. Subjects also completed questionnaires to assess their perception of recovery. Subjects kept a training and diet log during the study and followed the same training and nutrition plan the day prior and the day of testing for both trials. Results demonstrated improved training quality and an improved perception of recovery in all subjects with CWI. We also observed practically meaningful positive changes (1) in mean power output and percentage of goal power, HR and BLa during the quality interval training set following CWI. There were also significant improvements in the work-RPE, HR-RPE, and BLa-RPE relationships during the quality training set following CWI ($p<0.05$). These results show that between-session CWI augments subsequent training effort. The improved training performance appears to be linked to higher perception of physical recovery and reduced perception of fatigue and leg soreness.

References:

1. Hopkins WG (2003). A spreadsheet for analysis of straightforward controlled trials. Sportscience 7, sportsci.org/jour/03/wghtrials.htm.

Oral presentation (OP)

OP2-13 Health and Fitness 3/4 - "Berlin DE"

"TO GET GERMANY MOVING"- AIMS, TARGET-GROUPS, PROGRAMS, EVIDENCE OF HEALTH-SPORT

Brehm, W., Bös, K.

Universität Bayreuth, Germany

Introduction

As in most industrialized countries the majority of the German adults (90%) do not follow the recommendation of the American College of Sports Medicine. In order to improve the compliance with these requirements more intervention strategies that focus not only on health but even more on the behavior are needed and evaluated with regard to the evidence of the effectiveness.

Concept

Since about 1995 in Germany a field of health-Sport is created, besides the established fields of competition-sport, fitness-sport and fun-& nature-sport. On the basis of the "New Public Health Concept" of the WHO the German Sports Federation (DSB) and the German Gymnastics Federation (DTB) decided, that this field should be health and behavior directed and that this field demands – as a "bridge" to the medical system – specific qualities and a special quality management (evidence based approach).

Together with the sport organizations and cooperating with Health-Insurance Companies in Germany, we developed a concept of six specific aims of Health Sport. Two main target groups were defined:

- Sedentary persons who often have not been exercising for a long time.
- Persons with risk-factors and/or problems in metabolism and the heart circulation system, in the muscle-skeleton-system, in psy-chic and somatic areas.

In order to reach the above-mentioned aims a "seven sequence intervention" was developed for Health Sport programs. Every exercise session in this intervention – normally with a duration of 90 minutes – consists of seven sequences: 1. Preparation, 2. Warm-Up, 3. Endurance, 4. Strength & Flexibility, 5. Relaxation, 6. Stimulation, 7. Information (integrated in 1 – 6).

Programs and Evaluation

On the basis of the outlined concept in the last years several Health-Sport-Programs were developed and evaluated within different working groups. Especially the German Gymnastics Federation (DTB) is integrating these programs in the health sport offers of the clubs. The evaluations are showing that over all a behavioral change could be reached for about three quarters of the participants by the means of the intervention. Participants who were in a negative fitness- and health condition before the intervention had the greatest benefit from the pro-gram while other participants stabilized their status. The results emphasize the importance of a well-structured physical activity program as a bridge in non-medical therapy and the prevention especially of the metabolic syndrome.

References

BREHM W., WAGNER P, SYGUSCH R., HAHN U., JANKE, A. (2005). Health Promotion by means of Health Sport. A framework and a controlled intervention study with sedentary adults. Scandinavian Journal of Medicine and Science in Sports. 15(1):13-20.

WAGNER P, BREHM W., SYGUSCH R. (2004). The Seven-Sequence-Intervention – Sedentary adults on their way to fitness and health. Research in Sports Medicine. 12: 265 – 282.

SELF-REPORT PHYSICAL ACTIVITY LEVEL IN RELATION TO MAXIMUM OXYGEN UPTAKE IN A VOLUNTEER SAMPLE OF ADULT MEN AND WOMEN

Aadahl, M., Kjær, M., Kristensen, J.H., Jørgensen, T.

Research Centre for Prevention and Health, Denmark

Self-report physical activity level in relation to maximum oxygen uptake in a volunteer sample of adult men and women

Aadahl M1,2, Kjær M3, Kristensen JH 2, Jørgensen T1

1Research Centre for Prevention and Health, Glostrup University Hospital, Ndr. Ringvej 57, DK-2600 Glostrup,

Denmark. Tel: + 45 43232197, Fax:+45 43233977.

2University Hospital of Copenhagen, Rigshospitalet, Department of Medical Ortopaedics and Rehabilitation,

Blegdamsvej 9, DK-2100 Copenhagen, Denmark.

3 Institute of Sports Medicine, Bispebjerg Hospital, Bispebjerg Bakke 23, DK-2400 Copenhagen NV, Denmark.

Introduction: Valid measurement of physical activity level is essential, when exploring the association between physical activity and different health aspects, when monitoring interventions aimed at increasing physical activity and when estimating the balance between dietary energy intake and energy expenditure. Physical activity is often measured by self-report in large study populations and it is therefore important to establish how self-report methods relate to objective measures of physical capacity.

Aim: To assess the validity of a new self-report physical activity questionnaire in relation to maximum oxygen uptake.

Material: 102 volunteer men and women between 35 and 65 years of age, recruited from the 5-year follow-up of an on-going population-based intervention study, the Inter 99 study.

Methods: Participants filled out a self-report questionnaire on 24-hour physical activity on an average weekday and aerobic capacity was measured on an electrically-braked Krogh bicycle- ergometer. Oxygen uptake and heart rate was measured continuously during the test and the peak value was regarded as max V02. Relationship between physical activity level and max V02 was explored by linear regression.

Results: Data from 47 women and 53 men were analysed. Total amount of physical activity was not significantly associated with max V02 (p=0.098), whereas amount of vigorous physical activity was significantly associated with max V02 (p=0.0001).

Conclusion: The self-report questionnaire used in this study provides a reasonably valid measurement of physical activity, since vigorous, but not total amount of physical activity is associated with maximal oxygen uptake, corresponding to findings in similar validation studies.

WHICH ENVIRONMENTAL VARIABLES SUPPORT/INHIBIT PHYSICALLY ACTIVE COMMUTING IN URBAN AREAS?

Schantz, P., Stigell, E.

The Research Unit for Movement, Health and Environment, The Åstrand Laboratory, Sweden

Introduction

The understanding of how environment may stimulate or hinder physically active commuting in urban areas is meagre. The aim of this study is therefore to scrutinize environmental factors related to existing behaviours of bicycling between home and work/study place in the inner urban part of Stockholm. For this purpose physically active commuters rated their perceived experience of 13 environmental variables along their self-chosen commuting routes. They also expressed whether the overall route environment stimulated or inhibited their commuting.

Methods

The subjects volunteered to participate in the study after being contacted through advertisements in two large morning newspapers in Stockholm. They live in the County of Stockholm and cycled the whole way to work/study place at least once a year. The minimum age for inclusion was 20 years. A questionnaire was sent to 1950 persons in May 2005. The response frequency was 93 %. 847 of the respondents bicycled in the inner urban area of Stockholm and constitute the basis for this study. Semantic differential 15-point scales for responding were used. The variables studied were exhaust fumes, noise, flow and velocities of motorized vehicles, respectively, velocities of other bicyclists, congestion of all vehicles in non-separated traffic environments, congestion of bicyclists in bicycle lanes/paths, incidence of conflicts between the individual and other road-users (including pedestrians), the extent that the route consisted of paths/lanes specifically separated for bicyclists and apart from car traffic, feeling of unsafety/safety, the extent of green elements (nature, parks, trees, plantings), aesthetics, the extent to which route complexity hampered the commuting, hilliness, number of red lights, and the perceived distance. Whether these variables could explain the ratings of to what extent the overall route environment stimulated or inhibited their commuting was tested with multiple stepwise regression analysis.

Results

The following variables were statistically significant in explaining variations in the ratings of whether the overall route environment stimulated or inhibited the respondents commuting: 1) aesthetics, 2) unsafety/safety 3) exhaust fumes, 4) route complexity hampering the commuting and 5) green elements (nature, parks, trees, plantings). The multiple regression analysis built a regression equation of the form: Y = 5.90 + 0.32 x aesthetics + 0.19 x unsafety/safety – 0.17 x exhaust fumes – 0.11 x route complexity + 0.12 x green elements.

Discussion/Conclusion

The present findings are in part clearly unexpected and of distinct interest in understanding how existing behaviours of commuting can be understood in relation to the surrounding environment. On this basis the analysis will be furthered through e.g. analysis of what the important constituents of the feeling of unsafety/safety are. Also the dimensions of aesthetics and route complexity need to be understood in depth.

MOTHERS ARE KEY DETERMINANTS OF PHYSICAL ACTIVITY IN YOUNG CHILDREN

McKee, D.P., Boreham, C.A., Murphy, M.H., Nevill, A.M.

Stranmillis University College, United Kingdom

Aim: To examine the relationship between parental and child physical activity.

Methods: Physical activity (PA) measurement using a uniaxial pedometer was simultaneously assessed for six days in 38 (14 male) three and four year old children and their parents. The relationship between parental and child PA was assessed using an ANCOVA for both weekdays and the weekend.

Results: Weekdays showed mothers' PA was positively related to child PA (partial Eta squared 0.140), whilst paternal activity was negatively associated with child activity (partial Eta squared 0.257) and that girls were more active than boys (partial Eta squared 0.173, all P ≤ .05). These factors combined to explain 42% of the observed variance in weekday child physical activity. Child weekend PA was only associated with maternal PA (partial Eta squared 0.256, P ≤ .05) with no difference in PA by gender. Maternal PA explained 26% of the variation in child PA. The mothers and fathers of the girls in this study took 30% and 27% more steps per day than the parents of the boys. This may partially explain the observed higher level of female PA.
Conclusion: These results suggest that different factors influence the PA levels of young children during weekdays compared to the weekend, and that maternal PA is likely to be a key determinate of PA in young children at all stages of the week. However, a large proportion of the variance in PA in young children remains unexplained.

DETECTION OF SHORT WALKING EPISODES IN DAILY LIFE BY MEANS OF A NEW ACCELEROMETRIC APPROACH

Terrier, P., Chalokh, M. Schutz, Y.

University of Lausanne, Switzerland , Switzerland

The energy expenditure induced by spontaneous non-structured activities called Non-Exercise Activity Thermogenesis (NEAT) has been shown to play a key role in the regulation of energy balance. NEAT comprises fidgeting, posture changes, short discontinuous walking bouts and static work. Among these activities, walking is an energy demanding exercise and it may constitute a major component of NEAT.
The aim of the present work was to objectively assess walking activities during daily life with a new method using a motion sensor optimized for walking recognition. The technical challenge was to offer increased specificity, sensitivity and accuracy as compared to classical pedometers/accelerometers.
The tri-axial accelerometer was a Leica Vectronix DMC-SX Digital Magnetic Compass. The unit contains 3 accelerometers and signal processing capabilities: the acceleration is measured in a -2 G to +2G range, and sampled at 60Hz with signed 16bits words, for an accuracy of 0.003G. This small sensor (31x33x13.5mm, 28g) was attached to the low back (L4-L5). A programmable logger (prototype) received the digital acceleration data through a serial interface, compressed them "on the fly", and stored the file onto a Compact Flash data card. This device (20x10x5cm, 100g) was worn on the side, attached with a belt.
In order to specifically track walking activities, the accelerometric signals were analyzed to detect the repetitive acceleration pattern of the gait. Hence, the duration and frequency of walking episodes were specifically assessed. The hypothesis was that a substantial part of the daily walking activities was due to short walking "bouts".
The physical activity level of 29 healthy young subjects with variable Body Mass Index (18-41kg/m2) was assessed during their habitual occupation typically over 8 hours. The results showed that during daytime the subjects performed 151±77 (SD) very short walking episodes (<60s) of an average duration of 11second each (6-17s). The subjects spent 18.7% of their day-time in walking activities. Long duration walking (>60s) accounted for about two third of the walking duration, whereas short walking episodes (<60s) accounted for about one third (respectively 12.9 and 5.8% of the total time).
Although intermittent short walks are rarely considered in the analysis of daily walking pattern, we found that they were spontaneously performed by all the subjects. Because intermittent short walking bouts are relatively high energy demanding movement among sedentary activities, they should not be neglected, due to their repetitive pattern, for a more appropriate assessment of total daily physical activity and energy expenditure.
The use of new objective methods to assess physical activity level by taking into account movements performed during everyday activities (including short walking bouts) is probably a new opening area to a better understanding of energy balance dysfunction leading to obesity.

Oral presentation (OP)

OP2-14 Motor Learning 2/2 - "Turin DE"

CONTEXTUAL-INTERFERENCE-APPROACH VERSUS DIFFERENTIAL-LEARNING-APPROACH

Birklbauer, J., Haudum, A., Müller, E.

University of Salzburg, Austria

Shea and Morgan demonstrated that in motor learning performance improved more in a randomized order of exer-cises than in a blocked one (Contextual-Interference-Effect, CI). Schöllhorn developed the thesis of differential learning, based on the coordination dynamics approach. The aim of this study is to examine the efficiency of random-ized variable practicing on the one side and of variable practicing according to differential learning on the other side. This paper should prove that not only the choice of exercises, but also their methodically guided order are crucial for success in learning.
The skills to be learned were slalom dribbling and target shooting in indoor hockey. 57 sport students participated in the study. All subjects were parallelized into 4 groups: Control (CG, n=14), CI (n=15), Randomized differential learn-ing (RD, n=14) and Goal-oriented differential learning (GD, n=14). Each of the 3 intervention groups performed 12 training units within 5 weeks. The CI-group had to complete 5 x 5 randomized target shooting and 4 x 4 dribbling exercises per training unit. In the other two intervention groups no exercise was repeated. Both differential learning groups performed the same exercises. The RD had to execute exercises in random order, while those in the GD were arranged according to certain methodical criteria. The pretest (accuracy in target shots; movement time in slalom dribbling) was repeated immediately, 3 weeks, and 6 months after the training intervention.
4 X 4 ANOVA showed significant interaction for slalom dribbling, $F(9,147)=6.01$, $p<0.001$, $eta2=0.27$. All groups except CG improved significantly ($p<0.01$) by an average of 23.2% (±10.4%) in their performance after training and by another 3.7% (±7.2%) after 6 months. No significant difference between the 3 training methods was revealed. The results for target shooting were similar to the ones in slalom dribbling. But unlike the performance in cyclic dribbling, the accuracy in target shooting of the RD group between the first and the second retention test decreased by 29.4% (±55.9%), whereas the GD and CI groups improved their accuracy by an average of 6.3% (±27.7%). During this last retention interval, changes in motor behavior differed between RD and GD, RD and CI ($p>0.05$), while GD and CI did not ($p>0.05$).

The results cannot show differential learning's supremacy to randomized variable practice. The comparison of the two types of differential learning did not indicate significantly different performance improvements, but both groups showed significantly differing retention performances in the long term interval. It is remarkable that the choice of exercises for both methods was identical. Since the only difference was the order of exercises, great importance should be attached to the goal-directed use of exercises, in consideration of a temporally persisting change of motor behavior.

Schöllhorn W (1999). Leistungssport, 29, 5-12

Shea JB & Morgan RL (1979). J Exp Psychol, 5, 179-187.

ERRORLESS LEARNING AND TRANSFER TO NOVEL TASK VARIATIONS: A SWITCH FROM IMPLICIT TO EXPLICIT CONTROL?

Maxwell, J.P., Masters, R.S., Lam, G.

University of Hong Kong, Hong Kong

Maxwell, et al (2001) examined the role of errors in the implicit acquisition of motor skills. They reported beneficial effects for settings that reduced error execution during acquisition of a golf putting skill. Specifically, relative to training that involved a high rate of error committal, errorless learning reduced performance costs associated with imposition of a cognitively demanding secondary task load, and optimised performance during retention and novel distance transfer tests. However, previous research has uniformly demonstrated poor transfer to novel task variations for errorless learners, relative to discovery learning (e.g. Prather, 1971; Singer, 1977). Maxwell et al. suggest that previous results are confounded by the presence of artificial movement controls (e.g. physical restraints) that critically alter task parameters when removed. The present experiment examined the effects of transfer from a flat to sloped putting surface following errorless training that involved no artificial change in movement constraints during the transfer test. It was hypothesised that the performance of errorless learners would remain superior to that of errorful learners. The effects of secondary task load were also examined to confirm Maxwell et al's previous finding of robust performance for errorless learners, but not for errorful learners. A 400 trial learning phase, in which two groups (Errorless and Errorful) performed a putting task on a flat artificial grass surface at varying distances from the hole, was followed by a 50 trial retention test and a novel task (sloped surface) transfer test. The novel transfer test was followed by a second 50 trial retention test and a 50 trial secondary task transfer test, both performed on the flat surface. The performance of the Errorless group was uniformly superior to that of the Errorful group in the testing phase. In addition, the Errorless group suffered a smaller drop in performance during the novel task transfer test. However, both groups suffered an equivalent drop in performance when required to perform the secondary task transfer test, contrary to previous findings. The data support the novel task transfer hypothesis, but suggest that altering task requirements may cause the performer to adapt their cognitive strategy from a largely implicit to an explicit mode in order to overcome performance decrements. Continued employment of explicit cognitive activity may explain the subsequent inability of the Errorless group to cope with the secondary task load.

Maxwell, J.P., Masters, R.S.W., Kerr, E. & Weedon, E. (2001). Quarterly Journal of Experimental Psychology, 54A, 1049-1068.

Prather, D.C. (1971). American Journal of Psychology, 84, 377-386.

Singer, R.N. (1977). Review of Educational Research, 47, 479-498.

NEUROMUSCULAR TRAINING MAY DECREASE THE RISK OF ACL-INJURY DURING SIDECUTTING MANOEUVRES BY INCREASING MEDIAL HAMSTRING ACTIVITY

Zebis, M.K., Bencke, J., Magnusson, S.P., Døssing, S., Kjær, M., Aagaard, P.

Bispebjerg Hospital, Denmark

Introduction

In the recent years increasing focus has been directed on the prevention of anterior cruciate ligament injury (ACL-injury). Dynamic lower extremity valgus has been identified to predict ACL-injury risk in female athletes (Hewett et al. 2004). Different neuromuscular training regimes have been shown to effectively decrease the incidence of ACL-injuries in female sports like handball and football. However, little is known about the specific neuromuscular adaptation mechanisms elicited by these types of neuromuscular training.

In the present study we investigated the neural pre-activation pattern of the hamstring and quadriceps muscles, in a movement associated with non-contact ACL-injury, before and after the implementation of neuromuscular training.

Material and methods

A neuromuscular training program (Myklebust et al. 2003) was implemented (1/wk) during a full handball season (47 wk). Neuromuscular activity (EMG; biceps femoris, semitendinosus, vastus lateralis and medialis, rectus femoris) was recorded during a sidecutting manoeuvre in 8 female elite handball players pre and post the intervention period. Neuromuscular activity in the prelanding phase was obtained in time intervals 10 and 50 ms prior to foot strike on a force plate (AMTI). Neuromuscular activity was normalized to the peak EMG amplitude recorded during the standardized sidecutting manoeuvre.

Results

Pre-activation EMG of the medial hamstring was significantly altered after the period of neuromuscular training. Pre-activation of the semitendinosus in the pre-landing phase increased from 32 ± 11% to 46 ± 18% in time the 10 ms time interval before foot strike ($p<0.05$). No changes in neuromuscular activity were observed for any of the other examined muscles.

Conclusions

During rapid movements like sidecutting, which involves substantial eccentric quadriceps forces, substantial neural pre-activation of the hamstrings just prior to ground contact may be highly important in the control and dampening of ACL shear forces at toe down. Contraction of the medial hamstring muscle is important to medially compress the knee joint and thereby limit the risk of excessive valgus movement. It therefore seems important for dynamic knee joint stabilization that the ratio between semitendinosus and biceps femoris activity is optimally 'tuned' to avoid excessive valgus movement, and to control rotation of the tibia. The observed increase in semitendinosus activity and the unchanged activity of biceps femoris in the present study may result in more compression of the medial knee joint and greater control of tibial rotation just prior to landing, thereby reducing the risk of dynamic valgus, and the risk of ACL-injury.

REFERENCES

1. Myklebust G, et al. Clin J Sport Med.: 71-78, 2003.

2. Hewett H, et al. Am J Sports Med.: 492-501, 2004.

ARE WEIGHT AND SIZE OF THE FOOTBALL CRUCIAL FOR DEVELOPING GOOD KICKING SKILL?

Loftesnes, J.M., Buvik, P., Hansen, R.V.

Sogn og Fjordane University College, Sogndal, Norway

Children are more able to develop active play and get a better understanding of the football game as such if they have a high mastery of the relevant properties of the ball (Araūjo, 2004). These properties could be crucial for the acquisition of a good kicking action, but the study of how such a skill is acquired has not been extensively investigated (Haywood and Getchell, 2001). Both theory and the associated physical laws are discussed in this research in order to underline the importance of understanding the way ball size influences the development of the ability to kick a football. As novices children tend to all go for the ball rather than maintaining an appropriate position on the pitch, with the result that it looks like bees! Such behaviour could be due to the use of balls that are too large and heavy. When using a ball that is too heavy, inappropriate kicking actions may be acquired, leading to a static, and not a dynamical kick that is needed to kick with both temporal and spatial precision.

Methods

Forty Norwegian children served as subjects, with a mean± (SD age of 8.5± 0.8 yr). They were tested on a National Football Association test, kicking the ball 12 m in the air and hitting a 5x5 m square. Three different balls were used: internationally approved 4" and 3" footballs, and a beach volleyball.

Results

The children hit the square significantly more often with the beach volleyball than the other two balls ($p<0.01$). The 3" football was also better than the 4" football ($p<0.01$).

Discussion

In light of the results, we argue that the ball used for inexperienced football players of age 8-9 years, should be lighter than the normal 4" ball, but not smaller. This will enable such players to acquire a more appropriate kicking action by ensuring the ankle is not locked in order to achieve a successful outcome. We also argue that in using the beach volleyball the play becomes more open, and that the children will be able to make both short and long passes with better spatial and temporal precision.

References

Araūjo, D, Davids, K, Bennet, SJ, Button, C, Chapman, G.(2004): Emergence of sport skills under constraints. 409-435. In Williams, AM and Hodges, NJ (ed.): Skill acquisition in sport (pp. 409-435). Routledge, New York.

Haywood, KM, Getchell, N. (2001): Life span motor development. Human Kinetics, Champaign.

Oral presentation (OP)

OP2-15 Rehabilitation, Physiotherapy and Traumatology 2/2 - "Turin FG"

TRUNK STABILITY TRAINING IN CHRONIC LUMBAGO

Sarabon, N., Palma, P., Strojnik, V.

Faculty of Sport, University of Ljubljana & Institute of Clinical Neurophysiology, MC Ljubljana, Slovenia

Introduction

Low back pain is one of the most common orthopedic problems. Etiology can be very diverse, if only the patients share many deficiencies of their locomotor system. The aim of our study was to check the effectiveness of the sensory-motor trunk stability training in chronic low back pain patients.

Methods and Materials

10 subjects (3♂, 6♀; 48+8 yrs) volunteered for the study. After the initial measurements had been done, the experimental group was exposed to 8-week trunk stability training. Training sessions supervised by a professional staff have been carried out two times a week, for 50 to 75 min (10 min warm-up, 35 to 60 min stability training, and 5 min warm down). The subjects performed circuit training that consisted of 8 stations. Intensity as well as quantity of the exercises has been progressively modified. To test the training effects on flexibility, strength, reflex stabilization of the trunk, and individual self satisfaction, final measurements were done using the same diagnostic battery as at the beginning. We measured maximal isometric force (trunk flexion and lateral flexion, hip flexion and extension), flexibility (hip flexion and extension, Schober thoracic and lumbar, lateral flexion), m. multifidus reaction time to sudden external disturbance, Oswestry questionnaire, visual pain scale. Paired t-tests have been carried out in order to test statistical significance of the differences.

Results, Discussion and Conclusion

The general satisfaction of the subjects with the exercise program was very high (average 8 out of 10). After the training intervention, Oswestry total as well as pain level decreased significantly (7.0+2.1 to 4.0+2.5; P<.01 and 3.8+0.7 to 2.3+0.5; P<.01 respectively). The strength tests showed significant effects of the training program on trunk flexors and lateral flexors (41.7+15.1%; P<.001 and 33.3+25.2%; P<.05 respectively) while no significant changes were identified for the strength of hip muscles. Inversely, the flexibility tests indicated improved maximal range of motion for hip flexion and extension (10.4+12.8%; P<.05 and 34.4+26.1%; P<.01 respectively), while trunk flexibility remained unchanged. Multifidus reaction times to sudden perturbation was significantly decreased (98+12 ms to 87+14 ms; P<.05) after the trunk stability training.

Our data suggest that a changed neuro-muscular control in patients with chronic lower back pain can be affected by the use of systematic trunk stability training. Combining both basic situations that require trunk stability ("legs-to-center" and "arms-to-center") is a promising kinesioterapheutic approach.

MUSCLE STRENGTH AND FUNCTIONAL PERFORMANCE IN PERSONS WITH HEMIPARESIS: EFFECT OF HEAVY-LOAD RESISTANCE TRAINING

Andersen, L.L., Zeeman, P., Jørgensen, J., Andersen, J.L., Kjær, M.

Institute of Sports Medicine Copenhagen, Denmark

Stroke is the third leading cause of disability in the Western world. Hemiparesis is common after stroke, affecting more than 40 % of the stroke survivors chronically. Muscle strength is reduced and the gait cycle is altered causing walking speed to be drastically decreased. We investigated the effect of rehabilitation training consisting of heavy-load strength training combined with treadmill training on muscle strength and walking speed. Methods: 13 hemiparetic, poststroke subjects participated in the study (47±13 yrs, 180±6 cm, 86±7 kg). Training was performed for 12 wks with 5 training sessions (1-1½ hour) each week. Heavy-load strength training was performed only with the affected side of the body in resistance training machines that provided bio-feedback with regard to power-output and ROM (leg press, knee extension and knee flexion, 3-4 sets/exercise, 4-12 RM). Treadmill training was performed with partial bodyweight support to allow a progressive increase in walking speed. Before and after the training period eccentric (30 degr/s) and concentric isokinetic strength (30, 240 degr/s) for the quadriceps and hamstring muscles was measured in a KinCom dynamometer, with simultaneous recording of EMG amplitude in the agonist and antagonist muscles. Explosive muscle strength was measured as isometric rate of force development (RFD). Maximal walking speed over a 10 m distance and average walking speed over a 6 min period were also determined. Results: Before the training period all parameters of strength was markedly reduced in the affected side compared to the non-affected side, especially in the hamstrings (slow isokinetic strength: hamstrings 0-20% and quadriceps 56-69 % of the non-affected side). After the training period isokinetic strength increased in the quadriceps (e.g. slow concentric: from 92±45 to 127±52 Nm, $P<0.01$), with a similar increase in EMG amplitude. However, no significant change was seen in the hamstring muscles (slow concentric strength: from 21±15 to 29±10 Nm, $P>0.05$). RFD increased in the quadriceps from 277±176 to 329±170 Nm/s, $P<0.05$. Maximal and average walking speed increased 53 and 48 %. Discussion: In the present group of hemiparetic persons strength training combined with treadmill training increased muscle strength as well as walking speed. The relative increases in maximal and explosive strength in the quadriceps muscle were comparable to those previously observed in healthy persons undergoing strength training, which indicates that trainability of the quadriceps is not impaired. However, in the hamstring muscles where a greater pre-training deficit was observed no significant change occurred in response to the training intervention. This could indicate that a certain threshold of voluntary muscle activation is necessary to induce effective gains in response to training. The observed increase in walking speed is an important finding, since this may enhance many daily living functions in persons with hemiparesis

INTRAMENISCAL TEARS IN SPORTS MEDICINE - COMPARISON OF PRE-OPERATIVE CLINICAL AND MRI FINDINGS WITH ARTHROSCOPIC FINDINGS AND RELATIONSHIP TO THE CLINICAL OUTCOME AFTER ARTHROSCOPY –

Baraliakos, X., Meyer, O., Heikenfeld, R., Follrichs, E., Godolias, G.

St. Anna Hospital Herne, Germany

Introduction: Intrameniscal tears occur mostly in the medial meniscus with an incidence of about 3%. While a meniscal tear Grade III (with damage of the meniscal surface) in combination with the localization of the damage (meniscus basis of periphery) is an absolute indication for meniscectomy, intrameniscal tears are difficult to manage. This is also the case, if preoperative MRI shows suspicious signs of meniscal damage and clinical symptoms are also uncertain, but indicating meniscal damage.

Objectives: This study presents the results of our experience with the pre- and intraoperative management of intrameniscal tears in athletes and discusses these results with data from pre-operative MRI and postoperative clinical follow-up examinations in athletes where meniscectomy was performed in comparison to athletes where a decision against meniscectomy was failed.

Material and Methods: Overall, 37 young athletes (mean age 19.7 years, range: 15-27 years) were included in this study. All of them had a positive history of knee injury and also positive clinical findings indicating a meniscal damage, as also positive MRI examinations with signs of intrameniscal lesions. All patients underwent arthroscopic surgery because of their symptoms and positive preoperative MRI.

Results: In 31/37 athletes (84%), the preoperative diagnosis of intrameniscal tear was confirmed during arthroscopy. On the other hand, 4/37 (11%) showed a meniscal tear Grade III and in 2/37 patients (5%) we did not find any pathological finding during arthroscopy. Meniscectomy was only performed in patients with a meniscal tear Grade III. All 31 patients with intrameniscal tears were re-examined after a postoperative follow-up period of 4 months (range 2 – 7 months). During this period, intensive conservative care was performed to all patients. Loading of the knee could be performed shortly after the arthroscopy and sports activity was also possible with a very short time period (mean 14 days). At follow-up 20/31 (65%) athletes reported significant improvement of their clinical symptoms, as compared to the individual preoperative situation. However, 11/31 athletes had to be re-treated by arthroscopic meniscectomy due to remaining clinical symptoms. Finally, 10/11 athletes (91%) recovered successfully short time after meniscectomy, the remaining patient complained recurrent knee swelling, which recovered after intensive physiotherapy.

Conclusion: Intrameniscal lesions are a challenge for failing the correct treatment decision in arthroscopic surgery of the knee in sports medicine. Although many of the athletes can benefit by conservative treatment, some may require arthroscopic meniscectomy. Thus, decision for arthroscopy must be failed only after combination of excellent clinical examination, positive MRI signs preoperatively and failure of conservative treatment.

THE ROLE OF CONFIDENCE IN REHABILITATION FROM ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

Waters, A., Hardy, L., Gleeson, N.P., Rees, D.

University of Wales Bangor, United Kingdom

Whilst confidence has been identified as a potentially important factor in sports injury research, very little is known about its precise role within the athletic injury experience. For surgical treatments (such as anterior cruciate ligament (ACL) reconstruction) that involve considerable investment of time, effort, and money, establishing whether or not a significant relationship exists between confidence and recovery rates could have important implications for both injured athletes and medical teams. The aim of this study was to investigate whether certain facets of confidence early in the rehabilitation period following ACL reconstruction, could predict physical recovery later on. A non-experimental field study design was employed. Participants were 30 athletes (24 male & 6 female) with a mean age of 29.3 (SD = 8.4), of varying abilities from a wide range of sports undergoing ACL reconstruction. Six facets of confidence specific to injury rehabilition were measured using the Self-Evaluation Inventory. Measures of neuromuscular and musculoskeletal factors, including: peak force (PF), rate of force development (RFD), electromechanical delay (EMD) and joint laxity were taken. The PF, EMD & RFD performance measures

were assessed on both the knee extensors (quadriceps) and knee flexors (hamstrings). Performance Profiles (Butler & Hardy, 1992) were employed to measure self perceived recovery rates. Data for all measures was collected at pre-surgery, and 6, 12 and 24 weeks post-surgery. Results analysed using quadratic regression analysis demonstrated support for quadratic relationships between certain facets of confidence and physical outcome measures. Specifically, higher confidence in the body, higher confidence in the injured body part, less fear of re-injury at re-entry into sport and smaller lossses of self-esteem were significantly related to better susequent electromechanical delay and rate of force development outcomes, as well as self-perceived recovery rates. Inspection of the scatterplots indicated that these quadratic effects were plateau effects rather than inverted 'U' effects. The results provide some support for a positive relationship between confidence and recovery progress. They show no evidence of over-confidence effects. The findings suggest that interventions designed to augment certain facets of confidence in patients rehabilitating from ACL reconstruction might have a favourable effect on rehabilitation outcomes.

Butler, R.J., & Hardy, L. (1992). The performance profile: Theory and application. The Sport Psychologist, 6, 253-264.

ADAPTATION OF THE MUSCLE TENDON JUNCTION TO EXERCISE: REACTIONS OF THE COLLAGEN FIBRILS

Michna, H., Selg, P.J., Kühnel, W.

Institute of Public Health Research, Germany

Introduction

The collagen fibrils of the muscle tendon junction substantially contribute to the fact that a rupture between both tissues of the (muscle tendon) junction never appears: there is not one clinical report indicating a rupture of the muscle-tendon junction. Therefore, we set out to analyze the adaptation of the muscle tendon junction to exercise in an experimental model using high power transmission electron microscopy and stereological procedures. The collagen fibrils of the tendon play a significant functional role in transferring the stress to the muscle. Understanding the functional properties of the tendon it seems expedient to apply some of the concepts of material science to elucidate the adaptation of the muscle tendon junction. In materials the mechanical properties of the components and their geometric organization determine its characteristics.

Methods

Five segments of the tendon in the area of the muscle tendon junction of the flexor digitorum longus muscle were taken from the hind limbs, from mice of control groups (n= 20) and "exercised" mice (n=20). "Exercised" mice were trained in running wheels over a treatment periods up to one, thee, five and ten weeks. The tissues were prepared for electron microscopy (using a Zeiss EM10) and morphometry (using an IBAS II system)

Results

The principal structural features of the muscle tendon junction of exercised and controlled mice are indistinguishable: the plasmalemma of the muscle fiber is folded into fingerlike extensions and invaginations; and these folds increase the interfacial area between the tendon and the muscle fiber. The differences of trained and non-trained muscle tendon junctions can only be revealed by use of morphometrical procedures. The morphometric analysis of the collagen fibrils indicate that exercise stimulates the growth of thin collagen fibrils in the range of forty nm and thick collagen fibrils in the range of 250 nm, displaying a bimodal distribution pattern of the collagen fibril diameters. Growth of extremely thin and thick collagen fibrils enhances the volume fraction of collagen fibrils in up to 10 to 20% with a raise of the mean collagen fibril diameter up to 20%. Ultrastructural analysis of the muscle tendon interface indicate that, in exercised animals, the "interfacial ratio" (Trotter and Baca, 87) (the ratio of the surface area of force – transmitting membrane to the cross-sectional areal force – generating tendon fibrils) is significantly enhanced up to 30%.

Conclusion

It becomes evident, that the tendon tissue is not a "bradytrophic" tissue but that is lively reacting to functional loading. We present data indicating the pathways in which collagen fibrils responde to functional loading. We will also present data indicating, that collagen fibrils adapt dynamically to the loading regime they experience.

Reference:

Trotter JA, Baca JM: J Muscle Res Cell Mot 8, 517-526 (1987).

17:00 - 18:30

Invited symposium (IS)

IS2-16 Truth and scientific explanation: Some controversies - "Athene"

PARADIGMS AND POSSIBILITIES

McFee G., UK

Without abstract submission.

TRUTH AND SPORT SCIENCE RESEARCH: PROBLEMS WITH THE RELATIVIST TURN

Bailey, R.

Roehampton University, United Kingdom

Truth has had a hard time in recent social scientific writing, and this has started to be felt in some work in the sport and exercise sciences. The rise of relativism, or the view that conceptions of truth are not absolute but are relative to the persons or groups holding them, can be witnessed in the work of those influenced by post-modernism, radical social constructivism, pragmatism, and other schools of thought. Although such relativism reveals itself in many different ways, certain characteristics are common, which deserve questioning. It is suggested that a fully-fledged relativistic stance towards research is inherently self-contradictory, and is harmful to the research enterprise. A partial solution to the problems that relativists raise about the nature and growth of knowledge is suggested that seeks to balance a recognition that the truth is hard to come by, but matters, nonetheless.

THE TRUTH ABOUT OBESITY AND CHRONIC DISEASE: THE MEDICO-DARWINIAN PARADIGM

Batterham, A.

University of Teesside, United Kingdom

"Nothing in biology makes sense except in the light of evolution".
(Theodosius Dobzhansky).

In this talk, I present a thumbnail sketch of the Darwinian Medicine approach to health promotion research and practice, with an emphasis on obesity and the chronic 'diseases of civilization'. Historically, the limited impact of health promotion may relate to four key factors. First, there has been a lack of an overarching paradigm to guide interventions. Secondly, the target audience often perceives health messages as controlling and coercive. Thirdly, contradictory research findings and health messages have affected public confidence in health professionals. Fourthly, individual-level interventions have been over emphasised. Adoption of an evolutionary biology perspective may help surmount these barriers.

The central premise of the Darwinian Medicine approach to understanding the aetiology of chronic disease is a mismatch between our Stone-Age genes and the modern environment. This argument is founded on a key principle of natural selection applicable to human health - that genes are selected in particular contexts and consequently that our genes function optimally in the environment and lifestyle to which we have been most exposed, that is, a hunter-gatherer existence. Evidence suggests that the current human genome has remained essentially unchanged since the Late Palaeolithic era, and was selected in an environment in which a high level of physical activity was tightly coupled to food procurement. In industrialised societies physical activity is no longer obligatory, as pleasant tasting, energy dense foods are widely available. In short, food is plentiful and physical activity is optional.

Apparently, the prevalence of obesity and related conditions in developed countries has increased rapidly in just a few decades. Using Darwin's Razor, an explanation for this disturbing trend is that humans are not well adapted to modern environments. In brief, we are hard-wired to prefer sweet, salty, and energy dense foods, and to curtail physical activity whenever possible to conserve energy. These behaviours were adaptive in the Stone Age but now render many susceptible people with thrifty genes vulnerable to obesity and its pathological consequences. Humans are adapted to cycles of rest/ feast and physical activity/ famine, but this process has been interrupted. Today, physical inactivity and poor diet may result in abnormal gene expression and consequent clinical disease.

Evolutionary explanations of chronic disease represent an example of non-deductive reasoning in an 'inference to the best explanation', and a plausible and parsimonious way of accounting for the available data. Conventional health promotion approaches encouraging voluntary health behaviour changes may be doomed to failure – a losing battle against our own biology. The Darwinian Medicine paradigm may inform a research agenda and the development of more effective, translatable interventions.

Invited symposium (IS)

IS2-17 Carbohydrate metabolism, nutrition and gender differences (sponsored by Nestle-Nutrition) - "Innsbruck"

CARBOHYDRATE METABOLISM DURING EXERCISE

Jeukendrup, A.E., UK

Without abstract submission.

GENDER DIFFERENCES IN MUSCLE METABOLISM DURING EXERCISE

Kiens, B.

Copenhagen Muscle research Centre, Institute of Sport and Exercise Science, University of Copenhagen, Denmark

From the literature it seems reasonable to conclude that there is a small gender difference in relation to fat oxidation during submaximal exercise in the favour of a higher relative fat oxidation in women than men.

The mechanism(s) behind the higher relative fat oxidation seen during exercise in women compared to men is not known. Recent findings suggest that an improved muscle cellular energy balance during exercise in women than men, plays an important role (Roepstorff et al, 2006).

Besides a gender difference in relative fat oxidation during exercise, there seems also to be gender differences in substrate utilisation. Thus females use intramuscular located triacylglycerol to a larger extent than males.

It could be speculated whether the differences in energy substrate utilisation during exercise between gender could play a role in nutritional recommendations for athletes as well as for the population

Roepstorff, C.,Thiele,M.,Hillig,T.,Pilegaard,H.,Richter,EA.,Wojtaszewski,J and Kiens, B. J Physiol, April,2006. Epub Ahead of print.

QUANTITY OF CARBOHYDRATE INGESTED AFFECTS EXOGENOUS AND ENDOGENOUS CARBOHYDRATE UTILIZATION DURING EXERCISE IN TRAINED WOMEN

Wallis, G.A., Yeo, S., Blannin, A., Jeukendrup, A.E.

The University of Birmingham, United Kingdom

The effect of different quantities of carbohydrate (CHO) intake on CHO metabolism during prolonged exercise was examined in endurance trained females. On four occasions, 8 females performed 120 min cycling at ~60% maximal oxygen uptake with ingestion of beverages containing low (LOW, 0.5 g/min), moderate (MOD, 1.0 g/min) and high (HIGH, 1.5 g/min) amounts of CHO, or water only (WAT). Test solutions contained trace amounts of [U-13C] glucose. Indirect calorimetry combined with measurement of expired 13CO2 and plasma 13C enrichment enabled calculation of exogenous CHO, liver-derived glucose and muscle glycogen oxidation during the last 30 min of exercise. The highest rates of exogenous CHO oxidation were observed in MOD, with no further increases in HIGH (peak rates of 0.33±0.02, 0.50±0.03 and 0.48±0.05 g/min for LOW, MOD and HIGH respectively; $P<0.05$ for LOW vs. MOD and HIGH). Endogenous CHO oxidation was lowest in MOD (0.99±0.06, 0.82±0.08, 0.70±0.07 and 0.89±0.09 g/min; $P<0.05$ for MOD vs. all other trials). Compared to WAT, CHO ingestion reduced liver glucose oxidation during exercise by ~30% ($P<0.05$ for WAT vs. all CHO). Differential rates of

muscle glycogen oxidation were observed with different CHO doses (0.57±0.07, 0.53±0.08, 0.41±0.07 and 0.60±0.09 g/min for WAT, LOW, MOD and HIGH respectively; P<0.05 for MOD vs. HIGH). In endurance trained women, the highest rates of exogenous CHO oxidation and greatest endogenous CHO sparing was observed when CHO was ingested at moderate rates (1.0 g/min, 60 g/h) during exercise.

Invited symposium (IS)

IS2-18 Physical activity and the elderly - "St. Moritz"

CHANGES OF PHYSICAL ACTIVITY HABITS AMONG ELDERLY POPULATION

Schena, F., Lanza, M.

University of Trento, Italy

Exercise prescription represents a main step in the strategy to increase the amount of daily physical activity in order to improve the life quality and reduce the chronic pathologies in elderly people. The individualised progression of ageing process and the need to consider the elderly motivation and expectation related to exercise reinforce the role of a correct prescription to reach the higher success rate in promoting physical exercise among aged people. The optimal prescription for an elderly individual is determined by an proper evaluation of: 1- Subject goal(s) The final targets to reach with exercise; 2- Physical Capacity (determined by applying an appropriate physiological and performance evaluation); 3- Psychological profile (the individual attitude or fears towards exercise); 4- Social environment helps and barriers (probably the most important in reaching the changing in life style). Following medical tradition, exercise programs for elderly up to ten years ago was generally defined on the basis of a reduction in intensity in order to increased safety without any control on the efficacy of the intervention. Recently an increasing amount of evidences coming from the literature strongly suggested that elderly can exercise to a moderate and sometimes also hard intensity and these levels of effort produce the larger positive health effects while the risks remain low. Following these principles also exercise prescription for elderly can take advantage by using these five steps: 1- Appropriate mode(s) of exercise, 2-Intensity, 3-Duration, 4-Frequency, 5- Progression. We apply this strategy to the project "Health is in the Movement" developped in Italy as a model of health promotion through exercise in the elderly, actually involving es more than 7000 individuals aged 60 and more. The project includes actions which are targeted to the whole old people (healthy, diseased, frail) living in communities as well as in nursing homes.

HOW TO ASSESS PHYSICAL ACTIVITY IN ELDERLY ?

Vuillemin, A.

University Henri Poincare, France

There is evidence to suggest that reduced physical activity (PA) plays a major role in age-related decline, particularly in energy expenditure. PA guidelines have emphasized the importance of and the need to promote PA for health throughout life. Accordingly, accurate measures of PA are necessary to study the relationship between PA level and health outcomes in research practice; and to facilitate early initiation of appropriate intervention in clinical practice, thus reducing health problems. Nevertheless, there is a considerable problem to obtain reliable assessment of PA partly due to the difficulties to assess under free-living conditions. Assessing PA is a challenge because of the need to consider many activities of various duration, frequency and intensity that may occur as part of daily life in varying context (transportation, school, occupation, household chores, recreation, and sport). Many instruments are available in the literature but there is no single current instrument able to assess all aspects of PA. Each instrument has its own utility and limitations and some may be complementary. Simple field techniques for assessing usual PA are difficult to develop. The greatest obstacle to validating field methods of assessing usual PA is the lack of adequate comparison criteria. Doubly labelled water (DLW) is considered as a gold standard for validating methods to measure energy expenditure (total daily or PA-related energy expenditure) but it doesn't provide information on PA patterns. PA can also be objectively measured by wearable monitors that can record heart rate and/or movement. Accelerometer sensors are currently used mainly in a research setting; however, they can be used in clinical practice but they don't capture the type and context of activity (e.g., occupation, transportation, household, recreation). At present, self- or interview-administered questionnaires are also widely used, all the more in large population studies (surveillance, risk factor epidemiology). One of the limitations of these questionnaires is the definition of PA and the dimensions covered. Compared to DLW, PA questionnaire and accelerometry may significantly underestimate free-living PA in older adults. For example, Minnesota Leisure Time PA recall and Caltrac uniaxial accelerometer appear to significantly underestimate (by 50-55%) free-living PA in older adults. Inability of recall methods and accelerometers to detect every movement may partially contribute to this underestimation. The use of recall questionnaire as a proxy measure of individual energy expenditure is limited in older women and men. Despite their limitations, recall questionnaire are relatively easy to administer, relatively inexpensive, acceptable for the subject and of interest when studying the influence of lifelong physical activity.

CHALLENGES IN IMPLEMENTATION OF PHYSICAL ACTIVITY PROGRAMS FOR THE ELDERLY

Hopman-Rock, M.

TNO Quality of Life, Netherlands

During the last 10 years a lot of scientific effort has been put into the development and evaluation of effective physical activity programmes for older adults. Many programmes have been launched, but less is known about their fate. What happened to them after their introduction? Did they reach the intended public? What were the enabling factors and what were the barriers?. In this presentation it is explained why innovation processes often fail, why it is important to carry out research in this area, and what we can learn of earlier experiences in introduction of physical activity programmes for the elderly. We call this the 'Implementation challenge'.

First, attention is paid to the definition of some widely used concepts and what is known about the implementation challenge, using the review by Fleuren et al. After that, the pathway from basic research to implementation is viewed from the perspective of the researcher and from the perspective of the practitioner, illustrated with examples of own research.

- The researcher's perspective

A framework for evaluating health (education) programmes was proposed by Nutbeam et al., including:

- Basic research and theory
- Experimental studies (especially Randomised Controlled Trial)
- Demonstration studies (especially Community Intervention Trial)
- Dissemination studies (especially Monitoring)
- Operational management (Implementation)
- The practitioner's perspective

The practitioner works "opposite" the researcher. He or she may use the usual programmes in everyday practice and may be unwilling to change to a new programme. Orlandi et al. identified this as a potential problem for the dissemination and implementation of innovations. They proposed the "intermediary linkage system" as an efficient method to ensure the transfer of innovations from the source to the users. The idea is that researchers and practitioners exchange information and communicate with each other from the start of an innovative project onwards. In this way collaborating partners can provide each other with training, technical support, and feedback.

Finally, some basic principles of the diffusion theory of Rogers are given and the RE-AIM framework of Glasgow is introduced to support research on innovation processes.

- Fleuren M et al. Determinants of innovation within health care organizations. Literature review and Delphi study. Int J Quality in Health Care 2004; 16(2):107-123.
- Nutbeam D et al.. Evaluation in health education: a review of progress, possibilities, and problems. J Epid Comm Health 1990;44:83-89.
- Orlandi MA et al.. Diffusion of health promotion innovations. In: Glanz K, et al. (eds). Health behavior and health education: theory, research and practice. San Francisco: Jossey-Bas; 1990. p. 288-313.
- Rogers EM. Diffusion of Innovations. New York: The Free Press; 2003 (5th ed).
- Glasgow RE et al. Evaluating the public health impact of health promotion interventions: The RE-AIM framework.

Invited symposium (IS)

IS2-19 Delivering psychology services to top level sport - "Albertville"

SKEET SHOOTING ATHLETES' PSYCHOLOGICAL PREPARATION: AIMS AND CONTENT OF THEIR MENTAL IMAGERY USE

Psychountaki, M.

University of Athens, Greece

The mental imagery is an intervention strategy which is usually included in psychological programs for athletes. Applied sport psychologists suggest that imagery use -combined or not with other strategies- can influence athletes in a variety of ways. For example, in improving psychological skills (e.g., self-confidence, self-control, coping with stress etc.), as well as in improving the techniques and tactics of the sport and the athletes' performance (Moritz et al., 1996; Orlick, 1990; Suinn, 1996; Vadocz et al., 1997).

The purpose of this presentation is to describe indicative applications of mental imagery focusing on the aim, the content, the phase in which they were applied and the way they were evaluated. More specifically, the presentation includes the application of mental imagery in the case of four athletes of the Cyprus National Team (2 male athletes aged 27 and 36 and 2 female athletes aged 22 and 31).

For the formation of the mental imagery programs, the following were taken into consideration: (a) the psychological preparation phase (training and application phase), (b) the previous experience (primary or high) in the psychological preparation program, (c) the physical preparation phase (pre-competitive and competitive), and (d) the needs of each individual athlete. The presentation will provide examples of how the content of mental imagery is adapted to the intervention goals for each individual athlete.

After the teaching and training in mental imagery, each athlete used a specific program once or twice a day for 10 – 15 minutes. The mental imagery training took place before, during or after the physical training, or at another moment during the day. Each practice was evaluated by the athletes by filling in a relative evaluation form so that they would get aware of their ability for visualization.

Psychological service to skeet shooting athletes was evaluated at the end of each competitive year by taking interviews from the athletes. It was also informally evaluated by the officials of the team and by the fact that more and more athletes from the same federation every year asked for psychological support. Throughout the last six years, in which the program is in use, the athletes were able to achieve their goals: they got a lot of medals in European, World or Commonwealth competitions and one of them has equaled the world record. The program is still in use and has been planned to last until the 2008 Olympic Games.

References

Moritz, S.E., Hall, C.R., Martin, K.A., & Vadocz, E. (1996). What are confident athletes imaging? An examination of image content. The Sport Psychologists, 10, 171-179.

Orlick, (1990). In pursuit of excellence. Champaign, IL: Human Kinetics.

Suinn, (1996). Imagery rehearsal: A tool for clinical practice. Psychotherapy in Private Practice, 15, 27-31.

Vadocz, E., Hall, C.R., & Moritz, S.E. (1997). The relationship between competitive anxiety and imagery use. Journal of Applied sport Psychology, 9, 241-253.

PERFORMANCE ENHANCEMENT ISSUES IN SPORT PSYCHOLOGY CONSULTING: SEVENTEEN CASES SUMMARY

Johnson, U., Stambulova, N.

Centre for Sport and Health Research, Sweden

Address of Institution(s): Centre for Sport and Health Research, Halmstad University, Sweden

The study aimed at cross-case comparison and synthesis of final reports about implementation of individualized intervention programs. Clients were 17 Swedish competitive athletes (11 females and 6 males) between 14 and 35 years old, representatives of individual (e.g., boxing, golf, tennis) and team (e.g., soccer, floor ball) sports. Consultants were students under applied sport psychology course at Halmstad University who collected information, identified individual needs, planned and then implemented individualized intervention programs with athlete-clients during six months under supervision of the authors who were the course leaders. Inductive analysis of primary working issues showed that 35 (72%) of them across 17 cases related to performance enhancement and 13 (28%) to career development/transitions. In total performance enhancement issues were among the athletes' dominant individual needs in 16 cases. Five high

order themes representing the performance enhancement category were identified: a) performance-related mental skills, e.g., imagery, self-talk, relaxation, concentration, communication, etc. (40%); b) pre-performance routines (11%); c) self-confidence/efficacy in performance (11%); d) goal setting (9%); e) other, e.g., optimal recovery, self-image, high quality practice, attitude to failure, attributions, etc. (29%). All the consultants used educational approach based on a combination of sport specific and general theoretical frameworks, including e.g., the model of a seven-phase performance enhancement process, the pyramid model of peak performance (In Hardy, Jones & Gould, 1996); the IZOF-model (Hanin, 2000); the psychological preparation for a competition model (Puni, 1969); the sport self-confidence model (Vealey, 2001), but also social cognitive theory and attribution theories. The intervention programs involved education, counselling goal setting sessions, mental training, practical implementation of learned skills, homework, athletes' diary, analysis of video, after performance debriefing. Each consultant developed and employed an individualized assessment map that included both monitoring instruments (e.g., self-made scales, DART-notes, performance results, IZOF-profiles) and also pre-post intervention assessment (e.g., PSPP, TEOQS, Sport Imagery Evaluation form, CSAI-2, individualized self-made scales). Advantages and limitations of the synthesis undertaken will be discussed, and recommendations on how to improve applied sport psychology education will be suggested.

Hanin, Y. (2000). Emotions in Sport. Champaign, Il: Human Kinetics.

Hardy, L., Jones, G., & Gould, D. (1996). Understanding psychological preparation for sport. Chichester, UK: Wiley.

A DEVELOPMENTAL APPROACH TO MENTAL SKILLS TRAINING OF TALENTED YOUNG TENNIS PLAYERS

Wylleman, P., Kahan, N.

Vrije Universiteit Brussel, Belgium

Applied sport psychology literature provides insight into, and descriptions of techniques and approaches for sport psychologists on how to work with elite athletes and players (e.g., Hardy, Jones, & Gould, 1996; Taylor & Wilson, 2005). However, at present little information is available on the needs of, and approaches for mental training with talented young athletes and players. Using a combination of a qualitative and quantitative research methodology, 14 tennis coaches working on a daily basis with 12 to 18 year-old players in the elite tennis school of the Flemish Tennis Federation (VTV) were questioned on (a) their knowledge on mental coaching, (b) the mental functioning of their players in function of age and level of performance, (c) the learning and training of mental techniques with young players, and (d) the role and influence of significant others on the mental functioning of young players. Results showed, amongst others, that the coaches had a good basic knowledge of sport psychological techniques and mental coaching. Furthermore, coaches advocated the need to specify mental training and mental coaching not only in function of specific mental skills and/or attributes (e.g., being motivated and showing effort, being able to concentrate and focus, being able to manage stress) but also in function of specific age-groups. Finally, coaches also indicated that mental training of young players should not only be conducted on a day-to-day basis but also be integrated, as fully as possible, in young players' daily on-court training provided by the coaches themselves rather than via a sport psychologist or mental consultant. On the basis of these data, a developmental framework for teaching, training and using six mental skills (motivation, self-control and self-discipline, self-confidence and mental strength, concentration, relational and communication skills, lifestyle management skills) with tennis players in three age-groups (9-11 yrs, 12-14 yrs, 15-18 yrs) was tentatively formulated. In conclusion, the use of this developmental framework in working with coaches, players and parents in elite-level tennis will be illustrated, while recommendations for further research will be formulated.

Invited symposium (IS)

IS2-20 Tendon and ligaments - "Berlin ABC"

TENDON ADAPTATIONS TO LONG-TERM DISUSE

Narici, M.V., Reeves, N., Maganaris, C.N.

Manchester Metropolitan University, United Kingdom

Prolonged disuse is associated with a substantial decline in muscle mass and strength (1). Despite the importance of human tendons for the transmission of force to bones enabling movement, and for their influence on the behaviour of the contractile element in static and dynamic contractions, scanty information existed on their adaptations to prolonged disuse. Recently, however, we had the opportunity to study the changes in tendon mechanical properties in two disuse paradigms, simulated microgravity (long term bed rest, LTBR) and spinal cord injury.

Tendon stiffness, length and cross-sectional area were measured in 18 young healthy males (aged 25-45 years) before and after 90 days of bed rest (ESA LTBR 2001-2 study) (2). Nine subjects performed resistive exercise (BREx group), and nine underwent bed rest only (BR group). Calf raise and leg-press exercises were performed every third day using a gravity-independent flywheel device. Isometric plantar flexions and ultrasound imaging were used to determine the tensile deformation of the gastrocnemius tendon during contraction. At the end of the 90-day bed rest period, in the BR group, tendon stiffness and Young's modulus decreased by 58% (P 0.01), and 57% (P 0.01), respectively. Despite the intensive resistive exercise of the BREx group (4 sets of 7 leg-press, and 4 sets of 14 calf raise exercises), tendon stiffness and Young's modulus decreased by 37% (P 0.01), and 38% (P 0.01), respectively. These findings showed that unloading causes a decrese in tendon stiffness due to a change in tendon material properties, but not in tendon dimensions and that a very large volume of resistive exercises is needed to protect the tendon from disuse.

In the second paradigm of prolonged disuse (3), we compared the mechanical properties of the patellar tendon in six men who were spinal cord-injured (SCI) and eight age-matched, able-bodied men. Measurements were taken by combining dynamometry, electrical stimulation, and ultrasonography. Tendon stiffness and Young's modulus were lower by 77% ($P < 0.01$) and 59% ($P < 0.05$) in the SCI than able-bodied subjects. The cross-sectional area (CSA) of the tendon was 17% smaller ($P < 0.05$) in the SCI subjects, but there was no difference in tendon length between the two groups. These results indicate that paralysis causes substantial deterioration of both structural and material properties of tendon.

Hence the results of these two studies provide evidence of marked alterations in tendon mechanical properties in response to prolonged disuse. These alterations are expected to play a significant role in the loss of muscle function induced by this condition.

1) di Prampero PE, Narici MV. J Biomech. 2003, 36:403-12.

2) Reeves, N. D., C. N. Maganaris, G. Ferretti, and M. V. Narici. J Appl Physiol 2005, 98: 2278–2286.

3) Maganaris CN, Reeves ND, Rittweger J, Sargeant AJ, Jones DA, Gerrits K, De Haan A. Muscle Nerve. 2006, 33:85-92.

INFLUENCE OF EXHAUSTIVE FATIGUE ON STRETCH RESPONSE OF THE MUSCLE-TENDON UNIT

Nicol, C., Ishikawa, M., Cronin, N., Avela, J., Komi, P.V.

1 University of the Mediterranean, France, 2 University of Jyväskylä, Finland, France

Stretch-reflex changes are of particular interest in stretch-shortening cycle (SSC) exercises (such as jumping and running) where stretch loads are high and muscle stiffness must be regulated to meet the external loads (1). However, the exact contribution of stretch-reflexes to force and stiffness regulation needs to be quantified, especially in fatigue situation. As the stretch reflex mechanical response takes place in SSC actions while the muscle is actively stretched, the question arises about the potential fatigue effects on the resistance to stretch of the reflex mechanical response. Based on results with high speed ultrasonography (US) the entire fascicle-tendon interaction must be also considered (2).

Exhaustive SSC exercises are typically associated with ultrastructural muscle damage, delayed onset muscle soreness and with a bi-modal trend of decline of the neuromuscular function that may not recover for a few days. The stretch reflex EMG response follows a bimodal pattern when measured either in passive or active stretching conditions. Although sensitive to SSC fatigue, this does not apply to the contractile tissue (fascicle length and orientation) recovery (4). The follow-up of the mechanical response to fatigue of the muscle-tendon complex is critical as it requires repeated measurements of the Achilles tendon force (ATF).

The present report deals, first, with the reliability and limits of the torque signal to record passive stretch reflex responses of the triceps surae muscle group when compared with the simultaneous optic fiber signal of the ATF. Further comparison was then made with the US signal pre- and post-SSC exercise as well as 2h, 2 days and 7 days later. The reflex test included a series of passive double dorsiflexion stretches ranging from 0.1 to 3.1 rad.s-1 induced by a powerful ankle ergometer. Each mechanical stimulus consisted of 2 identical dorsi-flexions in both amplitude (.05 rad) and velocity. The 2nd stretch timing was varied to occur at different force levels during the contraction and relaxation phases of the reflex mechanical response.

The increase in torque at the slowest velocity followed well the pedal displacement, reflecting the pure passive resistance to stretch. This parameter was not influenced by SSC fatigue. At faster velocities, the magnitude of the reflex mechanical response confirmed the substantial role of the stretch reflex for force and stiffness enhancements. SSC fatigue resulted in a bimodal drop of the mechanical reflex response that recovered in parallel with the EMG response. The active resistance to the 2nd stretch (ARS) was found to be much influenced by the contraction-relaxation state of the muscle. It is noteworthy that this trend was preserved all along the SSC recovery period, and despite a large ARS reduction until day 2.

1. Komi and Gollhofer (1997) Eur J Appl Physiol 72: 401-409.

2. Ishikawa and Komi (2004) J Appl Physiol 96: 848-852.

3. Ishikawa et al. (in press) Eur J Appl Physiol.

CURRENT ISSUES IN THE TREATMENT OF TENDINOPATHY

Kjær, M.

Institute of Sports Medicine, Denmark

Treatment of chronic tendon pain has advanced, and attempts include eccentric training, anti-inflammatory drugs and sclerosing tendon vessels. However, mechanisms behind the effect of treatment modalities are far from solved. It is clear that even in injured tendon mechanical loading can increase collagen formation in the Achilles tendon. Furthermore, both concentric and eccentric training results in an upregalation in procollagen type I expression of tendon. Interestingly, the exercise stimulated increase in collagen synthesis is less pronounced in women than in men and furthermore gender differences in tendon fasicle tensile strength exists. This could have implications for a gender specific time frame of training and rehabilitation. During exercise tendon blood flow and metabolism increase, and blockade of prostaglandin release in relation to exercise reduces the blood flow in tendon.

Oral presentation (OP)

OP2-16 Physiology 8/10 - "Oslo"

DIFFERENCES IN INTRAMYOCELLULAR LIPIDS UTILIZATION IN THIGH AND CALF MUSCLES DURING ENDURANCE EXERCISE DETERMINED BY 1H-MR SPECTROSCOPIC IMAGING

Zehnder, M., Saillen, P., Kreis, R., Boesch, C., Vermathen, P.

University and Inselspital Berne, Switzerland

Introduction Intramyocellular lipids (IMCL) are important fuels during prolonged moderate-intensity exercise. However, little is known about specific IMCL usage in different muscles. Based on a previous feasibility study [1] we performed muscle specific analyses of metabolite changes in thigh and calf muscles using a standardized exercise protocol.

Methods 8 trained cyclists (6 males, 2 females, 31y, 8 training h/week) and 8 trained male runners (29y, 8 training h/week) exercised 3h on a cycle ergometer (at 49% of max workload = 69% of max heart rate) or on a treadmill (at 52% of max speed = 75% of max heart rate), respectively. The subjects added supplementary 0.75 g fat/kg bw to their diet during 2 days prior to exercise to ensure full IMCL stores. In 2 cyclists right and left thigh as well as in 4 runners right and left calf were examined. IMCL concentration was determined before and after endurance exercise in m. rectus femoris (RF), vastus intermedius (VI), medialis (VM), lateralis (VL1, VL2) and adductor magnus (AM) for the cyclists and in m. soleus (S), gastrocnemius (G), tibialis anterior (TA) and extensor digitorum (ED) for the runners.

MR-spectroscopic-imaging (MRSI) measurements were performed at 1.5T using a 2D-MRSI sequence in transverse orientation. Parameters: TR=1200ms, TE=35ms, Matrix=36×36, FOV=20cm. Processing included spatial zerofilling, lipid-extrapolation, receive profile correction and spectral fitting using TDFDFIT.

MRSI voxels were assigned to specific muscles using image segmentation and their metabolite content subsequently averaged to yield one value for each muscle and subject. Bone-marrow lipid served as reference for quantification.

Results a) a good correlation of IMCL before and after exercise in thigh and calf muscles ($R2=0.75$, $p<0.0001$), b) higher resting IMCL concentration in S than in G and TA for calf and higher resting IMCL in vastus muscles than in RF for thigh, c) strongly reduced IMCL after exercise by ~50%, d) stronger absolute IMCL depletion in muscles with high IMCL resting concentration. Beside absolute also relative

IMCL depletion differences between muscles (relative to resting IMCL) were detected with higher reductions in "slow" than in "fast" muscles, e.g. between S (slow) and G (fast) for calf, and between vastus muscles (slow) and RF (fast) for thigh. An additional finding was that trimethyl-ammonium (TMA) increased significantly with exercise.

Discussion The results showed muscle specific reductions of IMCL after exercise. In general, resting IMCL and absolute as well as relative IMCL depletion after exercise was higher in slow compared to fast muscles. The TMA increase may be related to acetyl-carnitine increase with exercise and differing MR-visibility between carnitine and acetyl-carnitine [2].

References 1. Vermathen et al. Proc. ISMRM 11: 786, 2003; 2. Kreis et al. NMR Biomed. 12:471, 1999

Acknowledgement Supported by Swiss National Foundation (3100-065315.01).

KINETICS OF MUSCLE PHOSPHOCREATINE AND PULMONARY OXYGEN UPTAKE DURING MODERATE INTENSITY EXERCISE IN CHILDREN

Armstrong, N., Barker, A.R., Fulford, J., Welford, D., Welsman, J.R., Williams, C.A.

University of Exeter, United Kingdom

Despite the influence of transit delays and utilization of O2 body stores, the rise in phase II pulmonary oxygen uptake (VO2) during a step-transition to moderate intensity exercise has been demonstrated to closely reflect (~10%) muscle O2 consumption (QO2) in adults, using phosphocreatine (PCr) as its proxy (Rossiter et al., 1999). However, as large inter-breath fluctuations and low response amplitudes complicate the child's VO2 response, the derived parameter estimates have low confidence, which may limit physiological inference to changes in QO2. To indirectly explore this association in children, this study compared the kinetic changes in quadriceps PCr and cycling VO2 during moderate intensity exercise.

Following habituation, 14 children (mean age 9.8 y, height 1.36 m, body mass 32.4 kg) completed a unilateral knee-extensor incremental exercise test to exhaustion whilst lying prone in a whole body scanner (Philips, 1.5T) for determination of muscle energetics using 31P-magnetic resonance spectroscopy. Subsequently, the dynamic changes in quadriceps PCr were resolved every 6 s during at least 4 constant rest-work transitions, corresponding to 80% of the previously determined intracellular threshold for Pi/PCr. Cycling VO2 was measured throughout no fewer than 4 work transitions from unloaded pedaling to 80% of the previously determined ventilatory threshold. Breath by breath responses were interpolated to 1 s intervals. Each subject's PCr and VO2 responses were time aligned and averaged to enhance the response profile. A mono-exponential model with no delay term was used from exercise onset for characterization of PCr kinetics, whereas for VO2, a mono-exponential including a delay term was used to determine phase II following deletion of phase I (>15 s). Values are reported as means ± standard deviation (SD).

A paired samples t-test revealed that at the onset of exercise PCr decreased with a mean time constant of 22.4 ± 4.4 s (range 13.9 - 32.2 s), which was non-significantly different (P=0.678) to the phase II VO2 mean time constant of 21.9 ± 3.8 s (range 14.5 – 26.5 s). The 95% confidence intervals for the estimated PCr and VO2 time constants were 5.5 ± 1.3 s and 5.3 ± 1.7 s, respectively.

These results suggest that during the child's on-transient response to moderate intensity exercise, the temporal rise in cycling phase II VO2 reflects that of the fall in PCr during knee-extensor exercise, and therefore provides an estimation of QO2. The measurement of VO2 kinetics during cycle ergometry rather than during knee-extensor exercise is a limitation of this study, but was necessary to obtain acceptable confidence (~±5 s) in the estimated VO2 time constant, that would be compromised if determined during knee-extensor exercise due to its associated low response amplitude.

Rossiter, HB. et al. (1999). J Physiol. 518.3, 921-932.

CAN WE MEASURE MAXIMAL VOLUNTARY MUSCLE ACTIVATION?

Kooistra, R., de Ruiter, C.J., de Haan, A.

Institute for Fundamental and Clinical Human Movement Sciences, Netherlands

Voluntary activation (VA) is often quantified using the interpolated twitch torque technique (ITT) and high levels of VA (>90%) are frequently reported, e.g for isometric knee extension. Generally, the superimposed 'twitch' torque increase on the highest MVC is expressed as a percentage of the resting twitch torque, subtraction from 100% results in a value for VA. The maximal torque capacity (MTC) is generated when activation is 100%. However, recent experiments and observations of non-linear evoked–voluntary torque relationships indicate that this ITT technique may represent a substantial overestimation of VA. Conversely, the calculated MTC will be a severe underestimation of true muscle capacity. This may have implications for clinical practice (e.g. the detection of central vs. peripheral strength deficits in the elderly and patient groups) and basic research related to muscle fatigue. The aim of the present study was to use a new method of several high force contractions with superimposed nerve stimulation to accurately quantify VA and MTC of the knee extensors and compare this method with the ITT method that is usually applied.

Seven male subjects, with previously confirmed very high ability for maximal VA, were tested at 30, 60 and 90° knee angles (full extension=0°) on a custom-built ergometer on two experimental days. On each day, at each angle, high force level isometric knee extension contractions (70, 80, 90 and, 100%MVC) were performed with supramaximal superimposed nerve stimulation (three 100ms pulses; 300Hz) to assess VA and MTC. The torque increment from the superimposed triplet was plotted as a function of the torque reached prior to stimulation. Following linear regression, the intersection with the x-axis yielded MTC and VA was defined MVC/MTC*100%. Paired t-tests were used to test for significant ($p<0.05$) differences between methods used and intraclass correlation coefficients (ICC) for reliability.

Results for 90° (shown) were very similar to 30 and 60° knee angles. Linear extrapolation of the torque increment from superimposed nerve stimulation on high intensity (>70%MVC) contractions provided high R2 values (0.85±0.11[SD]). MTC using the present method (204.6±38.7Nm) was reliable across days (ICC:0.97) and not significantly different from using the 'usual' ITT technique (192.7±22.3Nm). However, applying the 'usual' ITT technique to ~80%MVC contractions, lead to a substantial and significant overestimation of VA (94.8±1.1%) compared to the presented method (79.1±6.6%). Note that at this activation level, the torque increment was small (2.1±0.6%MTC) despite a substantial triplet torque on the resting muscle (39.7±4.0%MTC). Moreover, the overestimation of VA using the traditional ITT technique can only be demonstrated in subjects with a very high ability for maximal VA.

Thus, high levels of VA (~95%) obtained using the 'usual' ITT method represent a substantial overestimation of VA (~16%) when compared to the presented method.

THE ISOMETRIC KNEE EXTENSION TORQUE AT WHICH MUSCLE REOXYGENATION STOPS

de Ruiter, C. J., Goudsmit, J., van Tricht, J., de Haan, A.

Institute for Fundamental and Clinical Human Movement Sciences, Vrije Universiteit, Amsterdam, The , Netherlands

In skeletal muscles the intramuscular pressure, caused by the contraction of muscle fibers, rises with force. At a certain force blood flow may be hampered and with a further increase of contraction intensity it may even completely stop. This will cause a rapid decrease of tissue oxygenation and the active muscle fibers will largely depend on anaerobic energy supply, which will accelerate muscle fatigue. For the knee extensors complete occlusion of blood flow was reported at 64±12 % MVC in vastus lateralis muscle (VL) and at 50±6.5 % MVC in rectus femoris muscle (RF) (1). Clearly, reoxygenation of muscle (inflow of arterial blood, saturated with oxygen) during a submaximal contraction will postpone fatigue during daily activities. The goal of the present study was to investigate at which isometric torque knee extensor reoxygenation during the contraction would stop.

Fifteen healthy male subjects (20-30 years) signed informed consent and the local ethics committee approved the study. Isometric knee extension torque of the dominant leg was measured using a custom made dynamometer with 90° angles in hip and knee. Maximal voluntary activation, established with superimposed nerve stimulation upon MVC, was >90% in all subjects. Near infrared spectroscopy (NIRS) was used to measure changes in muscle oxygenation of the m. vastus medialis (VM), RF and VL during submaximal isometric contractions at intensities (based on pilot experiments) ranging from 20 – 45 % maximal torque capacity (MTC) with 5% increments. Torque levels were randomly assigned and divided over two days. At each torque, a contraction with inflated pressure cuff (450 mmHg), inducing full arterial occlusion, was followed (10 min rest) by a second contraction without pressure cuff. Both contractions lasted until maximal deoxygenation was reached (all oxygen consumed) during the contraction with cuff. It was assumed that if blood flow was occluded by internal muscle pressure during a contraction without cuff, tissue reoxygenation would not occur and maximal deoxygenation would be similar to that obtained during the contraction with cuff at the same torque. ANOVA repeated measures ($p<0.05$) followed by simple contrasts showed that maximal deoxygenation was independent of torque during the contractions with cuff but not without cuff. During contractions without cuff maximal deoxygenation became similar ($p<0.05$) to maximal deoxygenation reached with cuff from 25%, 25 % and 35% MTC in the VM, VL and RF muscle respectively. It was concluded that knee extensor reoxygenation stopped at lower torques than previously reported for blood flow (1). The higher torque at which reoxygenation stopped in the RF may be due to differences in anatomy among the muscles and/or because the biarticular RF is less active than the VM and VL at submaximal torques.

1. Sadamoto T, Bonde-Petersen F, and Suzuki Y. Eur J Appl Physiol Occup Physiol 51: 395-408, 1983.

WHY DOES VO2MAX NOT INCREASE WITH ACCLIMATIZATION TO HIGH ALTITUDE

Lundby, C., Boushel, R., Robach, P., Sander, M., van Hall, G., Møller, K., Calbet, J.A.

Copenhagen Muscle Research Center, Denmark

When arterial oxygen content (CaO2) is increased by hyperoxia or erythropoietin administration maximal oxygen uptake (VO2max) is increased. Conversely, when CaO2 is reduced acutely by hypoxia, VO2max is reduced proportionally to the degree of hypoxia. Thus, there seems to be a tight relation between CaO2 and VO2max. However, with acclimatization to high altitude CaO2 is normalized to sea level values without concomitant normalization in VO2max, and thus the tight relation between arterial oxygen content and VO2max at sea level is diminished with altitude acclimatization. The present data are gathered from two independent high altitude studies and focuses on oxygen delivery to the locomotor muscles during exercise with acclimatization. In study I six Danish lowlanders were studied at sea level, and with acute exposure to 4100 m altitude, and again after 2 and 8 weeks of acclimatization to this altitude. With acclimatization CaO2 was normalized, but VO2max remained unchanged compared to the acute hypoxic situation. This could be explained by a gradual reduction in maximum leg blood flow, and thus resulting in unchanged O2 delivery to the working muscles with acclimatization. Therefore it is also clear that VO2max should not be increased with acclimatization to high altitude. In study II 8 Danish lowlanders were studied after 7-9 days of exposure to 4559 m altitude. The aim of this study was to increase leg blood flow by arterial infusion of the vasodilator ATP, however, although the artery was dilated, leg blood flow, and therefore O2 delivery remained unchanged, and thus also leaving VO2max unchanged, as compared to the control situation. As a result of the two studies we conclude 1) VO2max does not increase with acclimatization since maximum leg blood flow is reduced with acclimatization, 2) as at sea level, VO2max at altitude is a function of oxygen delivery to the exercising muscles, and 3) Vasodilation of the femoral artery does not increase leg blood blow, suggesting that the limitation to maximal exercise in hypoxia is related to the failure of cardiac output to increase leg blood flow.

Oral presentation (OP)

OP2-17 Training and Testing 5/7 - "Turin ABC"

NO DIFFERENCE IN TIME TO EXHAUSTION AT MAXIMAL LACTATE STEADY STATE BETWEEN CYCLING AND RUNNING

Fontana, P., Boutellier, U., Knoepfli-Lenzin, C.

ETH-University of Zurich, Switzerland

Introduction: Heart rate (HR) and blood lactate concentration (Lac) in cycling and running are different, at exhaustion as well as at a comparable submaximal intensity (Roecker et al., 2003). The purpose of the present study was to investigate if the above mentioned results lead to differences in time to exhaustion at maximal lactate steady state (MLSS) between cycling and running. Methods: 15 moderatly endurance trained men (age: 30 ± 6 years, height: 180 ± 5 cm, weight: 77 ± 6 kg, maximal oxygen uptake: 50 ± 4 ml/kg/min, exercise activity: 2-6 h/week) performed a lactate minimum test to determine anaerobic threshold and several constant load tests (CLT) until criteria for MLSS were fulfilled [Lac in a CLT is constant (≤ 1 mmol/l) over 20 min after initial 10 min for reaching steady state and increases (> 1 mmol/l) in a second CLT in the same time when power (5 W) or speed (0.25 km/h) are elevated]. MLSS was determined on a cycle ergometer and a treadmill, respectively. During the CLT Lac and rate of perceived exertion (RPE) were measured every 5 min, oxygen uptake and ventilation were recorded continuously, HR every 5 s. Results: Time to exhaustion (37.5 ± 8.6 vs. 38.3 ± 5.9 min) and RPE (7.5 ± 1.5 vs. 7.4 ± 1.4) were equal in cycling and running. Oxygen uptake (3.1 ± 0.3 vs. 3.4 ± 0.3 l/min, $p < 0.001$), ventilation (95 ± 13 vs. 105 ± 17 l/min, $p < 0.01$) and HR (166 ± 8 vs. 176 ± 9 min-1, $p < 0.01$) were lower, Lac (5.6 ± 1.6 vs. 4.4 ± 1.3 mmol/l, $p < 0.05$) was higher in cycling than in running. MLSS parameters referred to maximal values (%) showed no difference in ventilation (70 ± 11 vs. 76 ± 8 %), HR (92 ± 4 vs. 94 ± 3 %), Lac (57 ± 17 vs. 48 ± 12 %) and RPE (79 ± 17 vs. 82 ± 14 %) between cycling and running, only oxygen uptake (86 ± 5 vs.

89 ± 5 %, $p < 0.05$) was slightly lower in cycling than in running. Conclusions: No difference in time to exhaustion at MLSS between cycling and running was found. Absolute differences in ventilation, HR and Lac disappeared when compared relatively with the exception of oxygen uptake, which was absolute as well as relative slightly lower in cycling than in running.

Roecker K., H. Striegel, and H.-H. Dickhuth: Heart-rate recommendations: transfer between running and cycling exercise? Int J Sports Med 24: 173-178, 2003.

LACTATE-MINIMUM AND LAKTAT TURN POINT

Hofmann, P., Hartleb, C., Wonisch, M., Schwaberger, G., Pokan, R., von Duvillard, S.P.

Universiities Graz and Vienna, Medical-University Graz, Austria, Texas A&M University-Commerce , Austria

The lactate minimum (Lamin) method was described to give the maximal lactate steady state and to be independent of the status of glycogen stores (1). A modification of the method was described repeating two incremental tests with only a short active break between (2). The method is discussed controversially in the literature (3). Aim of the study was to compare the Lamin threshold to the first (LTP1) and the second (LTP2) lactate turn points and the first (VETP1) and second (VETP2) turn points in ventilation (VE). METHODS: Young healthy students (N=16; age: 28.7±4.6 yrs, height: 178.2±8.3 cm; weight: 74.4±11.3 kg) performed two incremental exercise tests (T1, T2) with an active break between tests until La decreased to 5 mmol.l-1. Lamin was determined as exercise performance at the nadir of La during T2. The first increase in La above base level was defined as LTP1 and the second abrupt increase between LTP1 and Pmax was defined as LTP2. Turn points in VE were defined as the first (VETP1) and the second (VETP2) increase in VE accompanied by turn points in the equivalents for O2 uptake and CO2 output. TP˝s were determined in T1 and T2 and compared to Lamin by ANOVA and /or t-test where appropriate. Correlation coefficient was calculated to prove the relationship between TP values. RESULTS: VO2max (3.5±0.7 / 3.4±0.7 l.min-1) Pmax (298±54 / 288±55 W) but not HRmax were slightly but significantly lower in T2. Power output and VO2 were found at 127±34 W and 1.7±0.4 l.min-1 (LTP1-T1), 127±29 W and 1.7±0.4 l.min-1 (LTP1-T2) and 219±46 W and 2.7±0.5 l.min-1 (LTP2-T1) and 210±44 W and 2.6±0.6 l.min-1 (LTP2-T2) were TP˝s in La were not significantly different between T1 and T2. However, Lamin (146±33 W, 1.9±0.4 l.min-1) was significantly different from TP˝s in La from both T1 and T2.

Power output at Lamin was significantly related to LTP1 (T1: 0.836, $P<0.01$; T2: 0.921, $P<0.001$) and LTP2 (T1: 0.851, $P<0.001$; T2: 0.886, $P<0.001$). Power outputs at TP˝s for La from T1 were significantly related to TP˝s from T2.

Turn points in VE were not significantly different from turn points in La in T1 and T2 and they were significantly related.

CONCLUSIONS: The Lamin was significantly different from both TP˝s in La and VE from both T1 and T2 whereas TP˝s in La and VE were highly reproducible. As T2 and the Lamin did not give any additional information, T1 is suggested to be sufficient to describe exercise performance in healthy young subjects.

References:

1) Tegtbur U., et al.: Estimation of an individual equlibrium between lactate production and catabolism during exercise. Med. Sci. Sports Exerc. 25, 1993, 5: 620-627.

2) Tegtbur, U., et al.: Bestimmung des Bereichs intensiver Dauerleistungsfähigkeit bei Patienten mit koronarer Herzkrankheit. Z. Kardiol. 90, 2001: 637-645.

3) Jones, A.M., Doust, J.H.: The validity of the lactate minimum test for determination of the maximal lactate steady state. Med. Sci. Sports Exerc. 30, 1998, 8: 1304-1313.

DETECTION OF AN ANAEROBIC THRESHOLD USING NEAR INFRA RED SPECTROSCORY IN CHF PATIENTS

Karatzanos, L., Gerovassili, V., Renieris, P., Karaseridis, A., Dimopoulos, S., Georgiopoulou, V., Nanou, V., Mansolas, G., Roussos, C., Nanas, S.

University of Athens, Greece

Near infrared spectroscopy (NIRS) has been recently introduced as a non-invasive methodology providing measures of tissue oxygen saturation (StO2) (Boushel et al., 2001). This study was designed to evaluate different methods of detecting a threshold employing NIRS and correlate them to ventilatory threshold in patients with chronic heart failure (CHF).

Ten stable CHF patients, 2 males and 8 females [(M±S) age: 55.2±9.4 years, VO2peak: 14.2±2.5 ml/kg/min], performed a symptom-limited exercise test to exhaustion on a cycle ergometer. The test was consisted of 1-min stages and the increase in workload was individualised according to the Wasserman norms. The NIRS probe was placed on the vastus lateralis muscle. Power output at the NIRS threshold was evaluated with StO2-workload plots, employing three different models: linear (NTlin), log-log transformation (NTlog) (Beaver et al., 1985) and Dmax (NTD)(Cheng et al., 1992). Ventilatory threshold was assessed with the V-slope method (VCO2-VO2 plots), while the corresponding power output (VT) was calculated by the gas analysis system software.

Mean ± SD values for VT, NTlin, NTlog and NTD were 66.5±25.0, 69.3±23.0, 69.3±23.4, and 74.6±25.8 watts respectively. VT was significantly correlated ($p<0.05$) to NTlin ($r=0.84$), NTlog ($r=0.83$), and NTD ($r=0.90$). The 95% limits of agreement of VT with NTlin, NTlog and NTD were from -15.11 to 22.91 watts, from -16.21 to 24.01 watts, and from -6.31 to 21.71 watts respectively.

NIRS methodology seems to provide a useful means of detecting a threshold in CHF patients. All models employed were highly correlated with VT, with Dmax model showing higher correlation and narrower limits of agreement than linear and log transformation models. These findings, as well as the appropriateness of the NIRS methodology in prescribing exercise training in CHF patients, need to be further investigated.

Beaver et al. (1985), J Appl Physiol., 59, 1936-1940

Boushel et al. (2001) Scand J Med Sci Sports, 11, 213-222

Cheng et al. (1992), Int J Sports Med, 13, 518-522.

THE RELATIONSHIP BETWEEN SELECTED CARDIOVASCULAR VARIABLES AND EXERCISE INTENSITY DURING CONTINUOUS AND DISCONTINUOUS INCREMENTAL ISOMETRIC EXERCISE TESTS

Allum, S.R., Wiles, J.D., Coleman, D., Swaine, I.L.

Canterbury Christ Church University, United Kingdom

Introduction: It has been reported that there is a linear relationship between heart rate (HR) and exercise intensity during a continuous incremental isometric exercise test using bilateral knee extensions. However, it is unknown whether this relationship remains the same if

the exercise is performed in a discontinuous manner. Therefore, the aim of this study was to compare the relationship between selected cardiovascular variables and exercise intensity during continuous and discontinuous incremental isometric exercise tests.

Methods: 9 healthy male subjects (age 27.8± 4.1years) performed seated maximal bilateral isometric knee extensions, using an isokinetic dynamometer, in order to assess their maximum voluntary contraction (MVC). From this, the associated peak electromyographic activity (EMGpeak) was determined. Subjects then performed a continuous and discontinuous incremental isometric exercise test, in a randomly assigned order. These tests were commenced at 10% EMGpeak and increased by 5% EMGpeak every two minutes until 30% EMGpeak or voluntary exhaustion. During the discontinuous protocol, each exercise intensity was separated by a two minute rest period and the tests were performed within 72hrs of each other. HR was recorded continuously via electrocardiogram and values averaged for the last 30s of each two-minute intensity. Blood pressure (BP) was recorded every minute throughout each test.

Results: The results revealed a linear relationship between %EMGpeak and HR for both the continuous (r at least 0.92) and discontinuous (r at least 0.98) incremental tests. Analysis of covariance (ANCOVA) revealed no significant differences in the slopes of the EMGpeak versus HR relationships for the continuous and discontinuous tests (slope F= 3.16; P=0.13). However there was a significant difference between the elevations of the EMGpeak versus HR relationships for the continuous and discontinuous tests (slope F=16.8; P=0.005). In addition, there was no statistically significant difference (P >0.05) between the peak HRs achieved during the continuous and discontinuous protocols.

Conclusion: It would appear that for a given EMG, HR is higher with a continuous versus a discontinuous incremental isometric exercise protocol. However, there was no difference in the peak HR achieved in either test (P>0.05). It is therefore concluded that there appears to be no advantage in using a discontinuous versus a continuous incremental isometric exercise test to establish exercise intensity. However, it was found that a number of subjects were unable to complete the continuous test, whereas all subjects completed the discontinuous protocol.

VO2 RESPONSE TO EXERCISE INTENSITIES ABOVE VO2MAX IN TRAINED MIDDLE-DISTANCE RUNNERS

Duffield, R., Bishop, D.

Charles Sturt University, Australia

INTRODUCTION

Previously we have reported an association between faster VO2 kinetics (tau) and faster starting speeds with faster subsequent race performance in trained middle-distance runners during simulated on track 800-, 1500- and 3000-m races. However, only a single trial was analysed and the races were not constant exercise intensities. While this data fits with previous reports of faster tau values for higher exercise intensities, not all studies have reported faster tau values for higher intensities. Therefore, the aim was to determine whether faster running speeds were associated with faster VO2 kinetics at running speeds encountered in middle-distance track events.

METHODS

Seven male, trained middle-distance runners; VO2 max 60.6 (2.5) mL/kg/min, performed 5 testing sessions at the same time of day and separated by 48 h. Following an incremental graded exercise test of 1-min stages until volitional exhaustion to determine VO2max and velocity associated with VO2max (v-VO2max), the athletes twice performed runs to fatigue (RTF) at 100% and 110% v-VO2max. During the RTF, VO2 and heart rate (HR) were continuously measured on a breath-by-breath basis; lactate (La) was measured pre and post run and integrated electromyographic (iEMG) measures of the Rectus Femoris, Vastus Lateralis and Biceps Femoris muscles were recorded during the first and last 10 s of each run. VO2 data was smoothed using standing 5 s averages and along with HR data fit to a mono-exponential model. iEMG data was full wave-rectified and movement artefacts removed using a high (15Hz) and low (5Hz) pass Butterworth filter.

RESULTS

Time to fatigue was significantly longer in the 100% v-VO2max run (223(49) v 136(24) s: p=0.01). However, no significant differences were present between 100% and 110% v-VO2max for the baseline, primary amplitude, total amplitude or %max reached for either VO2 or HR data or for post-run La (p>0.05). Significant differences were present (p<0.05) between 100% and 110% speeds for tau values in both VO2 (29.3(1.8) v 26.3(2.7) s) and HR (31.8 (5.0) v 24.0(3.6) s). However, no significant correlations were observed between either VO2 or HR tau values and time to fatigue. EMG analysis indicated larger iEMG activity in the 110% run and an increase in iEMG activity as the run progressed at both speeds.

DISCUSSION

Faster running speeds during constant-speed treadmill runs were associated with faster VO2 and HR responses, with no difference evident in the amplitudes or %max of either run at the end of exercise or by 2min. iEMG activity indicated a greater muscle recruitment in the 110% run, however the association with VO2 response was weak to moderate and not correlated with performance. A combination of previous on-track and current treadmill data suggest the potential benefit of faster starting speeds at the commencement of a race to invoke faster VO2 and HR responses.

Oral presentation (OP)

OP2-18 Health and Fitness 4/4 - "Berlin DE"

WALKING AND CYCLING BEHAVIOUR OF CHILDREN AND YOUNG ADULTS IN SWITZERLAND: RESULTS FROM THE TRAVEL SURVEY 2000

Martin-Diener, E., Sauter, D.

Federal Office of Sports, Magglingen, Switzerland

At least one hour of physical activity a day is recommended for children and half an hour of moderate intensity activities for adults. Active transport can contribute substantially to meet these recommendations. As in many industrialized countries, there is public concern in Switzerland about an increasing number of children not walking or biking but being brought to their destinations by car. For this paper, travel survey data were analysed focussing specifically on children's travel behaviour.

The travel behaviour of 5030 individuals aged 6 to 20 years was assessed in a telephone interview in the context of a national representative travel survey. Basis for the results presented below are 1) the 6737 trips to school accumulated by those 2130 individuals reporting

at least one trip to school on the day preceding the interview, and 2) the 7889 trips during leisure time accumulated by those 3204 individuals reporting at least one trip on the day of interest.

In the year 2000, 76.8% of the 6-9 year old children walked to school, 3.6% used their bicycle, 8.1% were brought by car, 6% walked and used public transport and 5.4% other forms of combined mobility. The respective numbers for the other age groups were: 10-12 years: 61.6%, 18.7%, 4.6%, 8.4%, 6.7%; 13-15 years: 30.9%, 27.6%, 6.3%, 24.5%, 10.8%; 16-17 years: 18.7%, 20.0%, 9.8%, 32.0%, 19.5%; 18-20 years: 19.6%, 12.0%, 21.5%, 33.8%, 12.9%. In a logistic regression model, determinants for the choice of different modes of transport were assessed. Distances up to 1km increased the chance of walking compared to longer distances, while medium distances increased the use of a bicycle. Living in the German part of Switzerland was associated with a higher probability of walking or cycling to school than living in the French part of the country, where on the other hand the chance of being brought by car was higher. With an increasing number of cars in the household the chance of walking to school decreased.

During leisure time, 38.8% of 6-9 year olds walked to their destinations, 8.8% used their bicycle, 37.0% were brought by car, 3.7% walked and used public transport and 11.7% other forms of combined mobility. The respective numbers for the other age groups were: 10-12 years: 35.0%, 14.4%, 32.8%, 6.4%, 11.4%; 13-15 years: 33.7%, 21.7%, 23.8%, 9.2%, 11.6%; 16-17 years: 29.9%, 13.3%, 30.3%, 14.6%, 12.1%; 18-20 years: 21.1%, 7.6%, 44.2%, 11.1%, 15.9%.

A comparison with the 1994 survey data revealed that for school trips as well as for trips during leisure time, for trips up to 3km and overall, the shares of walking did not change between 1994 and 2000, whereas the shares of cycling decreased and the shares of individual motorized transport increased.

For trips to school the share of active transport was high, whereas for trips during leisure time the potential was not used. The development from 1994 to 2000 suggests that the use of the bicycle for short distances should be encouraged and facilitated.

PREVALENCE OF METABOLIC SYNDROME IN GREEK ADOLESCENTS

Bouziotas, C., Koutedakis, Y., Christodoulos, A., Ageli, E., Nikolaou, A., Nakou, A., Gara, S.

Consultant of Physical Education, Greece

Introduction

Childhood metabolic syndrome (MetS) promotes the development of premature atherosclerosis and significantly increases cardiovascular disease risk early in life (Kohen-Avramoglu et al. 2003). Hence, early identification of the syndrome is essential, so that appropriate interventions can be targeted to children, minimizing thus the risk of developing metabolic-related diseases later in life. Although research indicates an alarmingly high prevalence of cardiovascular risk factors among Greek adolescents, such as dyslipidemia, high blood pressure and obesity (Bouziotas et al. 2001), to our knowledge, there is a paucity of data examining the clustering of these disorders and the prevalence of MetS in Greek paediatric populations. In view of the dearth of such data, the present study was conducted to determine the prevalence of the MetS among Greek adolescents.

Methods

A population of 102 boys and 85 girls, 17.2±0.5 years of age, participated and had a physical examination to measure height, weight, and a useable fasting morning blood sample drawn after providing assent and informed consent from a parent. Paediatric MetS was defined using criteria analogous to ATP III (Alberti and Zimmet 1998, De Ferranti et al. 2004) as 3 or more of the following criteria: (1) fasting triglycerides ≥ 150 mg/dL; (2) HDL-C < 50 mg/dL (girls), < 45 mg/dL (boys); (3) fasting glucose ≥ 100 mg/dL; (4) BMI ≥ 90th percentile for age and gender; and (5) systolic blood pressure ≥ 130/85 mm Hg. Descriptive statistics and simple contingency table analyses were performed with SPSS Version 11.0 software.

Results

Low HDL-C was the most prevalent metabolic abnormality in this population (31.6%), followed by hyperglycemia (18.7%) and obesity (14.4%). The prevalence of elevated blood pressure and hypertriglyceridemia was 11.8% and 2.7%, respectively. Prevalence estimates indicated that 5.3% of these teenagers had MetS, according to the set criteria. Male adolescents had a greater prevalence of MetS compared with females (7.8% vs 2.4%, respectively), though, this difference did not reach statistical significance (chi-square=2.76, p<0.097).

Discussion/Conclusion

In the present cohort of adolescents, MetS prevalence was 5.3%. Since obesity and other cardiovascular risk factors originate in childhood and tend to track into adulthood (Andersen et al. 2003), the present data suggest that the prevalence of MetS among adolescents will increase, unless effective prevention efforts will be implemented early in life.

References

Alberti KG and Zimmet PZ (1998) Diabet Med 15: 539-53

Andersen LB et al. (2003) Prev Med 37 (4): 363– 7

Bouziotas C et al. (2001) Ped Exerc Sci 13: 173-184

De Ferranti SD et al. (2004) Circulation 110 : 2494-2497

Kohen-Avramoglu R et al. (2003) Clinical Biochemistry 36: 413–420.

GENDER-RELATED DIFFERENCES IN PERCEIVED ENVIRONMENTAL AND PSYCHOSOCIAL CORRELATES OF CYCLING AMONG YOUNG ADULTS

Titze, S., Stronegger, W.J., Janschitz, S., Oja, P.

Institute of Sport Science, University of Graz, Austria , Austria

Introduction

Non-motorized transport has been recognised as an ideal setting for regular health-enhancing physical activity. Bicycling, in particular, could be a feasible alternative for car to commute distances less than 5 km. Yet bicycling as a means of transportation makes up only a small percentage of such journeys in most European countries.

Recent studies suggest that several personal, social, and environmental variables are correlated with cycling for transportation. Furthermore, gender has been identified as a consistent predictor of travel pattern. The purpose of this study was to identify whether psychosocial and environmental variables are differently associated with bicycle use for transportation among young female and male adults.

Methods

In a cross-sectional sample of university students in Graz, Austria (n= 538; mean age 23.8 years SD = 3.5; female 43.9%) we applied a questionnaire to assess perceived personal, social and environmental attributes of cycling from home to university. Responses were given on a 4-point scale ranging from "strongly agree" to "strongly disagree". Participants were classified as non-cyclists (43,5 %), irregular cyclists (15,1 %) and regular cyclists (41,4 %). Two multi-nominal regression analyses, for men and women, were conducted to identify associations between independent variables and cycling behaviour. The comparison group for irregular and regular cyclists were non-cyclists.

Results

The proportions of no cyclists, irregular cyclists and regular cyclist were similar among men and women. Overall, more environmental and psychosocial factors were associated with cycling among women than among men. While high mobility and little physiological effort of cycling were positively correlated with irregular and regular cycling among both genders, among women, quickness of travel, enjoyment of cycling and convenience for errands correlated positively with cycling, but among men only no danger of bike theft did so. Paradoxically, no hills en route to university and car parking problems around home showed negative correlation with cycling among women, and high traffic safety among men.

Conclusions

Although no differences in the commuting pattern from home to university were found among male and female students the findings show divergences between men and women in the number and type of factors that are associated with cycling to university. These findings suggest that gender-specific strategies may be needed in order to successfully promote transport cycling among young adults.

AEROBIC FITNESS IN PATIENTS WITH CHEMICAL DEPENDENCE

Mamen, A., Martinsen, E.W.

Sogn og Fjordane University College, Norway

Introduction

Few investigations have assessed the aerobic fitness of people with substance dependence. These studies indicate that chemically dependent patients have a reduced level of fitness compared to non abusers of the same age. However, none of the previously reported studies have used direct measurements of VO2max, only indirect methods have been used. We wanted to test such a population's aerobic fitness using direct measurement of VO2max and the lactate profile test.

Methods

A total of 54 patients admitted to the psychiatric clinic for substance abuse or dependence served as subjects, 17 were females. Mean ± SD age for the group was 31±9 yr.

They performed a lactate profile test on either a cycle ergometer or a treadmill and a Bruce treadmill test for maximal aerobic capacity.

Results

VO2max for males, 39.2±10.3 ml kg-1min-1 (mean±SD), and females, 30.1±7.5 ml kg-1min-1, were significantly different, $p< 0.01$. The cycling load at lactate threshold was 92±25 W for males and 70±16 W for the females. The speed at threshold was 7.8±1.0 km h-1 for males and 7.2±0.8 km h-1 for females. Heart rate at threshold reached 72±7 % of HRmax for males and 70±3 % females when cycling. When running, the males had a threshold heart rate of 76±6 %, whereas the females reached 79±8 %. The difference between cycling and running was significant for the females, $p<0.05$.

Discussion

The VO2max in relation to body mass was somewhat higher than in most previous studies. Our results were on the same level as was found by Murphy et al. (1986) in a study of college students with excessive alcohol consumption, but our subjects were ~10 yr older. Compared to a normal population, the men are in the normal range for their age, whereas the women are somewhat lower than normal. As far as we know, testing of lactate threshold has never been done in such a group of subjects, but the values seem to be lower than the results of the aerobic capacity would indicate. This indicates a low training state, enabling them to use only 45-70 % of their maximal aerobic capacity before lactate elimination is reduced. The especially weak results on cycling indicate that this is a little used exercise modality. The discrepancy between the best and the least fit was great, indicating that people with chemical dependency represent a diverse group with large variations in aerobic fitness. This fact must be taken into consideration if physical activity is to be used as a part of a rehabilitation programme, so that level and intensity of the physical activity can be optimal.

References

Murphy, TJ, Pagano, RR, Marlatt, GA. Addictive behaviors, Vol. 11, 1986, 175-186.

Oral presentation (OP)

OP2-19 Biomechanics 3/4 - "Turin DE"

SINGLE MOTOR UNIT IDENTIFICATION IN HIGH ACTIVATION LEVEL USING A NEW SELECTIVE MULTI-WIRE ELECTRODE

Linnamo, V., Kallio, J., Søgaard, K., Komi, P.V.

University of Jyväskylä, Finland

Introduction

With low activation level in isometric condition the identification of single motor units (MU) is generally successful. As the recruitment and firing rate increases the process becomes more challenging. With decomposition and quadripolar needle technique it is possible to identify the MUs up to higher activation levels even if they are overlapping with each other (e.g. De Luca et al 1982). Although there is some data about the MU behavior also from high level dynamic conditions (Del Valle & Thomas 2005, Søgaard et al. 1998) the identification of single MUs near maximal force levels is difficult. The purpose of the present pilot study was to examine if single MUs could be identified even up to maximal level of activation using a new selective multi-wire electrode with larger number of channels to help identification and decomposition. If successful, this technique could then be utilized later also in dynamic conditions.

Methods

The new multi-wire electrode consists of four 50µm polyurethane insulated wires glued parallel together so that one of the wires was ¼ mm shorter than the other three. The insulation was then mechanically removed from the shortest wire over ½ mm distance from the tip.

A hook was formed to the end of the wires to ensure the fixation during the measurements. The electrode was inserted into the soleus muscle of a 20-year old subject. He was instructed to increase steadily the plantar flexion torque from 0 to 100% (ramp). Activities of one MU, whose recruitment threshold was at 17 % MVC, were then analysed in the following force ranges: 20-40%, 40-60%, 60-80% and 80-100% using Daisy software (Olsen et al. 2001).

Results and Discussion

The mean firing rate of the MU that was analysed was more than two times higher in maximal compared with lowest activation (20-40%) condition. At 20-40% the mean firing rate was 9,1 Hz, at 40-60% 10,1 Hz, at 60-80% 13,5 Hz and at 80-100% 18,5 Hz. This particular MU was recruited at 17% MVC threshold and derecruited at 58% MVC in the relaxation phase. It has been suggested with biceps muscle that at higher force levels the increase in force is mainly due to increased firing rate of the fast (phasic) MUs, which may increase almost linearly up to 100% MVC while slow (tonic) MU:s reach a saturation frequency of discharge at lower force levels of approximately 60% - 80% MVC (Gydikov & Kosarov 1974). Since soleus muscle consists mainly of tonic MUs, this indicates that also a tonic MU (with high threshold) is able to increase its firing rate up to maximal MVC. In conclusion, the present pilot test showed that with a selective multi-wire electrode it is possible to identify single motor unit activity even up to 100% MVC.

References

De Luca et al. (1982) J. Physiol. 329: 113-128

Del Valle & Thomas (2005) Muscle Nerve 32(3): 316-25

Gydikov & Kosarov (1974) Pflügers Arch. 347: 75-88

Olsen et al. (2001) Acta Phys Bulg 26:73-8

Søgaard et al. (1998) Eur J Appl Physiol. 78: 411-416.

SOLEUS MUSCLE SPINDLE SENSITIVITY AFTER 1 HOUR OF ELECTRICALLY EVOKED ECCENTRIC EXERCISE

Peltonen, J., Kanervo, M., Komi, P.V., Avela, J.

University of Jyväskylä, Finland

It has been shown that soleus muscles fascicles fall shorter even after such a low load stress as 1 hour of passive repetitive stretching (Avela et al., 2004). This is associated with reduced MVC, twitch response, stretch and H-reflex responses. Most probable explanation for reduced reflex sensitivity is disfacilitation of alpha motor neuron pool either because of 1) lower static firing frequency at shorter muscle length; or 2) lower dynamic response to length changes because of increased compliance of muscle-tendon unit. This study was aimed to identify the changes in static or dynamic spindle firing frequency after SSC exercise. 11 healthy males volunteered for the study. Their MVC torque and H-reflex responses at three different muscle pre-conditioning as well as corresponding soleus muscle fascicle lengths were measured before and after the exercise. Exercise consisted of 5200 cycles of electrically evoked eccentric contractions of the right leg triceps surae muscle group at frequency of 1,5 Hz. Exercise was performed in ankle dynamometer. Pre-conditioning was done by contracting muscle slightly at certain muscle length, holding it there for 10 seconds, then stretching it rapidly (pre-Fast), slowly (pre-Slow) or not stretching at all (Control) before H-reflex stimulation. Preliminary results show that, while H-reflex amplitude was not altered in control situation, it was reduced in both pre-Fast and pre-Slow conditioning. Important difference was that H-reflex amplitude diminished more in pre-Slow than pre-Fast conditioning after fatigue. Soleus muscle fascicles were shorter after exercise in both pre-Slow and pre-Fast conditions. Exercise was not associated with changes in MVC. This study confirmed the earlier observations of Avela et al. (2004) that soleus muscle fascicle length is shorter even after exercise containing relatively low tensile muscle and tendon forces. Since control H-reflex amplitude remained unchanged after exercise, it's unlikely that disfacilitation caused by lower static firing frequency of muscle spindles (if there is any) is adequate to alter H-reflex response. Explanation has to be found from changes in dynamic activity of muscle spindles. Smaller H-reflex reduction in pre-Fast, compared to pre-Slow, might suggest that fast pre-stretch-induced spindle activity is lower after exercise. Lower spindle activity presumably leads to a diminished release of neurotransmitter which, as a consequence, is not depleted from axon terminal and therefore allows better transmission of following action potentials (Hultborn et al., 1996). Lower dynamic spindle activity was also supported by lower reflex response, both neural and mechanical, to fast pre-stretch after exercise.

References

Avela J. et al. (2004) J Appl Physiol 96(6):2325-32

Hultborn H. et al. (1996) Exp Brain Res 108(3):450-462.

SEX SPECIFIC DIFFERENCES IN MECHANICAL PROPERTIES OF ISOLATED COLLAGEN FASCICLES FROM THE HUMAN PATELLAR TENDON

Haraldsson, B.T., Aagaard, P., Krogsgaard, M., Alkjaer, T., Kjær, M., Magnusson, S.P.

Institute of Sports Medicine, Copenhagen, Denmark

It is well known that women are much more likely to sustain certain connective tissue injuries than men during physical activity, for instance is the incidence of anterior cruciate ligament (ACL) tears several fold higher in women (1). The reasons for the sex specific predisposition to injury are unknown, however, it has been suggested that estradiol may reduce fibroblast proliferation, collagen synthesis, fibril diameter and collagen content, which may weaken the mechanical properties of connective tissue and make it more susceptible to injury (2-4). To our knowledge, there is no available information to what extent there is a sex specific difference in the mechanical properties of human tendon tissue in young persons.

The purpose of the present study was to examine and compare the mechanical properties of single isolated collagen fascicles from the anterior portion of the patellar tendon obtained from young males and females.

Thin collagen bundles (~ 35 mm long and ~ 3.5 mm in diameter (ø)) were obtained from the anterior portion of human patellar tendons from healthy young males (mean±SD, 29.0±4.6 yr., n=6) and females (mean±SD, 27.0±5.7 yr., n=6) that underwent elective anterior cruciate ligament reconstruction. A single individual collagen fascicle was dissected from each bundle under a stereoscopic microscope. The male (ø 320±33 µm) and female (ø 350±18 µm) fascicles were tested for tensile strength in a mechanical rig, placed under a stereoscopic microscope equipped with a digital camera that recorded elongation of the specimen.

The following parameters were obtained: fascicle ultimate stress, fascicle yield stress and strain, and tangent modulus. Fascicle stress (σ) was calculated as the tensile force (N) divided by the cross-sectional area (m2) of the fascicle and reported as MPa. Fascicle strain (ε) was defined as the length change divided by the initial length and was expressed as a percentage ((∆L / Lo) x 100)). The tangent modulus (E) was calculated in the linear portion of the stress-strain curve.

Ultimate stress was greater for male fascicles (76.0±9.5 MPa) than for female fascicles (44.1±1.9 MPa), P<0.05. Yield stress did not differ for male (56.6±10.4 MPa) and female fascicles (32.7±1.3 MPa, P=0.06). There was no significant difference in yield strain between male (6.8±1.0 %) and female fascicles (8.7±1.3 %). The tangent modulus was significantly greater for male fascicles (1231±188 MPa) than female fascicles (576±86 MPa), P<0.05.
These preliminary data suggests that the collagen fascicles from the patellar tendon of male subjects were stronger than that of females as indicated by the greater ultimate stress and tangent modulus in male fascicles, which may reflect a sex specific difference in mechanical properties. However, the effect of gender and training on the material properties of isolated collagen fascicles are not fully understood, or to what extend this influences the rate of collagen tissue injurie.

TIBIAL SAFETY FACTOR IN EXTREME IMPACT LOADING AMONG PHYSICALLY ACTIVE MALES AND FEMALES

Rantalainen, T.J., Heinonen, A., Linnamo, V., Kyröläinen, H., Sievänen, H., Komi, P.V.

University of Jyväskylä, Finland

INTRODUCTION: Extreme impact loading demonstrates considerable influence of mechanical loading on human bone strength (1). Bones have an intrinsic safety factor to sustain loads in strenuous activities (2). The safety factor is described as the strength of the bone compared with the stress imposed on it during extreme activity, usually fast locomotion (3). Safety factor is reflected as the ability of bone to adapt within boundaries to imposed loads. The present study was designed to examine the safety factor in cross-sectional study with males and females.
METHODS: Eight triple jumpers and eight age, height and gender matched nonathletic controls participated in the study. Neuromuscular performance was measured with walking test at normal pace (maximal ground reaction force [GRF]). Bone variables were measured with peripheral quantitative computer tomography (pOCT) from the tibial mid-shaft and from the distal end of tibia. Total density (ToD, mg/cm3) and total area (ToA, mm2) were calculated from the measured variables. To characterize the bone bending strength, bone strength index (BSI, 4) was determined as the density weighted section modulus. Safety factor (SF) at mid-tibial shaft (SFs) was calculated as BSI/(GRF*height) and at distal tibia (SFd) as ToD2*ToA/(GRF). Independent samples t-test was used for statistical analysis.
RESULTS: In tibial mid-shaft, SFs was significantly (P= 0.009) higher (15.7±0.5) in triple jumpers than that in the controls (12.9±1.8). No intergroup difference was observed in SFd (104,0±18,0 vs, 91,2±11,1, P = 0.132).
DISCUSSION: Present results indicate that the safety factor in normal locomotion (walking) can be greater in subjects imposed to regular high skeletal loads. The built of the long bones is actually determined by the forces imposed during locomotion to secure reasonable safety factors. The athletes demonstrated a high safety factor in sedentary locomotion as compared to nonathletic counterparts. Impact loading seems to increase the factor of safety towards normal loading and thus has clinical importance in preventing fractures from occurring.
REFERENCES

1. Heinonen A. et al. Bone 2001 Sep;29(3):279-85.
2. Blanco RE. et al. J Theor Biol 2003 May 7;222(1):117-25.
3. Currey JD. Bones: structure and mechanics. 2002.
4. Ferretti JL. et al. Bone 1996 Feb;18(2):97-102.

CHAIN WHEEL SHAPE AFFECTS BLOOD LACTATE CONCENTRATION DURING SUBMAXIMAL CYCLING

Hansen, E.A., Jensen, K., Hallén, J., Pedersen, P.

The Norwegian School of Sport Sciences, Norway

Introduction
Two decades ago the Shimano Corporation introduced a non-circular chain wheel (Biopace) to optimise the human engine for bicycling. It was reported that in comparison with the circular chain wheel, the Biopace (at a fixed pedal rate) reduced peak joint torques, calculated from pedal forces.
Unfortunately, only data from one subject was shown (Okajima, 1983).
Reduced peak pedal force or peak crank torque (Tpeak) with the Biopace, may lower sensory feed back from mechanoreceptors, which again may instigate cyclists to choose a slower and more energetically efficient pedal rate. We tested the hypotheses that in submaximal cycling, the use of a Biopace compared to a circular chain wheel would: (1) lower Tpeak at a preset pedal rate, and: (2) lower pedal rate and oxygen uptake (VO2) at freely chosen pedal rate (FCPR).
Methods
Ten male cyclists (182±4 cm, 77.5±7.0 kg, VO2max: 61.7±4.4 mL O2 min-1 kg-1) performed 10-min cycle ergometer bouts at 180 W using, at random order, a circular or a Biopace II (CR-BP20, Shimano) 52-tooth chain wheel. The cycling was performed at FCPR and separated by a 5-min rest. Means of power output, pedal rate, VO2, and heart rate (HR) were calculated over the last 5 min. Blood lactate concentration (BLC) and rate of perceived exertion (RPE) was measured during the last min. After another 5-min rest, the subjects performed 2 min cycling at 180 W at a target pedal rate of 90 rpm with each of the two chain wheels, for calculation of crank torque profile characteristics represented by minimum crank torque (Tnadir), Tpeak, and crank angle at Tpeak. The crank torque profile represented the sum of the torque applied by both legs. Paired t-tests were used to evaluate differences between the two chain wheels. Significance level was P<0.05.
Data are mean±SD.
Results
Crank torque profile characteristics at the target pedal rate of 90 rpm, were similar for the two chain wheels (Circular/Biopace): Pedal rate (89.9±1.5/88.9±1.7 rpm), Tnadir (4.4±1.3/4.7±0.9 Nm), Tpeak (29.0±2.6/29.3±2.0 Nm), and crank angle at Tpeak (89±8/90±9 deg). At FCPR, power output (178±2/178±3 W), pedal rate (93±4/93±6 rpm), VO2
(2.15±0.08/2.13±0.09 L min-1), HR (119±11/118±11 beats min-1), and RPE
(9.8±1.9/10.3±1.6) was also similar. Only BLC (0.9±0.4/0.7±0.2 mmol L-1) differed significantly, being 23% lower with Biopace.
Discussion

The hypotheses of a reduced Tpeak with Biopace during cycling at preset pedal rate, or lowered pedal rate and VO2 at FCPR were rejected. The lower BLC with the Biopace compared to the circular chain wheel may suggest that the non-circular chain wheel reduced fast twitch muscle fibre activity.

However, further investigations are needed to corroborate this, and to elucidate whether the small absolute difference in BLC response may affect performance when accumulated over hours of cycling or in more intense cycling.

Reference

Okajima S (1983). Designing chainwheels to optimize the human engine. Bike Tech 2, 1-7.

Oral presentation (OP)

OP2-20 Physical Education and Pedagogics 2/2 - "Turin FG"

THE PRACTICE OF PHYSICAL EDUCATION: LOOKING AT THE PAST, PLANNING FOR THE FUTURE

Hyatt, R.W., Freeman, W.H.

University of North Carolina at Chapel Hill, United States

The field of physical education has changed radically over the last 40 years. This presentation examines three periods of the university professional physical education program in the United States: (1) the traditional field of 40 years ago, (2) the more diverse focal areas of the field today, and (3) how we might plan for the future of a constantly changing field. The traditional field of 40 years ago was focused almost entirely on teacher preparation. Research within the field was primarily applied studies, with a heavy emphasis on health and fitness concerns, along with motor learning studies focused on skill acquisition by children and young people. This was natural in a field that developed from a 19th century health (rather than medical) concern about children. With the move into a more scientific focus within the field since the 1960s, today's university programs include teacher preparation, but in many cases a greater number of students are preparing to become medical professionals of one sort or another, while others are training for careers in sport businesses. Research-focused departments have largely abandoned any support for the teaching and program functions of the traditional field, focusing instead on getting students into medical-related professional schools. Technically speaking, in the new field the human body exists primarily as a locus of parts and functions, a flawed machine to be studied by kinesiologists. In short, the body is viewed mostly as a differentiated structure, not a holistic human, and certainly not something for which the applied is a major concern. So what does this mean in terms of focal areas of the field in the next half century? It means that more large programs will become (as many already are) agglomerates or consortia of a range of interests relating to sport and the human body, both moving and quiescent. This includes the old physical education and coaching interests, along with the growing sport management interests, along with the medical-related interests ranging from athletic training at the lower academic end of services to cardiac services at the upper end, including areas such as physical therapy, physician assistant programs, and medical doctors. It also may mean future curricula with combined degrees, such as Sport Management and an MBA or a law degree. In planning new curricula, we must remember that education for a profession does not end when the student crosses the stage after four years–it should continue throughout a career.

ON WHOSE TERMS? - EXPLORING YOUNG PEOPLE FROM ETHNIC MINORITY GROUPS IN SWEDEN AND THEIR VIEWS ON PE AND SPORT

Suzanne, L.

Swedish School of Sport and Health Sciences, Sweden

On whose terms?

- exploring young people from ethnic minority groups in Sweden and their views on Physical Education and Sport

Suzanne Lundvall, PhD., Swedish School of Sport & Health Sciences, Sweden

In the middle of 1990s Sweden was declared a multicultural society concerning ethnicities, languages and cultures. How do the majority and minority cultures meet in the context of physical education and the field of sport and on whose terms are they executed?

The aim of this study has been to explore, with the help of an interview study executed autumn 2004, how young people from ethnic minority groups and PE teachers in schools in multi cultural areas describe and perceive the subject PE and the field of sport. This is done through exploring the students and teachers formulated discourses in relation to the political assignment of school and to PE and sport as an issue for integration on a social, structural and/or cultural level. In total 32 students (12-18 yr) and 10 PE teachers of these students participated, chosen by a strategic sample.

Results: the school subject PE gives a considerable opportunity for participation in sports and physical activity for the interviewed students. This is specially marked for the girls. When talking about the organization of PE in school, girls place themselves in relation to boys and the male discourse of PE and sports, where they tend to demand less space and view themselves as slower, less active and with less ability. Religion and/or cultural background are not looked upon as a hindrance for exercising and/or participating in sports, although the older girls and the teachers put forward that there may be some difficulties for Muslim girls. The dominant discourses that came forward in the study were mainly based on a sport discourse with quite a narrow view on gender, movement and physical activity. Nature and outdoor activities were by the students put forward as something uninteresting, and partly, frightening.

Conclusions: in the interviews the potential of PE and sport as a tool for social and cultural integration in terms of norms and values of the sport culture of the majority culture are formulated. As long as the cultural identity of the students and their families was constrained by the lack of contact with other parts of society, this was a seen as threat for a more structural integration, not something that sport or the subject PE could contribute to. The nexus of gender in relation to physical activity has its implications and needs to be put on the agenda in terms of identifying which democratic values need to be protected.

Carroll, B. & Hollinshead, G. "Ethnicity and conflict in Physical Education in British Educational Research Journal 1993:19:1, p.59-77.

Dagkas, S. & Benn, T. (2006) "Young Muslim women's experiences of Islam and physical education in Greece and Britain: a comparative study" in Sport, Education and Society, 2006: vol.11:1, pp 21-38.

THE POSITION OF REGULAR PHYSICAL EXERCISE IN THE LIFESTYLE OF HUNGARIAN PUBESCENT GIRLS

Hamar, P., Munkacsi, I., Soós, I.,

Semmelweis University, University of Sunderland, Hungary

Introduction: The value changes that followed the system change in Hungary resulted in some negative trends. Inactivity has become an integral part of modern life. To name but one example: the fast development of information and computer technology encourages the 'home sedens' lifestyle. A number of past and present studies have addressed this problem, amongst them Mussino (1991), Bíróné (1994), Hamar (1997) and Soós (1998).

The aim of our survey was to establish the position of physical exercise and sport in the lives of teenage girls in Hungary. More precisely, what place does regular physical exercise take in the life of pubescent girls and their families at an age which is so important in terms of future physical activity. Does the attitude towards exercise within the family influence the sport activities pubescent girls take part in? If that is the case, to what extend?

Method: Data was collected from fifteen Hungarian schools during the second half of the 2003/2004 academic year. The questionnaires were distributed with the help of P.E. teachers amongst 1,000 10 to 15 year-old primary and secondary school female students. There were two reasons for selecting one of the sexes only: one theoretical and the other practical. Firstly, female and male puberty takes place at different ages and as a result exercise and sporting habits are noticeably different. Secondly, P.E. lessons at the age period chosen are conducted in most schools in separate all-male or all-female groups and therefore the filling in of the questionnaires was easier to administer in one particular group only.

For our study, we chose the questionnaire methodology. The questionnaire used had been originally compiled by Dishman and Ickes and later revised and applied by Edit Bíróné Nagy and Bohumil Svoboda (1994). The questionnaires were completed anonymously. Subjects were able to comments on the content of the questions by selecting 'yes' or 'no' and in addition to that, where applicable, they were also able to write additional comments. The 20 questions, aimed at finding out about subjects' personal details and preferences for sport activities, were divided into two sets (set I and II).

956 of the returned questionnaires were valid for data analysis. First, percentages were calculated from the data and then the results were analysed by groups of questions and by individual questions.

Results: The results indicate that an increasing number of young girls appreciate the role of sport in keeping healthy. The most dominating factor in forming exercise habits is family background. In addition to this, schools also play an important role in encouraging students to do regular exercise. The results also indicate that the majority of pubescent girls are characterised by a kind of inactive interest in sport which does not result in exercise crucial for their physical development.

HEALTH CONSCIOUS BEHAVIOR IN PHYSICAL EDUCATION: 10-14 YEARS OLD CHILDREN EXPERIENCES

Bognár, J., Fügedi, B., Ulrik, T., Suskovics, C., Kovács, T.L., Katona, Z.

Semmelweis University, Faculty of Physical Education and Sport Sciences (TF), Hungary

Introduction

The Hungarian National Core Curriculum justifies 5 general developmental objectives. Among other factors, it denotes the maintenance of the need for physical activity and recreation for a healthy active life-style. Most physical education programs in our country are generally responsive to the needs of society. One of the most important needs for a sound physical education is to plan and carry out a systematic and progressive program for all children that is worthwhile throughout their lives. If physical education is not promoting to lifelong physical activity and healthy active life-style, then we are not fulfilling the society's and our students' expectations.

Purpose of study

A major purpose of the study was to explore how 5th-8th grade students experience and view the role and function of health in their physical education program.

Methods

Data were gathered by one of the researchers from Hungarian state primary schools from five cities in Hungary. Using purposeful sampling, altogether we collected 3.384 questionnaires from 5-8th students (10-14 years of age). All students were asked to fill out an open-ended questionnaire anonymously. Questions were focused on children PE experiences as related to health conscious behavior. Due to the levels of data, frequencies, descriptive data, and non-parametric statistics were used in the analyses with SPSS 13.0 for Windows.

Results

A large number (67.6%) of students believe that information from physical education class will be useful and beneficial for their future. The usefulness in most cases relates to the types of activities, correct sport techniques and strategies, warming up and cooling down. According to students' beliefs the purpose of physical education is to have an opportunity to be physically active (36.6%), work on strength, stamina, speed, and flexibility as parts of conditioning (33.7%), and to pursue a healthy active lifestyle (20.9%). 63.2% of the sample enjoys physical education a lot but 14.9% does not like it at all. From those who enjoy PE, the reason is they have future plans with sports and games (26.2%), such as become healthier, toned, and physically sound. 17.4% enjoys PE because there is always game time during class, 15.3% likes it due to psychological reasons, another 15.% likes it altogether, and 12.6% generally likes to be active. From those who does not like PE, the reason tends to be they do not like to be active at all (32.0%), they hate running altogether (21.3%), and PE tends to be repetitive and boring (10.7%).

Discussion/conclusions

Students have high expectations towards physical education and quiet often PE teachers cannot meet their students' expectations. From our results it is obvious that we have to further promote PE's contributions to lifelong physical activities and health. Students do not mention health and healthy active life-styles in relation to PE, so our job is to purposefully include the notion in our daily routines.

Saturday, 8th July 2006

08:15 - 09:30

Plenary session (PLS)

PLS3 Injuries in sport - "Athene"

SPORT INJURIES AND BEYOND - A POPULATION PERSPECTIVE ON THE RISKS AND BENEFITS OF PHYSICAL ACTIVITY

Martin, B.W.

Swiss Federal Institute of Sports Magglingen, Switzerland

The health risks of physical inactivity are well documented, lack of physical activity is recognised as a world wide problem, and physical activity promotion has become an important public health issue on the national and international level. At the same time, the number of sport or exercise related injuries is substantial; in younger patients they are responsible for more than 10% of all emergency department visits and in population surveys they can make up more than 25% of all reported injuries. Both the costs of inactivity as well as the costs of sport injuries can acquire relevant dimensions, as the example of Switzerland shows where it was estimated in 2001 that about 4% of all health costs were caused by the former and about 3% by the latter. Does this mean that the overall health balance of physical activity and sports is not necessarily positive and that the intended health benefits in more physically active populations will be lost at least partly to an increase in sport injuries?

There are a number of studies in athletes and in soldiers showing that greater amounts of training are associated with greater numbers of musculoskeletal injuries. At the same time, there are also indications that the incidence of sports injuries can be reduced drastically by specific preventive measures and by optimised training interventions.

Whether the injury effects of specific sports are observed at the population level depends on the distribution of activity levels for the discipline within the different age and gender groups, and possibly also on the underlying overall activity and fitness levels of the population. Only a limited number of cross-sectional surveys have been carried out so far to study these questions on the population level. They have indicated that the cumulative risk for all injuries is comparable between groups of different activity levels; the risk for sport specific injuries may be elevated in habitually active individuals while it can even be decreased for non-sport specific injuries.

Though methodological issues still have to be solved, there are indications that shifts towards higher levels of physical activity do not have to lead to increases in overall injury risks. Taking into account that health promotion programmes usually focus on low risk activities, and that specific interventions can reduce risks in different sports even further, it should also be possible to keep the number of sport injuries constant or even reduce them.

ADVANCES IN PREVENTING SPORT INJURIES

Myklebust, G.

Norwegian School of Sport Sciences, Norway

Sporting activities have increased among people with all the positive effects for the health. In addition the number of people taken part in competing sports has risen. The high number of athletics in high level sports has increased the number of sport related injuries. With the increase of both the numbers and severity of injuries, a need of prevention studies has become essential to develop, and to try out in different sports.

The most common acute sport injury is ankle contusions. Another injury that has increased the recent years is knee ligament injuries, especially the anterior cruciate ligament (ACL) injury. ACL injuries are serious and give pain and disability for the athletes in the short run, and an increased risk of early osteoarthritis in the long run. Prevention of this injury is not important just for the athlete, but also for the society since these injuries require lots of money and efforts from the health system. There has been an increased focus on injury prevention the last years. The talk will give an overview on the advances in this field, and give examples of preventing studies of ankle, knee and muscle strain injuries. The practical implications of the prevention programs will be highlighted.

09:40 - 11:10

Invited symposium (IS)

IS3-01 Consensus statement on overtraining syndrome - "Athene"

CONSENSUS STATEMENT ON OVERTRAINING SYNDROME

Meeusen, R., Duclos, M., Gleeson, M., Rietjens, G., Steinacker, J., Urhausen, A.

Vrije Universiteit Brussel, Belgium

Successful training must involve overload but also must avoid the combination of excessive overload plus inadequate recovery. Athletes can experience short term performance decrement, without severe psychological, or lasting other negative symptoms. This Functional Overreaching (FOR) will eventually lead to an improvement in performance after recovery. When athletes do not sufficiently respect the balance between training and recovery, Non-Functional Overreaching (NFOR) can occur. The distinction between NFOR and the Overtraining Syndrome (OTS) is very difficult and will depend on the clinical outcome and exclusion diagnosis. The athlete will often show the same

clinical, hormonal and other signs and symptoms. A keyword in the recognition of OTS might be 'prolonged maladaptation' not only of the athlete, but also of several biological, neurochemical, and hormonal regulation mechanisms.

It is generally thought that symptoms of OTS, such as fatigue, performance decline, and mood disturbances, are more severe than those of NFOR. However, there is no scientific evidence to either confirm or refute this suggestion. One approach to understanding the aetiology of OTS involves the exclusion of organic diseases or infections and factors such as dietary caloric restriction (negative energy balance) and insufficient carbohydrate and/or protein intake, iron deficiency, magnesium deficiency, allergies, etc. together with identification of initiating events or triggers. In this symposium we provide the recent status of possible markers for the detection of OTS. Currently several markers (hormones, performance tests, psychological tests, biochemical and immune markers) are used, each of them will be outline by one of the presenters. First Dr Gleeson will present the current knowledge on immunological factors anf the link with OTS. Dr Nicolas Lemyre will give an overview of possible psychological features that might be detected with specific psychological tests. Dr Axel Urhausen will present clinical aspect of OTS, especially guideline for the 'exclusion diagnosis' for OTS

During the panel discussion we propose and explain a "check list" that might help the physicians and sport scientists to decide on the diagnosis of OTS and to exclude other possible causes of underperformance.

PSYCHOLOGICAL ASPECTS OF THE OTS

Lemyre P., NO

Without abstract submission.

CLINICAL ASPECTS OF THE OVERTRAINING SYNDROME

Urhausen, A.

Centre Hospitalier de Luxembourg, Luxembourg

As there is no single diagnostic tool to identify an athlete as suffering from an overtraining syndrome (OTS), diagnosis can only be made after exclusion of all other possible influences on changes in performance and mood state. Early and unequivocal recognition of OTS is virtually impossible because the only certain sign is a plateau or decrease in performance during competition or training. The definitive diagnosis of OTS always requires the exclusion of an organic disease, e.g. endocrinological disorders (thyroid or adrenal gland insufficiency, diabetes mellitus), iron deficiency especially with anaemia or infectious diseases (especially infectious mononucleosis, myocarditis).

Despite interesting theoretical assumptions, the validity of the heart rate variability in the diagnosis of OTS is not well established at present and the existing findings in overtrained athletes are confusing. Ergometric tests may reveal a decrement in sport-specific performance if they are maximal tests until exhaustion: Overtrained endurance athletes usually present an impaired anaerobic lactacid performance and a reduced time-to-exhaustion in standardized high-intensity endurance exercise accompanied by a small decrease in the maximum heart rate. Lactate levels are also slightly lowered during submaximal performance resulting in a slightly increased anaerobic threshold. Often the respiratory exchange ratio during exercise is also decreased. A deterioration of the mood state and typical subjective complaints ("heavy legs", sleep disorders) represent sensitive markers in study conditions, however, they may be manipulated, which is especially relevant in team sports. Although measurements of selected blood markers such as urea, uric acid, ammonia, enzymes (creatine kinase activity) or hormones including the ratio between (free) serum testosterone and cortisol, may serve to reveal circumstances which for the long-term impair the exercise performance, they are not useful in the diagnosis of an established OTS. The nocturnal urinary catecholamine excretion and the decrease in the maximum exercise-induced rise in pituitary hormones, especially adrenocorticotropic hormone and growth hormone, and, to a lesser degree, in cortisol and free plasma catecholamines, often provide interesting diagnostic information, but hormone measurements are less suitable in practical application.

From a critical review of the existing overtraining research it must be concluded that there has been little improvement in recent years. The lack of validity of variables in diagnosing an OTS, however, does not mean that these measures are not useful in the monitoring of training and thus, in the long term, in the prevention of an OTS.

Invited symposium (IS)

IS3-02 Children and exercise - "Innsbruck"

A BEHAVIOURAL PERSPECTIVE ON ENERGY-BALANCE RELATED BEHAVIOURS IN CHILDREN

van Mechelen, W., de Bruijn, G., Kremers, S., Brug, H.

VU University Medical Centre, Netherlands

In current society overweight and obesity are a major public health concern, which is increasing exponentially in importance in modern society. We are not only dealing with a problem in the adult population, but also in the paediatric population. The latter is witnessed for instance by the growing cases of type II diabetes mellitus in children. In the aetiology of this problem many factors play an important role. Next to genetic factors, behavioural factors also play an important role. Behavioural factors linked to overweight and obesity are nutrition and physical activity, nowadays referred to as 'energy-balance related behaviours' (EBRB's). In explaining behaviour many models have been applied so far, including models such as the Theory of Reasoned Action and the Theory of Planned Behaviour. Common denominator of such models is that they apply the principle that human behaviour is a function of cognitive behavioral principles in which behavioural intention is the strongest predictor of actual behaviour. However, there is increasing evidence that behaviour is not only directed by cognition, but also by a wide variety of environmental factors, as explained by so-called ecological models. Also, many behaviours are not based on cognition at all, but are 'automated' behaviours (i.e. habits). Bottom line is, that in order to change EBRB's effectively one needs to take into account all these determinants of behaviour. In this presentation examples on these issues will be given based on recent work by our group on behavioural determinants of EBRB's.

References.

- de Bruijn GJ, Kremers SP, Lensvelt-Mulders G, de Vries H, van Mechelen W, Brug J. Modeling individual and physical environmental factors with adolescent physical activity. Am J Prev Med. 2006 ;30(6):507-12.

- Kremers SP, De Bruijn GJ, Visscher TL, Van Mechelen W, De Vries NK, Brug J. Environmental influences on energy balance-related behaviors: A dual-process view. Int J Behav Nutr Phys Act. 2006; 15;3(1):9.
- de Bruijn GJ, Kremers SP, Schaalma H, van Mechelen W, Brug J. Determinants of adolescent bicycle use for transportation and snacking behavior. Prev Med. 2005; 40(6):658-67.
- de Bruijn GJ, Kremers SP, van Mechelen W, Brug J. Is personality related to fruit and vegetable intake and physical activity in adolescents? Health Educ Res. 2005; 20(6):635-44.
- Kremers SP, Visscher TL, Seidell JC, van Mechelen W, Brug J. Cognitive determinants of energy balance-related behaviours: measurement issues. Sports Med. 2005;35(11):923-33.

A GENETIC PERSPECTIVE

Wilkin T., UK

Without abstract submission.

A GENE-LIFESTYLE INTERACTION PERSPECTIVE

Franks, P.W.

Umea University Hospital, Sweden

Features of the metabolic syndrome are becoming increasingly common in children. Although a decline in children's physical activity levels during the past 40-50 yrs is likely to be an important aetiological factor, the degree of susceptibility to a sedentary lifestyle varies considerably from one child to the next. Indeed, some sedentary children are aerobically fit and have healthy metabolic profiles, whilst others appear highly susceptible to the adverse metabolic consequences of physical inactivity. Thus, other risk factors, such as genetic variation, plausibly modify the effects of physical activity on obesity and metabolism, such that children who carry specific genetic variants may benefit most from maintaining a physically active lifestyle. Identifying the nature of gene-lifestyle interactions may help elucidate the physiological pathways that lead to metabolic disease in childhood. This information may also be used to optimize lifestyle intervention programmes that use genetic information to optimize disease prevention.

Invited symposium (IS)

IS3-03 ACSM symposium: Diabesity - "St. Moritz"

DRUGS OR EXERCISE FOR OBESITY, DIABETES AND THE METABOLIC SYNDROME?

van Baak, M.

Maastricht University, Netherlands

Worldwide the prevalence of obesity, the metabolic syndrome and type 2 diabetes are increasing. It is well recognised that a healthy lifestyle, incorporating a sufficient level of physical activity and a healthy diet, will contribute to the prevention of these disorders. The effectiveness of increasing levels of physical activity in weight management has long been recognised, although it is clear that the weight reducing efficacy of increased physical activity is small in comparison with that of dietary restriction. The recent diabetes prevention trials in the US and Europe clearly show that a lifestyle intervention, including moderate weight loss, a healthy diet and increased physical activity, may postpone the development of type 2 diabetes in subjects with impaired glucose tolerance. A secondary analysis of the European trial demonstrated that within this healthy lifestyle intervention the physical activity component contributed significantly to this outcome. The US trial showed that the lifestyle intervention also reduced the risk of developing the metabolic syndrome in the participants. An exercise training programme alone has also been found to reduce this risk. Based on these and other similar findings, increased levels of physical activity of physical activity are clearly indicated in the prevention of obesity, the metabolic syndrome and type 2 diabetes.

Once obesity, the metabolic syndrome or type 2 diabetes are present, there is still a role for increased physical activity, because it will tackle all associated risk factors. A comparison between the effectiveness of drug treatment and increased levels of physical activity in is obviously difficult to make, but it is clear that the effects of increased activity will have a positive influence on all risk factors (apart from other health effects), whilst drug treatment will usually be targeted at one risk factor only.

In many cases a lifestyle intervention may be not sufficient to fully normalise the risk factors for the development of atherosclerotic cardiovascular disease or type 2 diabetes associated with obesity or the metabolic syndrome. The reason may be low compliance to the healthy lifestyle, or too high levels of these risk factors. In such cases additional drug treatment is needed. Because there are no drugs available that will tackle all risk factors simultaneously, this may lead to treatment with multiple drugs and associated side effects and compliance problems.

INSULIN RESISTANCE, THE METABOLIC SYNDROME AND DIABESITY: THE ROLE OF FITNESS AND FATNESS

Goodpaster, B.

University of Pittsburgh, United States

Insulin resistance is a critical factor in the development of type 2 diabetes. Although generalized obesity and aging have been associated with insulin resistance and type 2 diabetes, the relative roles of physical inactivity and body fat distribution in the etiology and treatment of insulin resistance warrant further attention. Obesity, aging, physical fitness, body fat distribution are all associated with insulin resistance and the metabolic syndrome. Moreover, exercise and diet-induced weight loss independently improve insulin resistance in obese, older adults who are at high risk for the development of type 2 diabetes.

EFFECTS OF STREPTOZOTOCIN-INDUCED DIABETES AND PHYSICAL TRAINING ON GENE EXPRESSION OF TITIN-BASED STRETCH SENSING COMPLEXES IN MOUSE STRIATED MUSCLE

Lehti, M., Silvennoinen, M., Kivelä, R., Kainulainen, H., Komulainen, J.

LIKES Research Center for Sport and Health Sciences, Neuromuscular Research Center, Finland

It is well known that endurance training enhances oxidative metabolism as well as e.g. glucose transport activity and these phenomena are markedly reduced in diabetes. Experimental (streptozotocin-induced) diabetes is accompanied by the reduction in weight gain and skeletal muscle atrophy. In striated muscle a sarcomeric non-contractile protein, titin, forms the backbone of the stress and strain sensing structures. We investigated the effects of diabetes, physical training, and their combination on the gene expression of proteins of titin stretch sensing complexes in skeletal and cardiac muscle.

Mice were divided to control (C), training (T), streptozotocin-induced diabetic (D), and diabetic training (DT) groups. Training groups performed 1, 3, or 5 weeks of endurance training on a motor-driven treadmill (1 h / day / 21 m/min). Muscle samples from T and DT groups together with respective controls were collected 24 hours after the last training session. Total RNA was isolated from the left calf (soleus, gastrocnemius and plantaris) as well as from the cardiac muscle. Gene expression was analysed with Affymetrix GeneChip (MG_U74A V2) and further processed with Microarray Suite and GeneSpring softwares. Proteins of titin-based stretch sensing complexes were trawled and Wilcoxon's Signed Rank test was used to derive biologically meaningful results from the raw probe cell intensities on expression arrays. Microarray results were verified and supplemented with quantitative PCR analyses.

Diabetes induced changes in mRNA expression of the proteins of titin stretch sensing complexes in Z-disc (MLP, myostatin), I-band (CARP, Ankrd2), and M-line (titin kinase signalling, SLIM3). mRNA level of MLP, CARP and Ankrd2 were increased while that of myostatin was decreased in diabetic skeletal muscle. Expression of SLIM3 mRNA was decreased in skeletal as well as cardiac muscle. In addition, mRNA levels of the titin kinase signalling pathway proteins were affected in skeletal muscle. Training alleviated diabetes-induced changes of most mRNA levels in skeletal muscle.

In conclusion, in streptozotocin-induced diabetes mRNA levels of the proteins of titin-based stretch sensing complexes were influenced substantially more in skeletal than in cardiac muscle. In skeletal muscle, we showed diabetes-induced changes in mRNA levels of several fiber type biased proteins (MLP, myostatin, Ankrd2). These results are consistent with the previous observations of diabetes-induced atrophy leading to slower fibertype composition. The ability of exercise to alleviate diabetes-induced changes may indicate slower transition of fiber type.

Invited symposium (IS)

IS3-04 Golf, motor learning and control - "Albertville"

ENERGY AND EFFICIENCY ANALYSIS OF THE GOLF SWING

Nesbit, S., Elzinga, M.

Lafayette.edu, United States

An energy and efficiency analysis of the golf swing is presented. Full-body computer models were used to estimate the energy production, transfers, and conversions within the body and the golf club. Four amateur subjects were analyzed and compared. The energy approach determined the force and torque components that accelerated the club, illustrated which body segments produced work, determined the timing of internal work generation, measured swing efficiencies, and proved that forces and range of motion were equally important in developing club head velocity.

The generation of work comes primarily from the back and hip joints generating 71.8, 72.2, 70.0, and 68.7 percent of the total body work for the subjects. This core body work is generated by high torques over the entire range of motion of the hip joints, and moderate but consistent torques applied over the considerable twisting range of motion of the spine. The secondary source of the body work comes from the joints of the shoulders and arms accounting for 24.7, 24.2, 26.2, and 28.0 percent of the total body work for the subjects. These joints generate their work primarily through large displacements, especially the right elbow, and in the case of the right wrist and shoulder, two DOF motion. The leg joints generate the remainder of the body work (3.6,3.6, 3.8, and 3.3 percent for the subjects).

The generation of work and its transference to the club appears to be a bottom up and outward event where a type of segmental summation of work occurs from the legs, through the hips, lower back, upper back, shoulders, arms, then wrists. The work generation in each joint generally peaks in the same order from distal to proximal. The work of the individual joints then stops increasing as the work is transferred upward, and the more distal joints change their function from doing work, to providing static support. The generation of joint work is equally dependent upon range of motion of the joint, and the ability to maintain consistent torques over the range of motion. An important measure of the efficiency of the golf swing is how much of the internal work is transferred to the golf club (24.5%, 20.2%, 26.1% and 26.8% for the subjects).

The internal body work is transferred to the club by and through the arms and wrists highlighting their dual work generating and structural functions. The external force, linear work, and linear power are transferred to the club via pulling on the club by and through the arms. The external torque, angular work, and angular power are transferred by and through the wrists. The large range in output torque and force values among subjects are tempered by each subject's ability to maintain these forces and torques over the range of motion of the downswing, thus the differences in club head velocities are not nearly as pronounced as the differences in forces and torques would imply.

MOTOR ADAPTATION DURING GOLF PUTTING

Reinkensmeyer, D., Wolbrecht, E.

University of California at Irvine, Vanuatu

A large number of recent studies have highlighted the key role that anticipatory control plays in motor adaptation during reaching, drawing, and walking. For example, when people are unexpectedly exposed to a novel force field created by a robot, their reaching paths initially become curved, but gradually straighten with practice [1]. When the force field is unexpectedly removed, the reaching paths become distorted in a way that indicates the motor system was anticipating the force field. This anticipation has been attributed to the

construction of an "internal model," a sensory motor mapping between limb state and muscle activation. The process of internal model formation can be mathematically described by a simple difference equation, which can be viewed as arising as a consequence of the use of an error-based, neural learning law. Here we studied whether the motor system uses internal model formation to control the accuracy of golf putting. A healthy adult subject practiced putting on a flat surface toward a hole-like target two meters away. A lightweight robot was attached to the head of the golf putter. Following an initial practice period with the robot passive, the robot unexpectedly applied a velocity dependent force field that slowed the putter head during the forward putting stroke. As a consequence, the subject putted the golf ball too short a distance. With practice over 60 putts, however, the subject gradually adapted to the force field and improved his putting accuracy. Then, when the force field was unexpectedly removed, the subject putted the ball too long a distance. This "after effect" persisted for approximately 40 putts. The presence of an after effect of adaptation indicates that the motor system modified its internal model of the golf putter to account for the altered putter dynamics when the robot resisted the putting stroke. The pattern of gradual adaptation and gradual de-adaptation were consistent with the error evolution observed during adaptation to novel force fields for reaching, drawing, and walking. These results indicate that the motor system updates an internal model of the putter dynamics on a putt-to-putt basis using an error-based learning law. Therefore, recently developed techniques for enhancing motor learning by amplifying errors during reaching [2] and walking [3] may also be applicable to golf putting.

[1] Shadmehr R, Mussa-Ivaldi FA (1994) Adaptive representation of dynamics during learning of a motor task. Journal of Neuroscience 14:3208-3224

[2] Patton JL, Stoykov ME, Kovic M, Mussa-Ivaldi FA. (2006) Evaluation of robotic training forces that either enhance or reduce error in chronic hemiparetic stroke survivors. Exp Brain Res. 168(3):368-383.

[3] Emken JL, Reinkensmeyer DJ (2005) Robot-enhanced motor learning: Accelerating internal model formation during locomotion by transient dynamic amplification. IEEE Trans Neural Systems & Rehab Eng 13:33-39.

EARLY PUTTING PRACTICE WITHOUT ERRORS RESULTS IN A STROKE UNAFFECTED BY EXTERNAL DISTRACTIONS

Poolton, J., Maxwell, J.P., Masters, R.S.

The University of Hong Kong, Hong Kong

Introduction

Golfers appear at large to be habitual hypothesis testers; even top professionals (famously, Nick Faldo and Tiger Woods) make swing changes in the hope of perfecting their performance. However, explicit control of movement (dependent on working memory) resulting from hypothesis testing behaviour can be disruptive to performance in certain situations (e.g., dual-task conditions or under pressure). Maxwell et al. (2001) proposed that one way to inhibit hypothesis testing, and so, encourage implicit motor acquisition, is to minimise errors in learning. Maxwell et al's 'errorless' learning paradigm for golf putting resulted in superior performance and robust performance under dual-task conditions. Maxwell et al. later showed that the initial period of learning, in which errors were dramatically reduced, seemed to be crucial for implicit learning despite later accumulation of explicit knowledge; we examined this hypothesis.

Method

The task required participants to putt to a hole cut to PGA regulations. Novice participants were randomly allocated to either an Implicit-Explicit (n =17) or an Explicit treatment condition (n =18). Replicating Maxwell et al's putting protocol, participants completed 8 blocks of 50 learning trials beginning 25 cm from the hole. After each block, putting distance increased in increments of 25 cm to a final putting distance of 200cm. Participants either received instructions on putting technique prior to learning (Explicit condition) or prior to the fourth block of trials (Implicit-Explicit). In the Test Phase, participants completed a dual-task transfer test (tone counting), sandwiched between two retention tests. Each test consisted of 50 trials from 200 cm.

Results & Discussion

Analysis of the Test Phase revealed a significant Group x Block interaction ($F(2, 32) = 4.59$, $p < .01$). Relative to both retention tests, dual-task conditions disrupted performance in the Explicit condition; whereas, performance in the Implicit-Explicit condition improved. Notably, the performance breakdown exhibited by explicit learners was correlated with a reduction in the number of visible adjustments made to technique ($p < .05$). It appears that the additional task interfered with movement modification and explicit control; consequently, performance was disrupted. The failure of the Implicit-Explicit condition to breakdown, despite having technical information of the putting stroke, suggests that they were not dependent on the availability of their explicit knowledge for movement control.

Exploiting the benefits of implicit motor learning in golf (e.g. robustness under pressure) is problematic. It appears difficult to limit explicit knowledge accumulation during the extensive bouts of practice that it takes to become an expert. The solution may be to limit the number of errors during initial learning experiences.

References

Maxwell, J. P., Masters, R. S. W., Kerr, E., & Weedon, E. (2001). The implicit benefit of learning without errors. Quarterly Journal of Experimental Psychology A, 54, 1049-1068.

Invited symposium (IS)

IS3-05 Force production and force transmission in skeletal muscles - "Berlin ABC"

BEHAVIOR OF ACHILLES TENDON AND GASTROCNEMIUS APONEUROSIS DURING CONCENTRIC AND ECCENTRIC PLANTAR FLEXIONS

Kawakami, Y., Sugisaki, N., Chino, K., Kanehisa, H., Fukunaga, T.

Waseda University, Japan

There is increasing evidence of substantial muscle-tendon interaction in human skeletal muscles. For instance, during isometric plantar flexion, fascicles can shorten by as much as 30% of their initial length (1). This shortening occurs primarily at the expense of elongations of the series elastic components (tendinous tissues for the most part). In pennate muscles, the tendinous tissues are comprised of external tendons and aponeuroses, the latter of which have been shown to be more compliant than the former (2). A recent study in animals, however, showed different strains for active contraction and passive loading even if the tension is the same (3). Recently we have further shown inconsistent behavior of the aponeurosis and external tendon of the medial gastrocnemius muscle (MG) when the subjects per-

formed maximal and submaximal concentric (CON) and eccentric (ECC) plantar flexion exercises (4). Each exercise was preceded by an isometric action (Pre-iso) on an isokinetic dynamometer. In addition, the subjects performed static ramp actions with the ankle positioned at dorsi- and plantar flexed positions. During the exercises, the length changes of the aponeurosis and external tendon of MG were determined using ultrasound apparatuses. In CON, the length of external tendon significantly shortened from the level of Pre-iso in all test conditions. However, the change of aponeurosis was significant only in the maximal exercises. In ECC, the external tendon was elongated in all test conditions, while the aponeurosis was not elongated even in the maximal effort. In static action, the lengths of both aponeurosis and external tendon increased with increasing force levels. The present results indicate that the behavior of aponeurosis of MG depends on the type of action and that the aponeurosis of MG plays a simple role of muscle force transmission in eccentric actions, while external tendon functions to store elastic energy.

References

1. Kawakami, Y., Ichinose, Y., Fukunaga, T., 1998. Architectural and functional features of human triceps surae muscles during contraction. J. Appl. Physiol. 85, 398-404.

2. Kawakami, Y., Lieber, R. L., 2000. Interaction between series compliance and sarcomere kinetics determines internal sarcomere shortening during fixed-end contraction. J. Biomech. 33, 1249-1255.

3. Lieber, R. L., Leonard, M. E., Brown-Maupin, C. G., 2000. Effects of muscle contraction on the load-strain properties of frog aponeurosis and tendon. Cells Tissues Organs 166, 48-54.

4. Sugisaki, N., Kanehisa, H., Kawakami, Y., Fukunaga, T., 2005. Behavior of aponeurosis and external tendon of the gastrocnemius muscle during dynamic plantar flexion exercise. Int. J. Sport Health Sci. 3, 235-244.

MUSCLE - TENDON INTERACTION IN HUMAN GASTROCNEMIUS DURING WALKING AND RUNNING

Wilson, A.M., Lichtwark, G.A.

The Royal Veterinary College and University College London, United Kingdom

The simplest representation of a muscle tendon unit (MTU) comprises a muscle fascicle (MF) in series with an elastic element (the tendon and aponeurosis, EE). The relative proportion of the contractile and elastic elements of the unit vary between muscles and species, but athletic animals like the horse and wallaby can have very long tendons and short muscle fibres in limb extensor muscles. The most similar muscle in humans is the triceps surae complex which has a long tendon that achieves high strains.

Tendons are elastic and can store energy by stretching when under load. Having a tendon in series with a muscle component means that the length change over time can differ between the MF and the MTU as a whole. For instance

1. The MF can remain isometric (hence doing no mechanical work) whilst the EE stretches and then recoils (seen in human hopping).

2. The MF can shorten gradually storing energy in the EE which is then released with a high shortening velocity. This can enable a MTU to perform work at a velocity higher than the MF can achieve directly.

3. Finally in cyclical movement the MTU can function across a range of external conditions whilst the MF always functions at close to its optimum contraction conditions for power or efficiency.

We have investigated these mechanisms in the medial gastrocnemius (MG) component of the human triceps surae muscle during hopping, walking and running. We have measured Achilles tendon strain during dynamic activities by tracking the position of the muscle tendon junction relative to its insertion on the calcaneous. This is achieved by combining motion analysis with ultrasound imaging. Similarly, we have measured MF length using ultrasound imaging. Our results indicate that the Achilles tendon is a highly compliant structure that can strain as much as 8-10% during high force activities, like one legged hopping, and 4-6% during walking and running. The energy stored in and returned from the tendon during hopping was found to account for approximately 16% of the total mechanical energy required for the hop.

During human gait under different conditions, MFs were found to act isometrically during force production and perform the required work during force decline. This has important implications for energetics of gait, because it allows the muscle to produce force under conditions which minimise energetic consumption and maximise force production (isometric conditions). This can only be achieved with a long, compliant tendon. We demonstrate this with a simple Hill-type muscle model which predicts that GM muscle efficiency during walking and running is maximised with a tendon very similar to the average stiffness we have measured. This is most evident in running, where high MTU shortening velocities are required.

THE ROLE OF TENDON AND APONEUROSIS IN FORCE TRANSMISSION IN UNI-PENNATE MUSCLES

Herzog, W.

University of Calgary, Canada

Tendon and aponeurosis have been associated with storing and releasing energy during cyclic movements. This storage and release of energy has typically been related to a reduced metabolic cost of movement. However, when calculating the energies stored and released, tendon and aponeurosis have been assumed to be arranged in series with each other and in series with the contractile fibres. Although tendons are clearly arranged in series with the muscle belly, the mechanical role of aponeuroses relative to the contractile fibres and tendons is much more complex and needs careful evaluation. Here, we performed in situ and in vivo experiments with the cat medial gastrocnemius, a uni-pennate muscle, and demonstrated that the aponeuroses of this muscle are not arranged in series with either the tendon or the muscle fibres. These results are explained with a theoretical model demonstrating that it is the incompressibility of the muscle that makes the arrangemnt of fibres, aponeuroses and tendon much more complex than a simple in series force transmission. Assuming incorrectly that the aponeuroses are in series with the muscle fibres and tendon would give a vast overestimation of the energy contributions of the aponeuroses to medial gastocnemius function. We conclude from this study that the role of aponeuroses needs careful evaluation and justification for each muscle before assuming an in series arrangement with tendon and fibres, and published results on aponeuroses function need careful interpretation.

INFLUENCE OF PASSIVE FORCE ENHANCEMENT ON ACTIVE FORCE ENHAMCEMENT

Tihanyi, J., Rácz, L., Trzaskoma, L., Costa, A.

Semmelweis University, Faculty of Physical Education and Sport Science, Budapest, Hungary

Introduction. The muscle tension remains elevated having terminated the stretch for a certain period of time called passive force enhancement (PFE). There are several theories explaining this phenomenon. Herzog and Leonard (2002) suggested that the passive force enhancement could be attributed to the increased stiffness of the passive elastic elements. We hypothesized if the muscle stiffness increases due to previous stretch then a second stretch may elicit a greater active force enhancement than the first stretch.

Material and methods. Six physically active male subjects were recruited in this study. The knee extensors of the non-dominant leg were used to test our hypothesis. The subjects were placed in a dynamometer (Muli-Cont II) in sitting position. Isometric torque (Mic) was performed at a joint angle of 30, 40, 50, 70, 80 and 90 degrees. Muscle stretch was carried at a pretension of 0.8Mic by applying 30/s constant velocity flexing the knee between 30 and 50, 40 and 50, 70 and 90, 80 and 90, respectively. Also, eccentric contractions were carried out between 30 and 40 followed by a second stretch between 40 and 50 with 200 ms delay. Similar procedure was done in the descending limb of torque-angle curve initiating the first stretch at 70 followed by the second stretch at 80. EMG activity of vastus lateralis and biceps femoris was also measured.

Results. In the ascending limb of torque-angle curve the eccentric torque was greater with 16% compared with Mic estimated at 40. After the first stretch the torque dropped to the isomeric torque level indicating no PFE. Applying the second stretch after 200 ms the torque increased and the AFE was 7% compared with Mic at 50. In the descending limb of the torque-angle curve at the first stretch the AFE was 32.6 % and torque remained in this level during 200 ms indicating a 33.3% PFE. The torque enhanced during the second stretch and the maximum eccentric torque was 61.3 % higher than the isometric torque at 90. The AFE was 15.2% greater when we applied double stretch compared to the AFE of the single stretch carried out between 80and 90. No significant difference was found in EMG activity of the muscles comparing the different experimental conditions.

Discussion. In agreement with the previous studies we found that active force enhancement is lower at the ascending limb of the torque-angle curve than at the descending limb. We did not experience PFE at the ascending limb which can be explained by the fact that passive elements do not contribute the force enhancement when the muscle works about resting length. On the other hand our results indicate, that the passive force enhancement may play a significant role in increasing eccentric force of the stretched muscle at the descending limb due to the increased stiffness of the passive elastic elements as Herzog and Leonard (2002) suggested.

References

Herzog W, Leonard TR . J Exp Biol 2002, 205:1275–1283.

Oral presentation (OP)

OP3-01 Physiology 9/10 - "Oslo"

RESPIRATORY ACIDOSIS BUT NOT METABOLIC ACIDOSIS DELAYS THE DEVELOPMENT OF FATIGUE DURING INTERMITTENT EXERCISE OF HIGH INTENSITY OF A SMALL MUSCLE GROUP IN HUMAN

Hilbert, M., Shushakov, V., Martens, T., Maassen, N.

Medical School Hannover, Germany

Introduction:

Low pH is said to impair several mechanisms, which contribute to muscular performance. Nevertheless, there is increasing data about a preserving effect of acidification on muscle power and excitability (1).

The aim of this study was to compare the influence of respiratory and metabolic acidosis on performance, m-wave and metabolism in intermittent exercise of high intensity.

Methods:

The tests were performed in two separated groups, one with respiratory acidosis (RAC) and a control group (CON,n=9), the other with metabolic acidosis (MAC) and a placebo group (PLA,n=8). The subjects performed handgrip interval exercise with maximum power. Each test consisted of a pre-period (20/90min (RAC/MAC), P1), an intermittent exercise period (10min, P2; 15s work/ 45s rest) and a recovery period (10min, P3). In P1 with PLA and MAC the subjects' were administered 0.12g/kgBW CaCO3 and 0.07g/kgBW NH4Cl, respectively, dissolved in fruit juice (MAC: pHart at the end of P1: 7.34±0.02; CON/PLA: 7.42±0.01). In CON the subjects breathed normal, whereas in RAC the subjetcs' PCO2 was increased by re-breathing before exercise (pHart at the end of P1: 7.36±0.02). This pH-level was maintained in P2 and P3. [K+], [Na+], pH and [lactate], were measured in venous and arterialized blood. Mechanical parameters and heart rate were monitored, m-wave was recorded by surface electrodes. For measurement the motor point of the muscle was stimulated supramaximally with rectangle constant current pulses before and after each exercise bout.

Results:

The pHven during exercise was significantly different ($p<0.001$) between CON/RAC and PLA/MAC, respectively (mean in P2: CON: 7.20±0.03; RAC: 7.16±0.03; PLA: 7.23±0.03; MAC: 7.16±0.03). Performance in RAC was significantly less decreased than in CON ($p<0.01$), no difference between MAC/PLA. M-wave area in P2 was significant lower with acidosis than with CON and PLA, respectively (RAC: $p<0.001$; MAC: $p<0.05$), and lower with RAC than with MAC ($p<0.001$). Duration of m-wave was not different between RAC/CON, but with MAC it was significantly longer than with PLA ($p<0.001$). [Lactate] was decreased with acidosis, but lactate release and muscle-VO2 were not different between RAC/CON or MAC/PLA. The plasma [K+] with MAC was significantly higher than with PLA during the experiment, no difference occurred between RAC/CON. The [K+]-release during exercise was not different.

Discussion:

The reasons for the different effects of acidosis on performance might result from the accumulation of CO2 in the muscle cell and the subsequent decrease in pH. This might have influenced intracellular mechanisms of the excitation-contraction-cycle (2,3). The effects on the [K+] in MAC might be explained by a partly inhibition of the Na+/K+-pump. Nevertheless, we found no correlation between m-wave area and power.

References:

1 Nielsen et al. (2001). J Physiol 536(1):161-6
2 Pedersen et al. (2004). Science 305:1144-7
3 Allen (2004). Clin.Exp.Pharmacol.Physiol 31(8):485-93.

PREECLAMPSIA IS ASSOCIATED WITH EXAGGERATED OXIDATIVE STRESS AND PULMONARY HYPERTENSION AT HIGH ALTITUDE – A NOVEL RISK FACTOR FOR HAPE DURING THE PRACTICE OF SPORTS AT HIGH ALTITUDE?

Schwab, M., Jayet, P.Y., Thalmann, S., Stuber, T., Hutter, D., Salinas, C., Cucchia, C., Spielvogel, H., Villena, M., Allemann, Y., Sartori, C., Scherrer, U.

Botnar Center for Extreme Medicine, University Hospital, Lausanne, Switzerland

High-altitude pulmonary edema is the most frequent life-threatening disease occurring during the practice of sports at high altitude. Exaggerated pulmonary HT and an individual predisposition are hallmarks of HAPE but the mechanism that underpins this individual susceptibility is unknown. There is increasing evidence that not only genetic, but also epigenetic mechanisms play an important role in the pathogenesis of human disease. The "Fetal Programming Theory" postulates that adverse events in predispose to disease in adulthood. In line with this theory, preliminary data from our group indicate that preeclampsia predisposes the offspring to exaggerated hypoxic pulmonary hypertension in later life, but the mechanism is unknown. Exaggerated pulmonary hypertension could be related to a structural (defective pulmonary angiogenesis, vascular remodeling) or functional defect. We, therefore, assessed carbon monoxide diffusion capacity (DLCO), and measured pulmonary-artery pressure (systolic right ventricular to right atrial [RV-RA] pressure gradient, echocardiography) before and during nitric oxide inhalation (40 ppb) in 27 young (age, 12±2 years, X±SE) healthy Bolivian offspring of preeclampsia and 68 sex- and age-matched offspring of normal pregnancies in La Paz (3600 m). The systolic RV-RA gradient was, as expected, roughly 36 percent higher in offspring of preeclampsia than in controls (34±1 vs. 25±1 mmHg, P<0.001). We found no evidence for defective pulmonary angiogenesis, since DLCO was comparable in the two groups. The exaggerated pulmonary hypertension was related, at least in part, to a functional defect, since nitric oxide inhalation caused an almost twice as large (P<0.001) decrease in pulmonary-artery pressure in offspring than in controls. In a second step, we tested for underlying mechanisms of this functional defect. Preeclampsia is associated with augmented oxidative stress in the mother as well as in the offspring, and in experimental animals, oxidative stress facilitates hypoxic pulmonary vasoconstriction. We, therefore, examined the effects of the antioxidant vitamin C on pulmonary-artery pressure in the two groups. Vitamin C significantly decreased pulmonary-artery pressure (by 6.5±1.3 mm Hg, P=0.002) in the offspring, but had no detectable effect in controls. In conclusion, these findings provide the very first evidence that preeclampsia leaves a persistent and potentially fatal epigenetic imprint in the pulmonary circulation of the offspring living at high-altitude, namely augmented oxidative stress, which predisposes to exaggerated hypoxic pulmonary hypertension in later life. We speculate that offspring of preeclampsia may be at risk to develop HAPE when practicing sports at high altitude. If so, prophylactic administration of antioxidants may prevent this life-threatening complication.

CYCLOOXYGENASE INHIBITION REDUCES THE PRESSURE REFLEX TO RHYTHMIC HANDGRIP EXERCISE IN HYPOXIA

Burtscher, M., Riedmann, G., Likar, R.

University of Innsbruck, Austria

Recently we observed attenuated cardiovascular and ventilatory responses to exercise in hypoxia when pre-treated with aspirin (1). Thus, an important role of prostaglandins on ergoreceptor activation may be assumed. This assumption is supported by the findings that hypoxia increases prostaglandin levels and that cyclooxygenase inhibition might attenuate the muscle ergoreceptor response (2). The purpose of the present study was to evaluate the effect of cyclooxygenase inhibition on the hypoxia-related exercise pressure reflex and its main determinants.

Six healthy and fit male subjects (38±12 yrs, 73±8 kg, 179±4 cm) performed rhythmic handgrip exercise for 50 s (1 rep/s) at about 50% of maximal voluntary contraction. Exercise was performed during normoxic and hypoxic (12 % oxygen) conditions with and without forearm occlusion (during exercise and 1 min post-exercise), and with and without cyclooxygenase inhibition by aspirin (10 mg/kg). Hemodynamic responses were monitored with the Physio Flow impedance device (Manatec, France).

Without aspirin pre-treatment the mean arterial pressure response (deltaMAP) to exercise was greater during hypoxia than normoxia without (means ± SEM: 13.0±7.0 vs. 2.0±1.5 mmHg) and with (11.7±4.6 vs. 6.7±4.3) forearm occlusion. With aspirin pre-treatment, however, values between hypoxia and normoxia were similar without (5.3±3.5 vs. 4.3±2.7 mmHg) and with (7.7±4.4 vs. 5.3±6.1 mmHg) forearm occlusion. P<0.05 for treatment-dependent differences between hypoxia and normoxia (without occlusion). In contrast, heart rate responses were enhanced in hypoxia but remained unaffected by aspirin intake. In all conditions, 1 min post-exercise the MAP was not different from baseline.

The hypoxia related increase of the arterial pressure response to handgrip exercise has been prevented by aspirin pre-treatment. The heart rate responses to exercise might mirror a central command which, however, was unaffected by cyclooxygenase inhibition. The deltaMAP was the same with and without forearm occlusion, indicating that group IV fibres may not have contributed considerably to the pressure reflex in hypoxia. Thus, the exercise pressure reflex in hypoxia is thought to be mainly mediated by group III afferents. Because this reflex is attenuated by cyclooxygenase inhibition it is supposed that mechanoreceptors are sensitised by prostaglandins in hypoxia.

1) Burtscher M, Philadelphy M, Likar R, Nachbauer W. Aspirin for prophylaxis against headache at high altitudes: randomised, double blind, placebo controlled trial. BMJ 1998; 316:1057-58.

2) Hayes SG, Kinding AE, Kaufman MP. Cyclooxygenase blockade attenuates the response of group III and group IV muscle afferents to dynamic exercise in cats. Am J Physiol Heart Circ Physiol 2006; doi:10.1152/ajpheart.01274.2005.

HORMONAL INFLUENCES ON THE IMMUNE FUNCTION DURING ACUTE AND CHRONIC HIGH ALTITUDE EXPOSURE

Ermolao, A., Travain, G., Tolomio, S., Zilli, C., Siviero, M., Facco, M., Zaccaria, M.

University of Padova, Italy

We recently observed that acute and chronic high altitude (HA) exposure can modify number and function of immune cells, leading to a disruption in the homeostatic regulation of Th1/Th2 immune responses*. The autonomic nervous system (ANS) and the hypothalamic-pituitary-adrenal (HPA) axis have been demonstrated to play a critical role in mediating many physiological adaptations to HA exposure. Both these systems are also known to modulate the immune function through cortisol (C) and catecholamines secretion.

AIM To evaluate possible relationships between stress hormones activation and immunological parameters during acute and chronic HA exposure.

METHODS 13 moderately active healthy women (age 21.3±3.1yr) reached after 5 days of trekking the Pyramid Laboratory at 5,050 m (Lobuche, Nepal) where they spent 21 days. Before and after HA exposure (SL1 and SL2), and in the first (P1) and 21th day spent at HA (P2), we collected blood samples for peripheral white blood cells, their subsets, IFN-γ, IL-4 and 24-h urine samples for norepinephrine (NE) epinephrine (E) and C.

RESULTS During HA exposure, total lymphocytes, compared to SL1 value significantly decreased at P1, rose at P2 and returned to their basal values at SL2 (SL1 2.0±0.5x103/ml, P1 1.3±0.6, p<.005; P2 2.4±0.6, p<.005, SL2 1.6±0.6, p=n.s).

In particular CD3+ T lymphocytes percentage fell respect to SL1, owing to a significant CD4+ T-cell fall (from 50.4±4.2 to 32.1±8.2, p<.001 at P1, and to 32.0±8.8 p<.01 at P2).

The percent of Natural Killer cells (NK) significantly increased both at P1 and at P2 (CD16+: SL1 14.2±4.5, P1 25.0±2.6 p<.001, P2 21.4±4.6, p<.001 and CD56+: SL1 12.5±5.2, P1 28.2±5.7 p<.001, P2 24.6±3.4, p<.001) while returned to basal values at SL2. From a functional viewpoint, the expression of IFN-γ (a typical Th1/Tc1 cytokine) significantly decreased at P1 and P2 respect to SL1 values (Mean Fluorescence Intensity: 32.0±8.5 at SL1, 19.2±5.5, p<.005 at P1, and 7.0±3.7, p<.005 at P2), whereas IL-4 (a typical Th2/Tc2 cytokine) didn't change.

Among stress hormones, only NE significantly increased at P1 and at P2 respect to SL values (from 178.6±69.2nmol/24h to 498.3±225.2 p<.001 and to 520.8±282.6 p<.005, respectively), E showed only a positive trend (p=.08), while C, respect to SL1 raised significantly at P1 (p<.01) and P2 (p<.05), but showed significantly lower values at SL2 (p<.005). CD3+, CD4+ and NK cells demonstrated a large and significant correlation with NE and C, (R ranged between 0.4 and 0.6), however only NE levels well correlated with IFN-γ expression (R=.537, p<.005).

CONCLUSIONS Our data suggest that the ANS and the HPA axis played a central role on the cellular and functional immunologic adaptations observed at HA. Specifically, the ANS activity, through NE secretion, may be one of the mechanisms responsible for the impairment of the Th1/Th2 immune balance, as demonstrated in other stress conditions.

*Facco M., et al. Med Sci Sports Exerc 2005 May;37(5):768-74.

LIMITATIONS OF HYPERBARIC BAG TREATMENT OF ACUTE MOUNTAIN SICKNESS

Mekjavic, I.B. 1, Gavran, B. 2, Golja, P. 3

1 Jozef Stefan Institute, 2 Univ. of Ljubljana, Faculty of Sport, 3 Nova Gorica Polytechnic, Slovenia

Hyperbaric bags are used at high altitude to alleviate the symptoms of acute mountain sickness (AMS). The patient is placed in a bag, which is then pressurised above the ambient pressure. Consequently, partial pressure of oxygen in the bag increases, which has a beneficial effect on the patient. During a 1-hour therapy, the hyperbaric bag must be adequately ventilated by the rescuer to minimise the CO2 accumulation in the bag. At altitude, the strenuous activity associated with the recommended pumping rate may induce AMS in a previously non-symptomatic rescuer. The aim of the experiment was to assess the physiological strain imposed on the rescuer during a typical AMS therapy, both, at low and high altitude. The CO2 level in the hyperbaric bag was also monitored to assess the potential development of hypercapnia during the AMS therapy.

Eight male subjects participated in 4 separate trials, both as "patients" and "rescuers", in both hypoxia (H) and normoxia (N). The subject's average (SD) age was 26 (2) years, and maximal heart rate (HRmax; bpm) obtained during normoxia was 186 (5) bpm. The "rescuer-patient" pair rested for 10 minutes in a climatic chamber (Ta = 21.2 (0.3)°C). Then, the "patient" lay in the bag (Certec, France) and the "rescuer" commenced a 1-hour AMS treatment. After inflation, the bag was ventilated every 10 seconds. In hypoxic trials, normobaric hypoxia was induced by decreasing the O2 fraction in the chamber to 13.4 (0.1) % (simulated altitude = 3500 m). To assess the physiological strain of the "rescuer" during the AMS therapy, his heart rate (HR; bpm) was measured with a heart rate monitor, and his haemoglobin saturation (SaO2; %) with a pulse oximeter every five minutes. CO2 level in the hyperbaric bag was monitored with a portable CO2 analyser.

Upon completion of the AMS therapy, rescuers' SaO2 attained 98 (0) % and 85 (5) % in the N and H, respectively, whereas the patients' SaO2 was 97 (1) % in the N and 93 (1) % in the H. Rescuers' HR at the end of the therapy was 88 (13) bpm in the N and 95 (9) bpm in the H, which corresponded to 47 (6) % and 51 (4) % of their normoxic HRmax. The difference in subjects' HR between the N and H was not significant ($p < 0.08$). The highest HR of the "rescuers" was observed during the initial inflation of the bag; HR reached 61 (9) % and 65 (9) % of their HRmax, in N and H, respectively. During the AMS treatment, CO2 increased gradually, attaining 2.6 (0.4) % in the N and 2.9 (0.4) % in the H trials.

During a 1-hour AMS therapy in a hyperbaric bag, CO2 concentration in the bag increased to approximately 3 %, despite maintaining the manufacturer's recommended ventilation rate. In normoxic conditions, heart rate of the rescuers during AMS therapy reached up to 60 % of their maximal heart rate, and the physiological strain was further increased with altitude.

Oral presentation (OP)

OP3-02 Training and Testing 6/7 - "Turin ABC"

CARDIOPULMONARY EXERCISE CAPACITY AND MUSCLE STRENGTH IN CHILDREN AND ADOLESCENTS WITH ACHONDROPLASIA: IS THERE A DISADVANTAGE OF BEING SMALL?

Takken, T., van Bergen, M., Sakkers, R., Helders, P., Engelbert, R.

Wilhelmina Children's Hospital, University Medical Center Utrecht, Netherlands

Aim: The aims of the present study were to determine whether subjects with achondroplasia have a different response to exercise compared to healthy peers, and whether exercise capacity might be related to anthropometric measurements or physical activity levels.

Methods: Seventeen patients (7 boys and 10 girls; mean age 11.8 ± 3.3; range 6.9-19.4) diagnosed with achondroplasia participated in this study. Weight, standing height, sitting height, arm span and head circumference were measured in a standardized manner. Strength of the proximal and distal muscles in lower and upper extremities was measured using a Hand Held Dynameter (Citec dynamometer) in

the following six muscle groups: shoulder abductors, grip strength, dorsal extensors of the wrist, hip flexors, knee extensors and dorsal flexors of the foot. A 3-day Bouchard physical activity record was used to estimate energy expenditure.

The subjects performed a maximal graded treadmill exercise test using a modified Bruce protocol. Heart rate (HR) and gas exchange variables (peak oxygen uptake: VO2peak, VO2peak/kg, respiratory gas exchange ratio: RER, and minute ventilation: VE) during the test were measured using a heart-rate monitor (Polar) and a calibrated mobile gas analysis system (Cortex Metamax B3).

Z-scores were calculated using reference values for healthy children and adolescents. Independent samples T-tests were used to test differences between patients and the reference values.

Results:All anthropometrical measurements differed significantly from reference values. Mean standing height was -5.77 ± 0.98 ($p < 0.0001$) standard deviations lower compared to normal values.

Subjects with achondroplasia showed a reduced muscle strength in dorsal extensors of the wrist, hip flexors, knee extensors and dorsal flexors of the foot. Muscle strength in the shoulder abductors was normal.

Physical activity levels were significantly lower in subjects with achondroplasia compared to reference values, and correlated significantly with VO2peak ($r = 0.594$, $p = 0.05$).

All patients were able to perform the maximal exercise test without complications. HRpeak of the patients was 178.6 ± 14.9 (range 151-201) beats/min and RERpeak was 1.15 ± 0.1 (range 1.0 – 1.41). Z-scores for VO2peak (-3.23 ± 0.66), VO 2peak/kg (-2.59 ± 0.70), and E (-2.20 ± 0.73) were significantly reduced compared to reference values for age and gender ($p < .001$). Peak ventilatory equivalent for VO2 (VEpeak/VO2peak) was higher in subjects with achondroplasia (45.25 ± 5.9) compared with reference values (37.9 ± 2.8 ($p < 0.001$). Peak O2 pulse (HRpeak/VO2peak) was significantly lower in subjects with achondroplasia (5,9 ± 1.9 ml/beat) compared to reference values (9.3 ± 2.3 ml/beat; $p < .0001$).

Conclusion: The cardiopulmonary exercise capacity and muscle strength in subjects with achondroplasia was reduced compared to age and gender matched reference values. Subjects with achondroplasia have a unique response to exercise compared to peers.

APPLIED SCIENCE IN ELITE YOUTH SOCCER: A DIAGNOSIS AND INTERVENTION PROJECT TO OPTIMIZE PREVENTION, REHABILITATION AND RE-INJURY-PROPHYLAXIS OF KNEE AND ANKLE INJURIES

Neumann, G., Stehle, P.

German Federal Institute of Sport Science, Germany

Epidemiological studies show an increased number and impact of serious knee and ankle injuries that occur not only in the field of high level senior soccer but also with dramatically rising figures in youth soccer. Therefore, since 2004 the German Federal Institute of Sport Science (BISp) promotes – in close cooperation with the German Soccer Federation (DFB) – a several years lasting interdisciplinary project to (a) optimize prevention, rehabilitation and re- injury-prophylaxis of knee and ankle injuries in soccer, (b) to create wholesome solutions and (c) campaigns to mediate and integrate these results into the soccer praxis.

Injuries of the lower extremities or the proneness to certain knee and/or ankle injuries are thought to be caused by many factors including situational, training, individual or material aspects. In our study we are interested in measuring and improving physiological and psychological impact factors to optimize prevention, rehabilitation and re-injury-prophylaxis of knee and ankle injuries in soccer. Diagnosis variables include the individual knee and ankle stability, coordinative and psychological abilities. Thus, a manifold of research disciplines (sports medicine, biomechanics, training science, sport psychology, epidemiology) work together. Moreover, the potential influence of the shoe design upon the knee and ankle stability is investigated by another research group.

The study takes place with five elite male youth soccer teams (U 17, U 19) of 1st division clubs. Each team takes part at four diagnosis sessions before and throughout the seasons 2004/05 and 2005/06 to measure the potential individual injury proneness as well as the intervention outcome. Throughout the season, a proprioceptive training program is integrated into the normal warm-up program as well as a weekly handheld assisted monitoring of perceived physical and psychological states.

In order to handle the vast amount of data, a dynamic database has been developed. Thereby (a) multivariate analyses of all variables for all measurements, players and teams become possible as well as (b) a fast and "comprehensible" interpretation and transfer of the measurement results for the coaches and teams - after each measurement, the coaches are given commented graphical and table analyses for the teams, including the individual performance of each player, compared to reference values. Delivering these tools, coaches can react immediately and more sensible to the individual and team needs by i.e. reducing/changing the training for players. The weekly feedbacks of the players' physical and psychological states help to become more aware of temporal stressors that might impair the performance or increase the risk for injuries.

Preliminary analyses indicate a positive influence of the proprioceptive training upon the dynamic knee stability and coordination.

More information about the project can be found under "http://www.bisp-fussball-interdisziplinaer.de".

DIAGNOSIS OF THE FOOTBALL-SPECIFIC VELOCITY IN YOUNG ELITE FOOTBALL PLAYERS

Laudenklos, P., Knop, T., Lottermann, S., Weber, K.

German Sport University Cologne, Germany

INTRODUCTION

In football the performance in competition depends among other parameters on the specific velocity. This ability is characterized by a distance up to 20 meters – with an emphasis of sprints between one and ten meters (Verheijen, 1999) – and shifts in direction (Rehhagel, 2004). Thus the solely use of the linear sprint (Gerisch & Weber, 1992) for the diagnosis of the velocity seems to be insufficient. The aim of this study was to investigate, whether the more specific agility test (Lottermann, Laudenklos & Friedrich, 2003) differentiates more clearly between young top-level and high-level football-players.

METHODS

The players (n = 15568) were members of youth teams from German Bundesliga-Clubs [LZ] (n = 812) or the DFB-Talent-Promotion-Program [SP] (n = 14756) in the age-groups [AG] 1988 to 1995. Every test (20 meter linear sprint [LS] and agility run [AR]) consisted of two heats by which the better one was evaluated. The test-times were measured by light barriers. The means of the two groups were analyzed by t-test for independent samples on a significance-level of 1%.

RESULTS

In LS the means of LZ varied from 3,12 ± 0,11 s [n1987 = 34] to 3,68 ± 0,14 s [n1994 = 102] while the results of SP ranged from 3,13 ± 0,16 s [n1987 = 56] to 3,80 ± 0,23 s [n1994 = 773]. Thereby LZ were significant better in the AG 1990 to 1994 (t varies from 2,94 [AG 1992] to 8,15

[AG 1993]) whereas in the older age-groups no significant differences were detected on the demanded significance-level (t varies from 0,35 [AG 1987] to 2,29 [AG 1988]). In AR the means of LZ varied from 7,58 ± 0,35 s in AG 1988 (n = 65) to 8,29 ± 0,43 s in AG 1994. Thus they are significant better in every single age-group (t varies from 2,82 [AG 1987] to 12,10 [AG 1993]) than SP, whose means are ranged from 7,89 ± 0,46 s in AG 1987 to 8,76 ± 0,50 s in AG 1994.

CONCLUSION

The results confirm the assumption that the AR differentiates more clearly between LZ – as the group of better players – and SP than LS. In the AG 1989 to 1987, there are no differences between LZ and SP in LS, while the differences in AR are still significant. Furthermore, the differences in AR between both groups – related to the standard deviation [SD] of LZ in the respective single-tests – are clearer than in LS and they grow with age. The quotient [(ARSP – ARLZ)/SDAR(LZ)]/[(LSSP – LSLZ)/SDLS(LZ)]] increases from 1,32 in AG 1994 to 6,74 in AG 1987.

REFERENCES

Gerisch, G., & Weber, K. (1992). Diagnostik der Ausdauer und Schnelligkeit im Leistungsfußball (2. Teil). Fußballtraining, 9 (9), 32-38.

Lottermann, S., Laudenklos, P., & Friedrich, A. (2003). Techniktraining – mehr als reine Ballarbeit. Fußballtraining, 21 (4), 6-15.

Rehhagel, J., Buschmann, J., & Weber, K. (2004). Running Speed in Soccer. In V. Klisouras, F. Kellis, & J. Mouratidis (Eds.): Pre-Olympic Congress (p. 284). Thessaloniki: Aristotle University.

Verheijen, R. (1999). Handbuch Fußballkondition (pp. 23 – 39). Leer: bfp.

EXPLORATORY RELATIONSHIP OF DROP JUMP PERFORMANCE WITH GYMNASTICS VAULTING AND FLOOR EXERCISE SCORES

Sands, W.A., McNeal, J.R., Stone, M.H., Smith, S.L., Dunlavy, J.K., Jemni, M., Haff, G.G., Mizushima, K.

United States Olympic Committe, United States

Purpose: This exploratory study sought to determine the relationship between drop jump performance and personal best scores on floor exercise (FX) and vaulting (VT) among elite male gymnasts. Methods: Nineteen male gymnasts (22.74, SD=2.2 yr; 164.8, SD=6.0 cm; 62.9, SD=7.8 kg) from the Senior National Teams of the U.S.A. (N=15) (Team Silver, Athens, 2004) and the Japan (N=4) (Team Gold, Athens 2004) agreed to participate. Athletes provided personal best FX and VT scores under the rules for the Athens Olympic Games. Athletes performed three trials of a rebound drop jump from 52 cm drop height onto a one-dimensional portable force platform. An arm swing was allowed. Athletes were instructed to rebound as high as possible with a short ground contact time and land on the force platform. Vertical force data were collected by custom computer software at 1000 Hz. Force-time curves were analyzed for maximum vertical force (MVF), rate of force development (RFD), ground contact time (GCT), and flight time. All variables except times were allometrically scaled (variable / body mass^0.66). Reliability analysis showed the first trial was statistically lower than trials two and three; trials two and three did not differ. All intraclass correlations of trials data exceeded 0.85; and relative technical errors of measurement ranged from 3.1% to 7.5% for all variables except RFD (11.1%). The mean of trials two and three was used for further analysis. Pearson correlation coefficients were calculated. Statistical significance was set at P<0.05. Results: variables significantly correlated with FX personal best scores were: RFD: r = 0.47, MVF: r = 0.57. GCT was the only variable significantly correlated with VT personal best scores (r = -0.52). Discussion: The results indicate that the data were reasonably stable. The significant correlations showed that allometrically scaled values of RFD and MVF were modestly predictive of variability of FX scores (r^2 = 0.22 to 0.32). Gymnasts with shorter ground contact times appeared to achieve superior VT scores. VT score variability was also modestly predictable from GCT (r^2 = 0.27). Conclusion: This study demonstrated that approximately 25%-32% of the variability of personal best scores in FX and VT could be predicted from a rebound drop jump test. Drop jump-type training and performance may serve the male gymnast in improving his scoring capability.

Oral presentation (OP)

OP3-03 Molecular Biology 2/2 - "Berlin DE"

MICROARRAY ANALYSIS OF SIMVASTATIN TREATED C2C12 MYOTUBES

Yu, J., Sewright, K., Hubal, M., Schwartz, L., Hoffman, E., Clarkson, P.

Mid Sweden University, Sweden

Statins are lipid-lowering drugs used by over 100 million people worldwide. Myopathy has been reported in 2–7% of cases and some of these cases are more serious involving rhabdomyolysis. So far the underlying mechanisms are unknown. The purpose of this study was to identify global gene expression patterns associated with the introduction of statin to myotubes in culture. For some of the most up- and down-regulated genes, their protein expressions were also analyzed. The satatin treated myotubes were also mechanically strained and protein expression were analyzed and compared with the results from the unstrained myotubes.

C2C12 cells were cultured using standard conditions and 15 μM of Simvastatin was then applied to these cells. A baseline sample and samples taken at 1 and 6 hours post-application were analyzed using Affymetrix MOE430A microarray. This analysis provided data for differing levels of gene expression for all genes in the mouse genome across the three time points. The differential gene expression data were filtered for genes that exhibited a 2-fold up-regulation or a 2-fold down-regulation across both time-points compared to baseline. Five of the most up- and down-regulated genes were selected, and then their protein expressions were analyzed. Proteins were also examined in statin treated myotubes mechanically strain for 1 hour.

61 genes exhibited a ≥ 2-fold up-regulation at both 1 and 6 hour compared to baseline. Of these genes, only 37 have known biological functions and/or localizations. The most common biological functions associated with these genes included transport or signal transduction, cell growth/maintenance, protein metabolism and apoptosis. 24 genes exhibited a ≥ 2-fold down-regulation at both time-points. Biological functions and/or localizations are known for only 9 of these genes. The transcripts of the genes coding for proteins at the membrane and the extracellular space make up a large portion of the data set. Statin treatment also results in significant increases in protein expression in four most up-regulated genes, and decreased protein expression in one down-regulated gene. Immunohistochemistry confirmed the altered expressions of these proteins. Cyclic mechanical strain rectified the changes in only three of the up-regulated proteins. These data indicate that the application of statin to C2C12 myotubes affect signalling and transport-associated gene expression related to cell growth/maintenance, protein metabolism, and apoptosis particularly at the cell membrane and extracellular space. When the cell is exposed to the statin drug, it appears that genes may increase their expression in an effort to adapt to the

changing environment. In rare cases, the cell may be unsuccessful in this attempt and, in vivo, myopathy could result. Mechanical strain may rectify some gene expressions suggesting exercise may in some extent alleviate the muscle pain induced by statin in vivo.

ABSENCE OF DYSTROPHIN IN SARCOLEMMA IS FOLLOWED BY PRESENCE OF INFLAMMATORY CELLS AND INTACT TYPE VI COLLAGEN IN HUMAN DAMAGED SKELETAL MUSCLE FIBERS

Koskinen, S., Paulsen, G., Kjær, M., Crameri, R., Raastad, T.

Institute of Sports Medicine, Denmark

Light microscopical examination of damaged rat skeletal muscle has shown that different collagen types are located similarly in swollen, necrotic and regenerated fibres as in undamaged skeletal muscle fibres (Koskinen et al. 2002). This is compatible with the view that collagen potentially could play an important role in skeletal muscle during the process of fiber damage when cytoskeleton is disrupted, contractile proteins are disorganized and extracellular fibronectin is deposited intracellularly. The aim of the present study is to investigate whether collagen has a similar role in human skeletal muscle. Eleven healthy male subjects (27.5+/-3.5 years, 180+/-8 cm, 82.6+/-6.4 kg) performed 300 (30 sets of 10 repetitions) maximal isokinetic eccentric actions (30 degree per second) with the knee extensors in one leg. Biopsies from the muscle vastus lateralis were taken in both unexercised and exercised legs 30 minutes, 4, 8, 23, 95, and 167 hours after the eccentric exercise. Each subject was biopsied at four time points. Serial transverse sections were immunohistochemically stained for type VI collagen, dystrophin, neutrophil granulocytes (CD16) and macrophages (CD68). Three of the eleven subjects showed dystrophin negative immunohistochemical stained fibers at 95 and 167 hours after the exercise. In these fibers the staining was absent in the part of sarcolemma or the staining was totally absent around the fibers. Type VI collagen immunohistochemical staining was visible in these areas where dystrophin staining was absent. There were typically both CD16 and CD68 positive cells near by the areas or inside the muscle fibers, where dystrophin staining was absent. Furthermore, a biphasic increase in serum creatine kinase activity was observed in these three subjects. The first peak was observed at 23 hours and the second and the highest peak at 95 hours after the exercise. The results from the present study suggest that the delayed peak in blood CK concentrations in three of the subjects is related to dystrophin negative sarcolemma staining and infiltration of inflammatory cells. It is unclear whether the signals that lead to recruitment of inflammatory cells from circulation are originating from skeletal muscle fibers or extracellular matrix. Interestingly, collagen staining in the dystrophin negative areas seems to be intact. This may indicate that collagen has an important role in supporting the part of the skeletal muscle fiber, where sarcolemma is damaged, as well as serve as an attachment site for cells, which are remodeling the damaged site.

EXPRESSION CHARACTERISTICS OF HOUSEKEEPING GENES IN HUMAN LYMPHOCYTES IN RESPONSE TO ACUTE EXERCISE AND CREATINE PYRUVATE SUPPLEMENTATION

Schoenfelder, M., Schulz, T., Meixner, H., Michna, H.

Technical University of Munich, Germany

Introduction: The application of reverse transcription polymerase chain reaction (RT-PCR) method has became a common technique in sports science to detect the modulating influence of exercise onto gene expression and to understand the mechanistic coherence of exercise and health.

The method of choice to quantify the relative abundance of the gene of interest (GOI) is the sensitive technique of real-time RT-PCR. The use of this technique generally requires endogen calibrators to get accurate results and prevent false interpretations. Therefore, the GOIs are set into proportion of endogenous control genes, so called housekeeping genes (HKGs), with the assumption that their expression is unregulated and constant for given experimental conditions.

The aim of the study was to determine if mRNA transcripts of a set of common HKGs are modulated in lymphocytes by acute exercise with or without creatine pyruvate (CrPyr) supplementation.

Materials and methods: Ten healthy male triathlets (age: 35+/-8 years; body weight 78+/-8 kg; BMI 24+/-1; body fat: 14+/-4 %) participated in the present study. All subjects passed through a baseline testing, including bike ergometer time trial at 3 mmol/L lactate and heparin blood sampling at rest as well as in context to the time trial. Subsequent, they had to complete two training periods each of three weeks under placebo or CrPyr (3 g twice a day) supplementation. After each training period all subjects had to absolve an additional time trial. Corresponding to baseline, blood samples were collected pre, post, 3 h post and 24 h post exercise and islolated for lymphocytes by Ficoll centrifugation. Total RNA were extracted by spin columns and analysed for mRNA gene expression (18S rRNA, GAPDH, histon 3, beta actin, ubiquitin, cyclophilin b, creatine kinase M) by two-step real-time RT-PCR. Expression results were analysed by 2^(-delta delta of cycle threshold) method and statistical analysis was performed by two way ANOVA (Holm-Sidak-Test) and Pearson Product Moment Correlation.

Results: Among all raw data of CT values, GAPDH and beta actin showed the lowest variance and the highest positive correlation to each other ($r=0.872$, $p<0.001$). Therefore, these two HKGs served as endogen controls for all other genes tested. Comparing the normalized mean values among the different levels of time and treatment, it was obvious that the influence of CrPyr supplementation would be greater than the influence of exercise or rather time.

Discussion: These data show that it is necessary to evaluate two or more HKGs before they are used as internal controls to validate gene expression data. Additionally, the result indicate that it is obligatory to compare different techniques of RT-PCR data analysis to find the most representative result.

Conclusion: In the given experimental setup beta actin and GAPDH seems to be the most reliable HKGs to normalize mRNA expression in human lymphocytes in response to physical activity and CrPyr supplementation.

EXERCISE GENOMICS IN COLON: GENE REGULATION IN THE COLON MUCOSA BY PHYSICAL ACTIVITY

Schulz, T. 1, Bühlmeyer, K. 1, Schoenfelder, M. 1, Doering, F. 2, Daniel, H. 3, Michna, H. 1

1,3 Technical University Munich, 2 University of Kiel, Germany

Introduction

World-wide dietary choices and physical activity are the most important modifiable determinants of cancer risk besides smoking cigarettes. Since colon cancer is the second most cause of cancer death in europe, and the risk reduction by physical activity could reach 40-50%, research to get insights in the biological mechanisms is expedient. Discussed mechanisms by which physical activity may prevent colon cancer involves both direct and indirect effects: it may helps to maintain a healthful body weight by balancing caloric intake with

energy expenditure, it may improves energy metabolism and thereby reduce circulating concentrations of insulin and related growth factors or it may modulates immune functions. For many issues, the evidence is not definitive either since studies are not yet available or current findings are inconsistent. In addition, there are many unanswered questions about the optimal intensity, duration, and frequency of physical activity. So the purpose of the study was to investigate colonic reactions of gene expression in the rat after physical exercise.
Methods
Male Wistar rats performed a 12 week voluntary physical exercise training program (n=20). 9 male sedentary rats served as a control group (CO). At the end of the study we extracted the mucosa of the proximal colon and isolated total RNA. Real-Time PCR was used to measure gene expression involved in vascularisation (VEGF, HIF-1α, ODC-1), apoptosis (BCL-2, PPARγ) and prostaglandin synthesis (COX-2) respective the insulin and/or insulin-like growth factor axis (IGF-1, IGF-1R and IGFBP3). The four housekeeping genes GAPDH, ß-ACTIN, 18S and ALDA served as references. The BestKeeper program (Pfaffl et al. 2004) was used to analyze the Real-time gene expression data.
Results
We differentiated between 3 running groups: a low running distance (L-EX, <2629m/night), a middle running distance (M-EX, 3003-7458m/night) and a high running distance (H-EX, >8314m/night) group. The HK genes ß-ACTIN, GAPDH and ALDA were found to be stably expressed in contrast to 18S and employed for further calculations. ODC-1 gene expression was 1.8 upregulated. mRNA expression analysis did not provide evidence for any regulation of the marker genes even it revealed some trends for IGF-1.
Discussion/Conclusion
ODC-1 activity is known to be increased after various stimuli including food intake and selected hormones and is discussed as a regulator and modulator of gastrointestinal cell growth. Besides, the enzyme displays an early response to a variety of growth-promoting stimuli. Even if gene expression alterations in the colon induced by physical activty in this study is rather rare, ODC-1 may is a target to show colonic adaptations to physical activity. With respect to the proposed role of ODC-1 as a marker of tissue damage and remodeling our finding may be taken as an indicator for physical activity induced energy turnover or metabolic changes to induce a remodeling in colonic mucosa.

THE GENES POLYMORPHISM AND ELITE ATHLETIC PERFORMANCE

Rogozkin, V., Astratenkova, I., Druzhevskaya, A., Komkova, A., Fedotovskaya, O.

St Petersburg Research Institute of Physical Culture, Russia

Growing evidence suggests an association of genetic variation with the formation, development and manifestation of physical performance of elite athletes. The search for genetic markers of trainability status will likely be more productive than the investigation of molecular markers of the performance phenotype in the untrained state. It has been shown physiologically that for rowing at least 70% of energy requirement comes from aerobic metabolism, the remainder comes from anaerobic sources. Given that the race distance is 2000 meters, which typically takes about 6 to 7 minutes to complete, depending on crew size, muscle mass of rower, gender and elite status, it is more accurate to think of rowing as a power endurance sport. Accumulating evidence suggests that polymorphism of ACE, ACTN3, AMPD1 and NOS3 genes are strongly influence human physical performance [1,2,3]. The purpose of this study was to determine genotype and allele frequencies of ACE I/D, ACTN3 R577X, AMPD1 C34T and NOS3 a/b polymorphisms in rowers and to detect genotype combinations that are prevalent in elite and sub-elite rowers compared to controls.
We examined the DNA of 90 male and female Russian elite (n=58) and sub-elite (n=32) rowers. Genotyping was carried out by PCR. Allele frequencies were determined by gene counting. Genotype distribution and allele frequencies between groups of rowers and controls (n=81) were then compared by Student's t-test.
As expected there was no significant difference in genotype and allele frequencies between groups of rowers and controls, indicating that rowing must be considered as mixed-type sport. When all endurance-associated alleles were combined we determined common endurance alleles frequencies in different groups. The highest value of endurance alleles frequency was observed in elite (68,9%) and sub-elite rowers(81,7 %) compared to controls (70,3%). The prevalent combination of genotypes in all groups was II-RX-CC-b/b. The frequency of this combination was highest in elite rowers (18,9%), sub-elite rowers (18,7 %) the lowest was found in controls (8,6%), indicating that II-RX-CC-b/b combination was optimal for achieving elite level of rowing performance. Besides that there were also detected frequently observed II-RR-CC-b/b; ID-RR-CC-b/b and ID-RX-CC-b/b (each of them 12,0 %) genotype combination in elite rowers.
The results of genotyping for ACE, ACTN3, AMPD1 and NOS3 gene polymorphism suggest that aerobic rather that anaerobic metabolism may be critical for rowing performance. The influence of polymorphic variations in the ACE, ACTN3, AMPD1 and NOS3 genes on the response to physical performance may have important implication in the development of elite athletic performance.
References
1. Druzhevskaya A., et al. (2005) 10th Ann. Congress ECSS, Abs. Book: P.213.
2. Fedotovskaya O., et al. (2005) 10th Ann. Congress ECSS, Abs. Book: P.52.
3. Rogozkin V., et al. (2005) 10th Ann. Congress ECSS, Abs. Book: P.54.

Oral presentation (OP)

OP3-04 Biomechanics 4/4 - "Turin DE"

SOLEUS H-REFLEX MODULATION DURING PASSIVE SINUSOIDAL ANKLE MOVEMENT IN YOUNG AND ELDERLY MEN

Kanervo, M., Peltonen, J., Avela, J., Komi, P.V.

University of Jyväskylä, Finland

Ageing is known to impair reflex sensitivity probably due to involvement of presynaptic inhibition. However, the mechanism of this inhibition is not clear. When a muscle is slowly stretched and lengthened during sinusoidal movement H-reflex is first drastically depressed and then recovered in two steps. It has been suggested that the fast recovery (500 ms) takes place due to the relief of presynaptic inhibition and the slow one (over 2 s) due to the recovery from transmitter depletion of the homonymous Ia-afferent terminals (Voigt & Sinkjaer 1998). Therefore, the purpose of the present study was to clarify the possible mechanisms behind the modulation of H-reflex in elderly people.

11 young (26±2 y) and 12 elderly (70±5 y) men participated in the study. Soleus H-reflex was measured during a single sinusoidal dorsi-plantar flexion ankle movement (20°, 20°/s) in a sitting position. Totally 14 time points during the movement and the recovery were tested in randomized order. Before the H-reflex measurement, Mmax was tested and intensity of H-reflex stimulation was adjusted to correspond 25% of Mmax in every condition. Time between the trials was 10 s and three successful trials were recorded for analysis.

H/M-ratio decreased rapidly during the first 900 ms by 75 % and 90 % in Young and Aged, respectively. During the following 600 ms H-reflex recovered to the resting levels of 68% and 63% for the Young and Aged, respectively. This increase coincided with the increase in plantar flexion velocity for both groups. This was again followed by decrease in H/M-ratio over a period of 1500-1800 ms in both groups, but it was more pronounced in Young. During the last 200 ms of the plantar flexion a fast increase was seen (Young 8% and Aged 29%) and this was then followed by a slow return to 90% of resting level over the recovery period (2-4s).

Interestingly, Aged showed stronger depression of H/M-ratio during dorsi flexion than Young. This is in contrast to earlier studies that showed lower depression for aged and spastic subjects (Robertson & Koceja 2003; Voigt & Sinkjaer 1998) as compared to Young. According to these studies this depression was related to decreased presynaptic inhibition and post-activation depression. The results of present study may indicate higher presynaptic inhibition during dorsi flexion in Aged. Thixotropic properties of the muscle may increase the spindle discharge (Woods et al. 1996) during stretch and, thus result in decreased H-reflex sensitivity due to post-activation depression. Both groups showed a fast type of recovery indicating a relief of presynaptic inhibition. However, the slow type of recovery was clearly faster in Aged. This high depression of H-reflex in Aged, which was then followed by a fast recovery, is naturally puzzling and, therefore, further studies are needed.

Robertson & Koceja 2003. Electomyogr. clin. Neurophysiol 43, 103-111

Voigt & Sinkjaer 1998. Brain Research 783, 332-346

Woods et al. 1996. J Physiol 497, 279-290.

AGE-RELATED DIFFERENCES IN THE SOLEUS MOTOR UNIT FIRING IN DYNAMIC CONTRACTIONS

Kallio, J., Linnamo, V., Søgaard, K., Komi, P.V.

University of Jyväskylä, Finland

Introduction

Ageing is related to muscle atrophy that leads to decreases in muscle force. The largest decreases are found in fast muscle fibres and fast force production. There is some evidence that in isometric condition with small hand muscles the maximal firing rate is decreased with aging (Kamen et al. 1995). Less is known about the effects of ageing on the firing rate behaviour in dynamic contractions, especially on large leg extensors that have an important role in maintaining balance. Earlier studies with young subjects on dynamic contractions have shown that when the load is constant, the firing rate of motor units is larger in concentric and smaller in eccentric contractions compared to isometric situation (Søgaard et al. 1996, Kossev & Christova 1998). The purpose of the present study was to investigate the effects of ageing on the motor unit firing rates in dynamic contractions of the Soleus muscle.

Methods

In total 8 YOUNG (25.4+3.1 yr.) and 8 OLD (68.8+5.3 yr.) physically active healthy males participated in the study. The present abstract includes the data of 2 YOUNG and 4 OLD subjects. The subjects performed plantar flexions while seated in an ankle dynamometer. The tasks included 1) isometric maximum voluntary contraction (MVC), 2) isometric ramp and 3) isotonic (ISO) contractions, and 4) concentric (CON) and 5) eccentric (ECC) contractions (10 and 20% MVC). In the dynamic trials the subjects lifted (CON) or resisted lowering (ECC) weights at 10 deg/s. Intramuscular EMG was recorded by utilizing 2 bipolar wire-electrodes inserted into the soleus muscle. The measured signal was decomposed to single motor unit action potential trains with Daisy software (Olsen et al. 2001).

Results

Maximal voluntary contraction torque was 33.1% lower in OLD (63.9+17.9Nm) compared to YOUNG (95.6+11.3Nm). The total number of motor units analyzed was 6 in OLD and 7 in YOUNG. On average, the highest motor unit firing rates were observed in CON. In addition, 2 units were found to only fire in CON and 3 units in ISO and CON but not in ECC. The firing rate of the identified motor units was lower in OLD in all measured conditions: At 10% MVC, the firing rates of OLD were 41.0% (ISO), 35.7% (CON) and 43.0% (ECC) lower compared to YOUNG. Similarly, at 20% MVC the differences were 69.4% in ISO, 72.9% in CON and 62.5% in ECC.

Discussion

The identification of motor units in dynamic movement is a challenging task, due to movement of the electrodes and the varying distance of the electrode to the motor unit during the movement. The observed higher firing rate in CON was similar to earlier studies. The preliminary results also suggest that the age-related decrease in the firing rates of distal muscles also applies to dynamic conditions.

References

Kamen et al. (1995) J Appl Phys 79: 1908-1913

Kossev & Christova (1998) Electroencephalogr Clin Neurophysiol 109: 245-55

Olsen et al. (2001) Acta Phys Bulg 26:73-8

Søgaard et al. (1996). Electroenceph Clin Neurophysiol 101, 453-460.

NEUROMUSCULAR FUNCTION DURING DYNAMIC MOVEMENTS ASSOCIATED WITH AGING

Hoffrén, M., Ishikawa, M., Komi, P.V.

Neuromuscular Research Center, Finland

Elasticity of the skeletal muscle plays an important role by improving the power output and efficiency in dynamic movements. With aging, the stiffness of tendon structures can decrease when measured in isometric contraction (Morse et al. 2005), suggesting greater utilization of elasticity during dynamic movements. Several studies reported that the greater joint stiffness has been observed in the elderly than in the young (Hortobaqyi & De Vita 2000). However, the metabolic cost is higher in elderly than in young during the human locomotion (Mian et al. 2006). The present study was designed to address the issue whether the elderly can utilize TT elasticity efficiently during dynamic movements.

Twelve young (YA; 25.2 ± 2.5 yr) and thirteen older (OA; 69.0 ± 3.8 yr) adults performed maximal squat jumps (SJ) and drop jumps (DJ) in a sledge apparatus inclined to an angle of 18 deg. DJs were done from three dropping heights (10, 15 and 20 cm). The lowest knee angle (145.6 ± 8.2 deg) was visually evaluated during the measurements and was kept the same in every condition. Kinematics, kinetics and

EMG (SOL, GM, TA) were recorded together with ultrasonography (GM and muscle tendon junction). Average force and EMG were analysed for preactivation (100ms before contact), braking and push-off phases during the jumps.
The ratio ((positive work - SJ work) / negative work) was greater in YA than in OA during DJs. When EMG ratio (push off phase / braking phase) was calculated for GM and SOL muscles, OA showed higher values indicating less efficiency.
Before the contact, due to the preactivation, the GM fascicles shortened in YA but not in OA. During the contact of DJ, the GM fascicles in YA shortened throughout the contact. With increasing the drop height, this fascicle shortening decreased. In OA, however, the fascicles behaved differently and individually although EMG activities during drop jumps were significantly greater in OA than in YA in each phase. Some of them behaved similarly to YA. Other OA showed that fascicles were stretched during the braking phase from the low DJ condition.
The results of the present study confirm that OA could not transfer negative work to positive work more efficiently as compared to YA. The increased fascicle lengthening in OA suggest that OA cannot utilize TT elasticity effectively during the DJs. This may be related to the increased antagonist muscle coactivation, which influences the joint stiffness more than tendon elasticity.
Hortobaqyi T & De Vita P (2000) J Electromyogr Kinesiol 10: 117–126.
Mian OS et al. (2006) Acta Physiol 186:127–139.
Morse CI et al. (2005) J Appl Physiol 98: 221–226.

ROLE OF MECHANICAL EXTERNAL WORK AND PENDULAR ENERGY TRANSDUCTION IN GAIT ECONOMY IN HEALTHY 65- AND 80-YR-OLDS

Malatesta, D., Borrani, F., Simar, D., Candau, R., Préfaut, C., Caillaud, C.
Institut des Sciences du Sport et de l'Education Physique (ISSEP), Switzerland

INTRODUCTION
Several studies have reported higher energy cost of level walking (Cw) in elderly subjects at several walking speed (3, 4). The mechanisms involved in this age-related decline in economy of walking remain however unclear. Even though it has been suggested that increased in energy expenditure associated with walking movements and related to mechanical external work (Wext) and to impaired pendular energy transfer may be a contributing factor (3). The purpose of this study was to determine whether higher Cw in healthy elderly subjects is due to greater Wext necessary to translate the centre of body mass during gait.
METHODS
Three groups of subjects participated in the study: G80 (n=10; 81.6±3.3 yr), G65 (n=10; 65.3±2.5) and G25 (n=10; 24.6±2.6). Groups were matched according to gender, height, lower limb length, body mass, lean body mass, percent body fat. The subjects performed five 6 min treadmill walking trials at five different speeds (0.56, 0.78, 1.01, 1.24, 1.46 m/s), separated by 5 min resting periods. During these trials, metabolic and mechanical data were collected. For each subject, VO2 values from the last two minutes were averaged and normalized to body mass. These data were subsequently used to calculate the net energy cost of walking (NCw). Wext changes and the fraction of mechanical energy recovered (Rstep) (2), due to the pendular transduction of potential to kinetic energy and vice-versa, were determined with a kinematic arm (1).
RESULTS
NCw was higher for G80 and G65 than for G25 across the different walking speeds (38% and 23%, respectively; $P < 0.05$). Wext was respectively 42% and 34% higher in G80 and G65 compared with G25 at the three fastest experimental walking speeds (1.01, 1.24, 1.46 m/s; $P<0.05$). Rstep was significantly lower in G80 than in G25 for the same walking speeds (-25%; $P<0.05$) and for the two fastest speeds (1.24 and 1.46 m/s) in G65 compared with G25 (-18%; $P<0.05$). NCw was directly correlated with Wext at the five walking speeds ($r=0.49$; $r=0.40$; $r=0.46$; $r=0.46$; $r=0.68$, respectively; $P < 0.05$). NCw was inversely correlated with Rstep at the four fastest walking speeds ($r=-0.43$; $r=-0.42$; $r=-0.41$; $r=-0.62$, respectively; $P<0.05$).
DISCUSSION/CONCLUSION
These findings demonstrate that greater energy cost in healthy elderly while walking is associated with greater mechanical external work and lower fraction of mechanical energy recovered. Our results suggest that greater mechanical muscular work, due to impaired pendular energy transfer, is involved in energy cost of walking in elderly subjects especially at intermediate and higher speeds. Future research should examine the role of co-activation of lower limb muscles and lower limb stiffness in biomechanics and energetics of walking in elderly.
REFERENCES
1. Belli A et al. Ergonomics 35: 177-186, 1992.
2. Cavagna GA et al. J Physiol 262: 639-657, 1976.
3. Malatesta D et al. J Appl Physiol 95: 2248-2256, 2003.
4. Martin PE et al. J Appl Physiol 73: 200-206., 1992.

PERIPHERAL FATIGUE AFTER ALPINE SKIING

Tomazin, K., Dolenec, A., Jereb, B., Ulaga, M., Strojnik, V.
University of Ljubljana, Faculty of Sport, Slovenia

Introduction
It is well known that alteration of neuromuscular functions were not only time (Strojnik and Komi, 1998) but also task dependent (Millet and Lepers, 2004). Fatigue after alpine skiing could originate from sites located proximal (central fatigue) or distal to neuromuscular junction (peripheral fatigue). Measuring knee-extensors torque during electrically-evoked contractions with low- (20 Hz) and high- (100 Hz) stimulation frequencies after different fatiguing exercises has often been used to evaluate the alteration of neuromuscular function distal to neuromuscular junction (Strojnik and Komi, 1998, Millet and Lepers, 2004). Due to this method, we could discriminate between low- and high-frequency peripheral fatigues. In alpine skiing, fatigue is important factor of success and a lot of training efforts are devoted to reduce its effects. However, it is important to know the type of fatigue to employ proper training methods. Slalom is specific in alpine skiing for its emphasis on stretch-shortening cycle. Therefore, the aim of our study was to examine the presence of high- and low-frequency peripheral fatigue after alpine skiing slalom.
Methods

Eight male alpine skiers (19.0±1.3 years., 182.4±3.6 cm, 81.5±4.4 kg) volunteered the study. They performed slalom with 45 gaits, which duration was approximately 45 seconds. Measurements included mechanical twitch characteristics of m. vastus lateralis (VL) and mechanical response of VL to high (100 Hz, 0,8s) and low (20 Hz, 1s) frequency stimulation were measured. From maximal torques during high- and low-frequency electrical stimulation a torque ratio between high- and low-frequency torques was calculated. The measurements of knee torque were performed after standardized warm-up prior the skiing and exactly one and three minutes after the skiing. The significance of differences between measured and calculated parameters prior and after the skiing exercise was tested with paired sample t – test at 5% alpha error.

Results

The maximum twitch torque was reduced one minute after the slalom but potentiated ($P<0.01$), accompanied with half relaxation time prolongation, three minutes after the skiing. Maximal knee torque during the train of electrical impulses decreased significantly only during 100 Hz electrical stimulation after the first minute ($P<0.05$) and was accompanied with significantly reduced torque ratio one minute after the skiing ($P<0.05$).

Discussion/Conclusion

Analysed parameters showed that slalom caused high-frequency peripheral fatigue and were well related to results of former studies showing that high-frequency fatigue is expected after maximally intensive short term stretch-shortening cycle exercises (Strojnik and Komi, 1998). These results imply that training to prevent fatigue in slalom should be specific to high-frequency fatigue.

References

Strojnik V. and Komi P.V. (1998). J Appl Physiol, 84 (1): 344-350.

Millet G.Y. and Lepers R. (2004). Sports Med, 34: 105-16.

Oral presentation (OP)

OP3-05 Psychology 4/5 - "Turin FG"

THE RELATIONSHIP BETWEEN SELF-CONCEPT, ATTRACTION TO PHYSICAL ACTIVITY, AND LEVEL OF PHYSICAL ACTIVITY, IN 6 TO 8 YEAR- OLD GIRLS AND BOYS

Howard, B., Rose, E., Larkin, D., Hands, B., Parker, H.

Edith Cowan University, Australia

Self-concept and attraction to exercise, games and sports are frequently cited as key influences in children's level of physical activity. Whilst there is substantial support for this notion with middle school children, there are few reported findings with children in lower grades. Adopting a stance grounded in Social Cognitive Theory, we examined the relationships between children's self-concepts, aspects of attraction to physical activity, and level of physical activity. Considering the influence of gender socialization, we predicted that girls' and boys' responses would differ. Children (N = 125)(boys = 57; girls = 68) aged 6 to 8 years (M = 6.7, SD = .47) from metropolitan primary schools took part in the study. Each child answered questions administered by a trained interviewer on the Self-Description Questionnaire -1 (physical ability, physical appearance, peer relations, and general self-concept) and the Children's Attraction to Physical Activity Scale (peer acceptance, importance of exercise, liking of games and sport, liking of physical exertion, and liking of vigorous exercise). The children wore pedometers over a 7-day period from which a mean step count was calculated to indicate level of physical activity. Independent t-tests ($p < .05$) revealed significant differences between boys and girls only on the self-concept subscale for peer relations. Pearson's r revealed no relationship between level of physical activity and self-concepts, or attraction to physical activity. However, there were significant relationships between attraction to physical exertion and the self-concept dimensions of (a) physical ability ($r =. 56$, $p < .001$), (b) physical appearance ($r = .41$, $p < .001$), and (c) peer relations ($r =. 53$, $p < .05$). The strongest relationship was between liking of games and sports and general self - concept ($r = .64$, $p < .001$). There was no support for the notion that self-concepts and aspects of attraction to physical activity are related to level of activity. Among other possibilities, this finding may reflect an age related limitation whereby self-descriptions are not realistic or dimensions of attraction to physical activity are not clearly defined. The findings provided partial support for the theoretical stance in this study. General self-concept clearly was related to liking of games and sports. Self-concepts in the physical (ability and appearance) and social (peer relations) domains clearly were related to liking of physical exertion. The results support previous findings that enjoyment derived from being physically active and interacting in games and sports are important to specific aspects of children's self-concept as well as their general self-concept.

THE VALIDITY AND RELIABILITY OF THE CHILDREN'S ATTRACTION TO PHYSICAL ACTIVITY SCALE (CAPA) WITH 6 TO 8 YEAR-OLD AUSTRALIAN CHILDREN

Rose, E., Howard, B., Larkin, D., Hands, B., Parker, H.

Edith Cowan University, Australia

There is increasing concern that physical activity levels of children are declining. One of the limitations in evaluating effectiveness of programmes designed to attract children to physical activity is the availability of measures that are both developmentally and culturally appropriate. The purpose of this study with Australian children was to assess the validity and reliability of a modified version of the Children's Attraction to Physical Activity Scale (CAPA; Brustad, 1993) validated for use with North American children (grades 4 to 7). The CAPA was designed to reflect aspects of attraction to physical activity and comprises of 5 subscales; liking of vigorous activity, liking of games and sports, importance of exercise, enjoyment of physical exertion and exercise, and peer acceptance in games and sports. In this study boys (n = 180) and girls (n = 154) aged 6 to 8 years (M = 6.7 years, SD = 0.47) completed the CAPA by individual interview with trained researchers who recorded responses on a Likert scale ranging from 1 (low) to 4 (high). Internal consistency reliabilities (Cronbach's alpha) were acceptable for three of the subscales; liking of games and sports (.75), importance of exercise (.72) and, liking of physical exertion (.67). With this age group, negatively worded statements reduced the internal consistency of the subscale. When the negative item (6) was removed from the subscale, liking of vigorous exercise, Cronbach's alpha improved from .54 to .75. Similarly, the alpha level for peer acceptance improved from .30 to .55 when the two negatively worded items (7 and 8) were removed. Factor analysis with Varimax rotation provided support for 3 of the subscales: liking of games and sports (all 5 items plus 1 item from liking of vigorous activity), importance of physical activity (all 5 items plus one item from liking of vigorous activity plus 2 from liking of exertion), and liking of exertion (4

items plus 1 from liking of vigorous physical activity). Liking of vigorous physical activity and peer acceptance did not emerge as stable factors and the negatively worded items influenced the factor structure. A second order factor analysis using Promax rotation defined two higher order factors, one representative of attraction to physical activity and the other focused on the negatively worded items. It was clear that negatively worded items were unsuitable for the 5 to 8 years age group. Our findings provide support for a modified version of the CAPA as an overall measure of attraction to physical activity with young Australian children. In order to clarify whether children in this age group are able to clearly differentiate among the five subscales further refinement of some items is recommended.

Reference

Brustad, R. J. (1993). Who will go out to play? Parental and child psychological influences on children's attraction to physical activity. Pediatric Exercise Science, 5,210-223.

INVESTIGATING AND UNDERSTANDING PHYSICAL ACTIVITY BEHAVIOR OF CHINESE ADULTS: THE BERLIN EXERCISE STAGE MODEL

Duan, Y., Brehm, W., Wagner, P.

Wuhan Institute of Physical Education, Wuhan, China

The Berlin Exercise Stage Model (BSM) describes eight stages of individual's physical activity: precontemplation (inactive, no idea about physical activity), contemplation (inactive, think about physical activity but no intention to engage in), disposition (inactive, make a decision to engage in physical activity), preaction (inactive, specify goal intentions with detailed plan), implementation (initiation stage of physical activity, less than six months), habituation (regularly active for more than 6 months), fluctuation (irregular active), and resumption (inactive, have intention to restart physical activity after long term drop-out) (1). Through the behavior-change process, multiple attempts and relapse can occur. Furthermore, the BSM also incorporated two social cognitive variables, namely self-efficacy and social support, which are assumed to be essential for stage movement. Consequently, according to the note of Sutton, discontinuity patterns/non-linear trends for social cognitive variables across stages should emerge if BSM is a genuine stage model (2). In order to examine the applicability of the BSM in China and evaluate stage assumption on discontinuity patterns /non-linear trends, Chinese adults (n=856), which consist of three subgroups including 211 bank employees (M=31 years), 346 university staff (M=38 years) and 299 college students (M=19 years), were investigated by using BSM model in physical activity context. The findings revealed the applicability of BSM in China, as stage distribution showed that all Chinese participants could be assigned into one of eight stages proposed by BSM model. By using planned contrast tests, it was found that, among university staff and college students, participants in the habituation stage have superior self-efficacy and feel more social support than those in the fluctuation stage, supporting the discontinuity patterns across the BSM stages partially. By using polynomial trend analyses, significant linear trends were revealed between stages and two social-cognitive variables among three subgroups, with quadratic trends were significant for self-efficacy in bank employees, social support in university staff and social support in college students, indicating selected discontinuity patterns in restricted variables. In conclusion, this study is the first attempt to test the BSM model with Chinese adults, supporting the applicability of the BSM and providing partial evidence on discontinuity patterns/non-linear trends examination. Future research might be targeted on improving the validity of BSM in China and conducting stage-specific interventions to motivate Chinese adults adopting and maintaining physical activity behavior.

(1)Fuchs,R. (2001). Entwicklungsstadien zum Sporttreiben [Developmental stages of exercise behavior]. Sportwissenschaft, 31(3), 255-281.

(2)Sutton,S.R. (2000): Interpreting cross-sectional data on stages of change. Psychology and Health, 15, 163-171.

11:40 - 13:10

Invited symposium (IS)

IS3-06 Medical ethics and sports medicine - "Athene"

'STEROIDS AREN'T COOL': CRIMINALISING ENHANCEMENT & THE POLITICS OF HEALTHCARE ETHICS

Miah, A.

University of Paisley, United Kingdom

This paper explores the relationship between medical ethics and sports medicine by considering recent conversations in the USA on the doping dilemma. Specifically, the Congressional hearings on Baseball opened with the Chairman Tom Davis calling for a need to help 'kids understand that steroids aren't cool' (Davis, 2005). His words allude to a general transformation of social values and attitudes towards body modification. Indeed, they resonate with wider governmental concern over the prevalence of enhancement interventions (The President's Council on Bioethics, 2003; Elliott, 2003). Yet, these sentiments are confused by Davis' subsequent claim that the 'new [drug] testing program…gets that job done'. His statement fails to recognise that testing is a quite different task compared with changing social values (American Academy of Pediatrics, 2005). In short, young people use steroids for a wider range of reasons other than a competitive edge in sport. The AAP is part of an emerging discourse that treats the doping dilemma as a broader public health issue. This frame raises a number of questions about how the relationship between ethics in sports medicine and medical ethics. Indeed, the last 5 years has shown an increased interest within the medical ethics literature to consider enhancement in sport. I suggest that it is only a matter of time before greater limits are placed on the practice of sports medicine. Indeed, the ensuing controversy surrounding hypoxic chambers is some indication of this. In connection with this emerging public health care discourse, I present a second strand of recent debates on doping, which indicate an increasing sympathy for seeking criminal sanctions for positive doping cases (Donati, 2005). To explain this, I discuss the relationship between the regulation of medical products and their use in sport. I also draw attention to various legal developments that reinforce my claim and warn of a future where doped athletes face criminal prosecution. Finally, I argue for a critical educational framework within anti-doping. Davis' reductionism exposes the absence of a developed science communication and public engagement methodology within sports medicine and science. In conclusion, I urge caution over the criminalizing of performance enhancement in sport and propose a critical healthcare approach to understanding the doping phenomenon in its wider socio-cultural context. Within such a framework, the relationship between sports medicine and medical ethics should be different from convention medical ethics practices, but nevertheless characterised by models of best practice that derive from professional bodies.

WHAT'S WRONG WITH ANTI-DOPING: SOME THOUGHTS CONCERNING THE FEAR OF MODERNITY AND EROSION OF REASON

Moller, V.

University of Southern Denmark, Denmark

This paper is based on the idea that doping is closely related to modernity. It will argue that the current anti-doping campaign reflects an erosion of reason that is caused by a growing fear of scientific progress.

Cycle sports have inspired medical doctors and physiologists to carry out research on the mechanisms of human fatigue. The Monark-cycle, which can be found in laboratories at countless institutes of sports science, symbolises the successful but currently discredited alliance between science and sports. Were it not for the curiosity of science, its wonderful lack of narrow-mindedness and self-restraint, we probably would not have as serious a doping problem as we do today.

The close connection between science and cycle sports is nothing new. What is new is that this connection has been called into question. The heavy-handed way in which the authorities around Europe have begun to take action against doping use in cycling serves as an indication of a growing sense of uncertainty about medicine, even though the scepticism is highly ambivalent. That is, it is neither the production of new medicaments nor the general growth in drug consumption that is the main cause of concern. Instead, it is specifically the connection between medicine and sport to which people take exception. The doping scandal at the Tour de France in 1998 cast a very harsh spotlight on the reality of cycle sport. Although the revelations were shocking, they were not really very surprising. Nothing was found beyond what one might have expected, namely some of the most effective performance-enhancing substances available on the market.

In the process of carrying out their raids and revealing ever more dangerous drugs, what the authorities are doing, all things considered, is eliciting the core problem of modernity. Riders are making use of what modernity is making available to them. This has been the case from the very outset. With this attitude, cycle sport reflects its heritage in modernity. When it is maintained that cycle sport is in crisis, the implication is that modernity is in crisis.

Cycling has come under heavy attack over the past few years. The reason for this, it seems, is that modernity has become old-fashioned, while anti-modern forces has gained in popularity.

WHAT IS WRONG WITH GENE DOPING

McNamee, M.

Swansea University, United Kingdom

The aim of this paper is to offer a critique of recent ethico-political research (Miah, 2004; 2005; Tamburrini, 2000; 2005;2006) that proposes a liberal stance towards doping in general and gene doping in particular. In contrast to these positions, I offer both negative and positive arguments in favour of the status quo as presented by WADA. First, I argue that the argument from inconsistency, which is typically presented, is impotent. Secondly, I present two versions of the slippery slope argument which supports a general anti-doing posture. I conclude with the need to observe a precautionary principle with respect to biotechnology in elite sports.

References

Miah, A. (2004) Genetically modififed athletes

Miah, A. (2005) Gene doping in C. Tamburrini and T. Tansjo, (eds) Genetic technology and sport, London: Routledge, 42-54.

Tamburrini, C. (2000) What's wrong with doping? in T. Tannsjo and C. Tamburrini(eds) Values in Sport, London; Routledge, 20-16.

Tamburrini, C. (2005) Educational or genetic blueprints, what's the difference? in C. Tamburrini and T Tansjo op cit, 82-90

Tamburrini, C.(2006) Are doping sanctions justified? A moral relativistic view. Sport in Society 9 (2) 199-211.

Invited symposium (IS)

IS3-07 Spinal cord injury and physical activity - "Innsbruck"

EXERCISE AND WELLBEING IN INDIVIDUALS WITH SPINAL CORD INJURY

Janssen, T., Goedbloed, L., Van der Woude, L.

Rehabilitation Center Amsterdam, Netherlands

An important goal of rehabilitation is to improve the quality of life (QoL) of wheelchair users with a spinal cord injury (SCI). Objective concepts of QoL include mental and physical health (e.g. number of hospitalizations) and functional performance (e.g. Modified Barthel Index (MBI), task performance, Sickness Impact Profile (SIP)). Subjective concepts of QoL contain measures such as the degree of life satisfaction or feeling of well-being. Various factors that affect QoL appear to be related to the degree of physical activity. Inactivity of wheelchair users seems to adversely affect physical and mental health, functional performance and participation level, and independency. After the rehabilitation period, individuals with SCI tend to decrease their activity level, which puts them at risk of ending up in a vicious cycle of deconditioning. In the general population, an active lifestyle and exercise participation have been shown to improve QoL. The purpose of the present overview is to evaluate whether the same holds for wheelchair users with SCI.

Only few studies have evaluated the effect of an active lifestyle and exercise on functional performance. However, based on these, mostly cross-sectional studies, it appears that an active lifestyle and exercise may result in a lower physical strain during daily activities, higher MBI-scores, better SIP-scores, and a better work potential.(1-3) The effects of physical health, as indicated by the number of hospitalizations or medical complications, are less clear and no definitive statements can be made. In contrast, a better mental health appears to result from sports participation. A study by Paulsen et al. (4) showed that wheelchair basketball players had lower depression levels than an inactive control group and Muraki et al. (5) showed that the frequency of sports participation was inversely related to depression scores in a group of 169 men with a SCI. Moreover, various studies have shown that participation in an aerobic and strength training programs can actually decrease depression scores (5-8). These lower depression scores coincided with higher levels of well-being, as indicated by significantly higher scores on the Perceived QoL Scale (6). Whether higher levels of regular daily activity can lead to the same results is not clear yet. In conclusion, it seems that an active lifestyle, exercise and sports participation can contribute to the improvement

of the QoL and feelings of well-being in wheelchair users with a SCI. However, more high-quality longitudinal research is necessary to fully elucidate the suggested relationships.

References
1. Dallmeijer & Van der Woude, Spinal Cord, 2001.
2. Janssen et al. MSSE, 1996.
3. Noreau & Shephard, Paraplegia, 1992.
4. Paulsen et al. Perceptual and Motor Skills, 1990.
5. Muraki et al. Spinal Cord, 2000.
6. Hicks et al. Spinal Cord, 2003
7. Martin-Ginis et al. Rehabil Psychol, 2003.
8. Latimer et al. JRRD, 2004.

RESPIRATORY MUSCLE TRAINING IN INDIVIDUALS WITH SPINAL CORD INJURY

Perret, C.

Swiss Paraplegic Research, Switzerland

Among spinal cord injured (SCI) subjects respiratory complications are still one of the most common causes of death (approximately 25%) and occur three to four times more frequently than in the able-bodied population. Thereby, a higher neurological level and completeness of SCI is associated with a higher mortality risk. Due to respiratory complications, duration of hospitalisation during first rehabilitation is prolonged and quality of life in SCI patients is markedly decreased. As a consequence, health care costs increase.

Lesion dependent paralysed respiratory muscles lead to a diminished pulmonary function and respiratory insufficiency. Weakness or failure of the inspiratory muscles may cause alveolar hypoventilation and respiratory failure; the missing expiratory muscles impede a satisfying cough flow. As a consequence pulmonary complications, e.g. pneumonia and atelectasis frequently occur in this population. Thus, interventions to improve respiratory muscle performance and physical fitness of SCI patients are urgently needed.

In this context respiratory muscle training appears to be a promising approach. At present no generally accepted guidelines about respiratory training in SCI exist. Published data is insufficient to make conclusions concerning the effects of respiratory training on respiratory muscle endurance and strength, exercise performance, respiratory complications and quality of life in SCI subjects. Moreover, different types of respiratory muscle training have been used (e.g. respiratory strength vs. endurance training) and it has still to be determined, which form of training (i.e. type, frequency, duration and intensity) will best meet the needs of the clinic and patients. However, our clinical experiences and feedback of patients treated with respiratory muscle training were positive and indicate the potential of such training in SCI subjects. Thus, in the future, well directed studies have to be performed to fill the above mentioned gaps.

OPTIMISATION OF EXERCIES PERFORMANCE IN WHEELCHAIR RACING ATHLETES

Mueller, G.

Swiss Paraplegic Research, 6207 Nottwil, Switzerland

Wheelchair racing is a paralympic discipline where exercise performance is at the highest level in many categories. To win a medal at the paralympic games, athletes have to exercise and prepare for such competitions as able-bodied olympic athletes do.

However, spinal cord injured (SCI) athletes have additional problems to consider due to their impairment. Such problems may cause special or additional exercise training, supplementation, or other arrangements to be used in order to reach the highest possible exercise performance level.

Some of these additional problems are the absence of the sympathetic nervous system regulation in tetraplegic and high lesion paraplegic athletes, the absence of thermoregulation below the lesion level, the lower amount of active muscle mass which also affects respiratory muscles e.g. abdominals and in tetraplegic athletes even most expiratory muscles. This leads to an altered coenaesthesia which needs special attention throughout the whole training process.

Invited symposium (IS)

IS3-08 The exercising brain - "St. Moritz"

EXERCISE BEGINS AND ENDS IN THE BRAIN

Kayser, B., CH

Without abstract submission.

THE BRAIN METABOLIC RESPONSE TO EXERCISE: A LINK TO CENTRAL FATIGUE

Dalsgaard, M., DK

Without abstract submission.

BRAIN, NEUROTRANSMISSION AND CENTRAL FATIGUE

Meeusen, R.

Vrije Universiteit Brussel, Belgium

The original central fatigue hypothesis suggested that an exercise-induced increase in extracellular serotonin (5-HT) concentrations in several brain regions contributed to the development of fatigue during prolonged exercise. Serotonin has been linked to fatigue because of its well-known effects on sleep, lethargy and drowsiness and loss of motivation. Several nutritional and pharmacological studies have attempted to manipulate central serotonergic activity during exercise, but this work has yet to provide robust evidence for a significant

role of 5-HT in the fatigue process. However, it is important to note that brain function is not determined by a single neurotransmitter system and the interaction between brain 5-HT and dopamine during prolonged exercise has also been explored as having a regulative role in the development of fatigue. This revised central fatigue hypothesis suggests that an increase in central ratio of 5-HT to DA is associated with feelings of tiredness and lethargy, accelerating the onset of fatigue, whereas a low ratio favors improved performance through the maintenance of motivation and arousal. Convincing evidence for a role of dopamine in the development of fatigue comes from work investigating the physiological responses to amphetamine use, but other strategies to manipulate central catecholamines have yet to influence exercise capacity during exercise in temperate conditions. Recent findings have, however, provided support for a significant role of dopamine and noradrenaline in performance during exercise in the heat. As serotonergic and catecholaminergic projections innervate areas of the hypothalamus, the thermoregulatory centre, a change in the activity of these neurons may be expected to contribute to the control of body temperature whilst at rest and during exercise. Fatigue during prolonged exercise clearly is influenced by a complex interaction between peripheral and central factors.

LIMITS TO PERFORMANCE: INTEGRATION AND ANTICIPATION

St Clair Gibson, A., Dalsgaard, M., Meeusen, R., Jones, D.A., Kayser, B.

University of Cape Town, South Africa

How the information required to moderate pacing strategy during exercise is processed by the brain is still not well understood. Recently work has shown that perhaps the most important factor alowing the establishing of a pacing strategy is knowledge of the endpoint. The brain centre controlling pace strategy and associated power output incorporates knowledge of the endpoint into an algorithm, together with memory of prior events of similar distance or duration, and knowledge of external (environmental) and internal (metabolic) conditions to set a particular optimal strategy for a particular exercise bout in an anticipatory manner at the start of the exercise bout. Once the exercise bout has started, an internal clock, which appears to use scalar rather than absolute time, is used by the brain to generate knowledge of the duration or distance still to be covered, so that power output and metabolic rate can be altered appropriately and continuously by the brain algorithm, using feedback information from both external and internal receptors, with the perception of effort being a scalar representation of these underlying brain algorithmic control processes.

Invited symposium (IS)

IS3-09 JSPFSM exchange symposium - "Albertville"

EFFECTS OF CARBOHYDRATE AND FLUID INTAKE ON LEUCOCYTE AND CYTOKINE RESPONSES TO ENDURANCE EXERCISE IN THE HEAT

Suzuki, K. 1-3, Oh, T. 2, Peake, J. 1, Usui, C. 2, Kaneko, K. 2, Ishijima, T. 2, Ogawa, K. 1, Terada, O. 1, Mitsuda, H. 4, Sato, K. 4, Ishii, C. 4, Muraoka, I. 2, Higuchi, M. 2+3

1-3 Waseda University, 4 Asahi Soft Drinks Co., Japan

Purpose: Carbohydrate ingestion is known to promote energy supply and attenuate hormonal and inflammatory responses to endurance exercise. Fluid intake is also important to prevent dehydration, exertional rhabdomyolysis and heat stroke. The present study was designed to investigate the effects of oral carbohydrate and fluid supplementation on body temperature, dehydration state, energy substrate levels, related hormones, cytokines, muscle damage marker and leucocyte responses to endurance exercise in the heat using three different fluids; isotonic and hypotonic carbohydrate drinks and pure water.

Methods: Six well-trained male cyclists completed three separate cycling trials at 60% VO2max for 90 min in hot conditions (28.1±1.5 ºC and 52.6±3.1% relative humidity). Three different fluids were orally ingested ad libitum during 90-min exercise: (1) isotonic drink consisting of 4.0% glucose and 2.0% sucrose, osmolarity 317 mOsm/kg; (2) hypotonic drink consisting of 2.4% sucrose, 1.2% fructose and 0.5% malt dextran, osmolarity 193 mOsm/kg; and (3) deionised water. Each trial was separated by at least one week, and the ingested amount was recorded. Body weight, drink consumption, rectal temperature, and heart rate were monitored, and blood samples were collected before, during (45 min), immediately after, and 30 min after exercise. Blood was analyzed for total and differential leucocyte counts, glucose, free fatty acid (FFA), lactate, catecholamines, cytokines, myoglobin, and osmolarity. All the blood data were adjusted for plasma volume changes by haemoglobin and haematocrit.

Results: Fluid intake was greatest for the hypotonic trial (1403±557 g) and significantly larger than that of the water trial (701±249 g). There were no significant differences between the three different drink trials in exercise-induced increases in core temperature, heart rate, blood lactate, osmolarity and myoglobin levels. However, plasma glucose levels were significantly elevated for the isotonic trial (137±34 mg/dl) than the hypotonic (103±17 mg/dl) and water trials (87±8 mg/dl) at 30 min after exercise. FFA levels, total leucocyte and neutrophil counts increased following exercise, but carbohydrate attenuated these responses at 30 min after exercise in both the isotonic and hypotonic drink trials. The plasma levels of epinephrine and interleukin (IL)-6 were elevated following exercise, but these responses were lower in the hypotonic trial compared to the isotonic and water trials.

Conclusion: Carbohydrate interventions had significant effects to lower FFA and leucocyte responses to endurance exercise in the heat. Interestingly, compared to the isotonic drink and water, the hypotonic drink was more effective for not only fluid supply but also preventing epinephrine and IL-6 responses.

References :

Suzuki, et al. Eur. J. Appl. Physiol. 81: 281-287, 2000.

Suzuki, et al. Med. Sci. Sports Exerc. 35: 348-355, 2003.

Suzuki, et al. Exerc. Immunol. Rev. 9: 48-57, 2003.

WAVE FORM OF MOTOR UNIT ACTION POTENTIALS DURING CONSTANT FORCE CONTRACTION IN HUMAN MUSCLE

Kamo, M., Morimoto, S.

Japan Women's College of Physical Education, Japan

INTRODUCTION : Amplitude and/or the integrated value of the surface electromyogram (sEMG) increased with time during submaximal sustained contraction. The increase of interference sEMG contains both a central mechanism, motor unit (MU) discharge pattern and a peripheral mechanism, changes in the motor unit action potential (MUAP) wave form. The contribution ratio of the each factor to sEMG remains unclear. In the present study, we focused on wave form changes of surface detected MUAPs during voluntary constant force contraction at low levels.

METHODS: Subjects were requested to sit on a high stool. To record the force developed at the ankle, the lower leg, articulatio pedis, was fastened with a strap connected to a strain gauge. The angle of the knee joint was set at 90 degrees. The subjects isometrically produced a constant force for 3min. The target force was set below the force level at which MUAPs became undistinguishable during the contraction (≤20%MVC). MUAPs were detected bipolarly using surface disc or array electrodes (Ag/AgCl with a diameter of 5-mm) placed on the vastus medialis or vastus latelaris muscles. We analyzed amplitude (peak-to-peak voltage) and duration (time between first and last base- line intersections) of MUAP and measured spike intervals during the contraction. Furthermore, conduction velocity (CV) of MUAP was calculated from the relationship between the time delay in the negative peak of MUAP detected from each surface electrode and the distances between the electrodes.

RESULTS: Spike interval of MU gradually became elongated during the constant force contraction for 3min. CV initially started to steeply decrease for 1min, then, the decrease became gentle. During the initial 1min of the contraction, the amplitude and duration of MUAP gradually increased, then became sustained during the last 2min. The magnitude of the change was about 10-20%.

CONCLUSION: Even though the low level contraction only weakly activated slow MUs, the magnitude of MUAP increased significantly. These findings suggest that peripheral mechanisms, such as these changes in MUAP, influence sEMG during low-level contraction.

ADIPOSE TISSUE AS AN ENDOCRINE ORGAN: EFFECTS OF EXERCISE AND DIETARY THERAPY

Kimura, M., Yoda, E., Shinozaki, T., Kadoriku, H., Shibasaki, Y., Tateishi, N., Yamauchi, H., Suzuki, M., Hosoyamada, M., Shibasaki, T.

Kyoritsu University of Pharmacy, Japan

Obesity is becoming a worldwide medical problem. Risks of the onset of metabolic syndrome are exacerbated by overweight conditions. Nevertheless, the mechanism of the harmful influence of obesity has remained obscured until quite recently. In addition to its classical function as an energy reservoir, adipose tissue is now known to be very active as the largest endocrine organ. It produces several hormones that are referred to as adipocytokines.

Adiponectin (Ad) is an extremely important adipocytokine: Ad putatively acts as an anti-diabetic and anti-atherogenic factor. Numerous studies have reported an inverse relationship between body weight and/or fat volume and blood Ad concentration.

On the other hand, food restriction (FR) and exercise (EX) are commonly recommended for prevention and amelioration of obesity and life style-related diseases. In obese and diabetic patients, weight reduction induced by FR increases the Ad level in blood. However, only sparse and conflicting evidence has been reported in relation to the effects of EX on blood Ad concentrations. For that reason, we examine whether blood Ad concentrations are similarly regulated by EX as with weight-matched FR in spontaneously hyperphagic and obese rats.

A 12-week wheel running EX brought no change in plasma Ad concentration even though it engendered similar reductions in weight and fat volume to those of FR. Against our expectations, these similar changes in weight induced by different interventions imply contradictory changes in plasma Ad concentration.

Gender differences are reported in blood Ad concentrations. Therefore, sex hormones might affect the expression and/or secretion of Ad from adipocytes. Previous studies have reported that castrated mice have high plasma Ad concentrations, and that testosterone administration decreased plasma Ad levels in those mice. Another study reported the presence of higher Ad concentration in hypogonadal men than in eugonadal subjects. Those levels decreased following testosterone replacement therapy.

On the other hand, some types of EX are known to increase blood testosterone levels. In the present study, chronic EX significantly increased plasma testosterone concentrations over those of control and FR rats. For all animals, a significant inverse relationship existed between the levels of plasma testosterone and Ad concentration.

These results suggest that the hypoadiponectinemic effect of testosterone might offset the hyperadiponectinemic effect of reduced fat volume observed in EX rats. We speculate that different results garnered from previous studies designed to examine the effects of EX on Ad might be attributable to variable effects of EX on blood testosterone levels (training status, sampling timing, aging, and species, etc.), and that the type of EX training that raises testosterone levels might suppress the expression and/or secretion of Ad from adipocytes.

ACUTE EXERCISE ALTERS EXPRESSION OF STEROIDOGENESIS-RELATED ENZYMES IN THE SKELETAL MUSCLE OF RATS

Aizawa, K., Maeda, S., Lemitsu, M., Otsuki, T., Jesmin, S., Miyauchi, T., Mesaki, N.

University of Tsukuba, Japan

Sex steroid hormones, such as testosterone and estradiol, are mainly synthesized in ovary, testis, and adorenal cortex and have various physiological actions. Aromatase cytochrome P450 (P450arom), 3beta-hydroxysteroid dehydrogenase (HSD), and 17beta-HSD are essential component enzymes in the steroidogenesis metabolic pathway. Recently, several studies have been reported the presence of the steroidogenesis-related enzymes in the brain, liver, and kidney as well as ovary and testis tissues. In the skeletal muscle, testosterone and estradiol play an important role of buildup in the muscle form and strength. However, the presence of the steroidogenesis-related enzymes in the skeletal muscle and effect of these enzymes by a single bout of exercise are unclear.

PURPOSE: We investigated whether the gene and protein expressions of steroidogenesis-related enzymes, namely, P450arom, 3beta-HSD, and 17beta-HSD, are present in the skeletal muscle and the expression of these enzymes is altered by acute exercise in male rats.

METHOD: Sixteen male SD rats (10-week old) were randomly divided into two groups. Exercise rats (n=8) performed treadmill-running exercise (30m/min) for 30min. Immediately after this exercise, the gastrocnemius muscle was quickly removed. Control rats (n=8) remained at rest during the same 30-min period.

RESULTS: The present study evaluated the presence of mRNA and protein expression of P450arom, 3beta-HSD, and 17beta-HSD in the gastrocnemius muscle by using quantitative RT-PCR, Western bolt, and in situ hybridization analyses. The mRNA expression of P450arom, 3beta-HSD, and 17beta-HSD detected in the gastrocnemius muscle. The protein expression of P450arom and 17beta-HSD detected in the gastrocnemius muscle. The mRNA expression of 17beta-HSD and P450arom in the gastrocnemius muscles was significantly higher in the exercised than in the control rats, but that of 3beta-HSD did not change. Additionally, the protein expression of 17beta-HSD and P450arom in the gastrocnemius muscles were significantly higher in the exercised than in the control rats.
CONCLUDION: The present results suggest that steroidogenesis-related enzymes locally express in the skeletal muscle and the expression of 17beta-HSD and P450arom are increased by a single bout of exercise. Thus, the acute exercise-induced increase in expression of steroidgenesis-related enzyme may be enhance the locally steroidogenesis in the skeletal muscle.
Supported by grants from the Ministry of Education, Science, Sports and Culture of Japan (17300204).

Invited symposium (IS)

IS3-10 High-Tech in skiing - "Berlin ABC"

THE ALPINE SKI BINDING: WHAT DO WE KNOW, WHERE SHOULD WE GO?

Senner, V., Lehner, St.

Technische Universität München, Germany

Alpine ski bindings seem to have lost the importance they used to have until the beginning of the nineties. There are several reasons for this discouraging development. First today's manufacturers are selling ski and binding as a system and this does not allow the customer to choose between different brands. Competition between the producers is therefore built on the ski and its success in ski race. Secondly manufacturers marketing efforts in the last few years have reduced functionality of ski bindings to just "fix-the-boot-to-the-ski". Safety however has become a very unpopular marketing argument. Third – and for this science should be blamed – no convincing solution has brought up to overcome the No.1 problem in skiing, the high incidence of knee injuries. Finally the entire ski industry and also many researchers have been focusing on the topic "carving" under various aspects such as its impact on skiing performance, its implications regarding new skiing technique, its impact on muscular and joint loads or regarding metabolic consumption. The ski binding however was overlooked for these years.
This presentation will try to structure the current knowledge on ski bindings and identify the open questions, giving biomechanists, engineers and sport scientists the motivation to continue with research in this field. It will explain that since the late 70ties all knowledge has been available to build ski bindings being perfectly able to protect the tibia. A look at today's bindings however will demonstrate that this knowledge still has not been completely transferred into current designs.
Understanding that protection of the knee was not a consideration when the actual bindings have been developed, it is obvious that the scientific community had to struggle towards a better understanding of knee injury mechanisms in skiing. A brief summary of some of the major studies conducted by three US research groups D. Mote (Maryland), M. Hull (California) and B. Johnson, J. Shealy, C. Ettlinger (Vermont) will be given. Their results and those of other scientists clearly define the problems; their observations however were interpreted differently regarding setting values of release bindings. Whereas the Vermont scientists conclude that current recommended torques and moments are optimum, French researchers see the need to reduce the settings especially for female skiers. To prove the efficiency of this idea (and to demonstrate that this is not a trade-off regarding inadvertent release) the French are currently conducting a monitored case-control prospective epidemiological study with reduced binding settings. American efforts go towards improvements in the standardization of i.e. boot to binding interfaces, improved shop practise for retail and rental and ACL awareness programs. The ongoing German efforts towards ski binding and improved safety technology will close the presentation.

METHODS FOR TESTING SLIDING PERFORMANCE ON SNOW

Rhyner, H., Lüthi, A., Fauve, M.

Swiss Federal Institut for Snow and Avalanche Research (SLF) Davos, Switzerland

Sliding of skis on snow is influenced by many variables. The following ones are important for us: Concerning the skier: its his weight and aerodynamics. For the ski: its hardness and dynamical behaviour. For the ski base: its hardness, surface roughness, heat conductivity and wetting behaviour are the main factors regarding sliding on snow. Snow is the other side of the sliding system where following variables are important: surface temperature, roughness and hardness. At snow temperatures around zero degree Celsius the liquid water of snow is another important variable. The influence of all these variables can be analysed in field tests, under the condition that all variables are measured on the same scale and remain constant during the tests. We have conducted over 2500 test runs during which we have analysed the influence of some of the aforementioned variables. Such field tests are very time-consuming and expensive. Therefore we have developed a device which allows sliding tests under laboratory conditions. The friction coefficient of small ski samples on ice or snow is measured on a 180 cm diameter turn-table under constant conditions. These laboratory measurements allow comparisons between different sliding materials and systems on a small scale before whole skis can be built . Measurements with this device is used as well for the development of a new friction model..

HIGH TECH IN ELITE ALPINE SKI RACING

Müller, E., Müller, J., Schiefermüller, C., Kröll, J., Schwameder, H.

University of Salzburg, Austria

Sport biomechanics plays an important role in optimising the training quality in ski racing. The areas of applying biomechanics in the training process of elite skiers are very diverse. In the first area those parameters which essentially influence performance have to be analysed. These investigations have to be done during field studies using highly developed kinematic, kinetic and electromyographical measurement systems. The scientific challenges lie in the precision of the parameters determined (accuracy of the measurement system) and in the fact that the athlete should not be interfered severely by the measurement system during performance. The results of such

investigations lead to a better understanding of movements used and provide coaches and athletes valuable support in directing training goals.

The efficiency of the training process also depends on the quality of performance tests available. Standardised tests should be built into the trainings process for all performance-relevant features. These tests must satisfy the criteria of objectivity, reliability and validity. In recent years a ski specific test battery using various high tech measurement devices has successfully been developed at our department.

Especially in seasonal sports like alpine ski racing the quality of training relies to a great extent on the availability of specific training exercises. Specific exercises must be in harmony with those parameters of movement which characterise the structure of competition technique. Most of these exercises can only performed on specially developed training devices. Both, training exercises as well as training devices have to be evaluated using kinematic, kinetic and electromyographical methods.

Numerous investigations in the area of motor learning and technical training have indicated that suitable feedback systems can significantly contribute to shortening acquisition time. These systems, on the one hand, should measure as exactly as possible the characteristics which are to be improved in training and, on the other, make the measurement results available to the athlete in an easily understandable form and within the most effective 'PR-KR Interval'.

And, last but not least, biomechanical investigations should also assist the athlete's efforts of optimising the equipment. Alpine skis and the corresponding equipment as bindings and risers are not optimised yet for individuals in ski racing regarding length, shape, stiffness etc. The bases for this optimisation are measurements of the mechanical characteristics of the material in typical and natural skiing conditions. This knowledge is used to optimise the skiing equipment to finally enhance the performance.

References

Müller E et al (2005), Science and Skiing III. Aachen.

Oral presentation (OP)

OP3-06 Physiology 10/10 - "Oslo"

DECREASE IN THE NUMBERS OF MECHANORECEPTORS IN RABBIT ACL: THE EFFECTS OF AGEING

Aydog, S.T., Korkusuz, P., Doral, M.N., Tetik, O., Demirel, H.A.

Department of Sports Medicine, Faculty of Medicine, Hacettepe University, Turkey

It is proposed that there is a positive correlation between the numbers of mechanoreceptors and proprioceptive function. On the other hand, normal aging process is associated with deficits in proprioception.

This study is designed to test the hypothesis that aging resulted in decreased numbers of mechanoreceptors. Anterior cruciate ligaments of 14 male rabbits (2 months, n=5; 12 months, n=4 and 60 months, n=5) were extracted and the total numbers of Ruffini, Pacini and Golgi tendon-like receptors were accounted.

As a result, the numbers of mechanoreceptors, especially Ruffini receptors, decreased with aging ($p<0.05$). Increased age was associated with changes in the morphology of mechanoreceptors.

In conclusion, aging results in both diminished numbers and changed morphology of mechanoreceptors.

TRAINING INDUCED ADAPTATIONS IN MUSCLE EXTRACELLULAR MATRIX AND TENDON IN RATS: HOW DOES CONTRACTION TYPE INFLUENCE COLLAGEN- AND GROWTH FACTOR EXPRESSION?

Heinemeier, K., Olesen, J., Schjerling, P., Haddad, F., Langberg, H., Baldwin, K., Kjær, M.

Bispebjerg hospital, Denmark

Introduction: Tendon and muscle extracellular matrix (ECM) are essential for force transmission in skeletal muscle. Though acute exercise is known to increase collagen synthesis in both muscle and tendon, differential effects of specific training types on collagen expression in muscle ECM and tendon are unknown. Furthermore, mechanisms involved in the adaptation of these tissues are not fully understood. We investigated the effect of concentric-, eccentric- and isometric training on expression of collagens, and of growth factors, known to induce collagen synthesis, in rat muscle and -tendon.

Methods: Three groups (n = 8) of young adult female Sprague-Dawley rats were subjected to concentric-(CT), eccentric-(ET)- or isometric (IT) training. The m. gastrocnemius was activated by electrically stimulating the sciatic nerve at a frequency (~ 50 Hz) and voltage adjusted to produce maximal isometric tension. Sets, divided by 5 min rest, consisted of 10 x 2 s stimulations with 18 s rest between contractions. Rats were trained for 4 days with 2 sets on day 1, 3 sets on day 2, and 4 sets on day 3 and -4. Rats had their right foot placed in a footplate with an angle of ~ 44° relative to the tibia. For the IT group the angle was fixed during muscle stimulation. During contraction the footplate was moved from 44 ° to 64 ° for the CT group and from 44° to 24 ° for the ET group. RNA was extracted from medial gastrocnemius- and Achilles tendon tissue 24 h after the last training bout, and mRNA levels for collagen I and -III, transforming growth factor-b-1 (TGFb1), insulin like growth factor-IEa (IGF-IEa) and mechano growht factor (MGF) were measured by real-time RT-PCR. Real-time RT-PCR results were normalised to the weight of the individual tissue samples.

Results: Training increased type I collagen mRNA in muscle tissue ($p<0.001$) and in tendon a specific increase was seen in response to CT and IT ($p<0.05$). In both tendon and muscle tissue, type III collagen mRNA increased markedly (up to 20-fold in tendon) in response to all types of training ($p<0.001$). Muscle subjected to ET had a greater increase in mRNA for TGFb1, IGF-IEa and MGF than muscle subjected to CT ($p<0.05$). Additionally the effect of IT on IGF-IEa and MGF was larger than the effect of CT ($p<0.05$). In tendon tissue we also found an increase in TGFb1, IGF-IEa and MGF mRNA but no difference was seen between the different types of training ($p>0.05$).

Discussion: The increased collagen expression supports a training-induced adaptive response in muscle ECM and tendon. Furthermore ET appears to have a larger potential than CT for increasing the expression of collagen-inducing growth factors in muscle. This may be connected to a greater force production during eccentric contraction, or perhaps to a greater local shear stress in the muscle tissue. The changes seen in tendon were not dependent on training type, which indicates that this tissue is unable to distinguish between the 3 contraction modes.

CAUSES OF MUSCLE CELL DAMAGE: MECHANICAL STRAIN OR CALCIUM OVERLOAD?

Fredsted, A., Gissel, H., Clausen, T.

University of Aarhus, Denmark

Background: Prolonged or unaccustomed exercise leads to muscle cell damage, detectable as a release of the intracellular enzyme lactic acid dehydrogenase (LDH). This is correlated to excitation-induced influx of Ca2+ (1). If the cytosolic concentration of Ca2+ is elevated locally or globally to critical levels for longer time periods degradative mechanisms may be initiated leading to membrane damage. It cannot be excluded, however, that the mechanical strain on the muscle occurring during contraction contributes to the damage. We here explore this question using a chemical tool, N-benzyl-p-toluene sulphonamide (BTS), which specifically blocks muscle contraction in fast-twitch muscles (2).

Methods: Isolated extensor digitorum longus (EDL) muscles (20-25 mg) were prepared from 4 wk old Wistar rats and mounted on holders for isometric contractions. Muscles were incubated in normal Krebs-Ringer bicarbonate buffer and continuously gassed with a mixture of 95 % O2 and 5 % CO2. Muscles were stimulated intermittently (10 sec on, 30 sec off) at 40 Hz (1 ms pulses of 10 V) for 15, 30 or 60 min or exposed to the Ca2+ ionophore A23187.

Results: Electrical stimulation increased 45Ca influx 3-5 fold. This was followed by a progressive release of LDH. In the presence of BTS at a concentration (50 μM) causing 90% inhibition of contractile force, excitation induced the same increase in 45Ca influx, but the increased release of LDH was completely suppressed. Both in the absence and in the presence of BTS (50 μM), A23187 markedly increased LDH-release. Muscles exposed to passive mechanical stretching of up to 0.39 N, which is comparable to the tension developed during electrical stimulation, showed no release of LDH in the 180 min exposure period. In control muscles, electrical stimulation induced a drop of 49% and 54% in the contents of ATP and creatine phosphate, respectively. These drops were significantly reduced in BTS treated muscles to 32% for ATP ($p=0.001$) and to 42% for creatine phosphate ($p<0.05$).

Conclusion: During isometric contractions muscle excitation is associated with a large influx of Ca2+ and a progressive release of LDH. We suggest, that BTS treated muscles have a better capacity (more ATP) to clear the cytosol for the incoming Ca2+, thereby reducing the membrane damage caused by Ca2+ activated degradative mechanisms. Even though A23187 treated muscles do not contract, a large increase in Ca2+ influx and LDH release occurred. Thus, we conclude that the degree of cell damage during isometric contractions depends mainly on the size of Ca2+ influx and on the energy status of the cell, but not on mechanical stretch.

References:

1. Gissel H and Clausen T. Am J Physiol Regul Integr Comp Physiol 279: R917-R924, 2000.
2. Macdonald WA, Pedersen TH, Clausen T and Nielsen OB. Exp Physiol 90: 815-825, 2005.

CHANGES IN MUSCLE FIBRE CSA AND MUSCLE FIBRE PENNATION ANGLE WITH DISUSE AND TRAINING IN ELDERLY POSTOPERATIVE PATIENTS

Suetta, C., Magnusson, S.P., Dalgas, U., Berget, J., Andersen, J.L., Koskinen, S., Aagaard, P., Kjær, M.

Institute of Sports Medicine, Bispebjerg Hospital, Denmark

Introduction

Sarcopenia has long been recognized as a major cause of muscle strength loss in old age, however, the contribution of changes in muscle architecture has seldom been considered. Furthermore, it is well known that a substantial amount of muscle mass and strength is lost during joint-surgery related immobilization (Häggmark 1981). However, despite the increasing prevalence of musculoskeletal diseases that requires surgery in the elderly, regimes for optimal rehabilitation remains unknown and in general, only limited research is available on the role of training in preventing or reversing age and disuse-related changes in muscle morphology. The purpose of the present study was therefore to compare the change in muscle size and muscle architecture induced by unilateral Strength Training (ST) or Electrical Stimulation (ES) of the quadriceps muscle compared to a Standard Rehabilitation (SR) program after hip-replacement surgery.

Methods

Thirty patients (60-86 yrs) scheduled for unilateral hip replacement due to osteoarthritis (OA) were randomised to either 1) ST (3/wk×12 wks), 2) ES (1 h/day×12 wks) or 3) SR (1 h/day×12 wks). Muscle biopsies were obtained from vastus lateralis (VL) of both legs at baseline, 5 and 12 wks post-surgery to analyze for changes in muscle fibre CSA. Muscle architecture was evaluated by measurement of muscle fibre pennation angle in the VL muscle by use of ultrasonography. Non-parametric tests were used for statistical analyses (significance level, $p<0.05$).

Results

At the onset of the study significantly reduced muscle fibre pennation angle (- 15%) and single fibre CSA of type I (-14%) and type II (-26%) muscle fibre area was observed in the OA-leg compared to the healthy leg. After 12 wks of strength training a 20% increase was observed in muscle fibre pennation angle (7.2±0.50 to 8.6±0.60, $p<0.05$) whereas no increase was observed with ES and SR. Furthermore, a significant increase was observed in type I muscle fibre CSA (+17%, $p<0.05$) and type II muscle fibre CSA (+37%, $p<0.05$) with strength training but not with ES and SR.

Discussion

The present study is the first to demonstrate that postoperative strength training is highly effective in increasing muscle fibre area of both type I (+17%) and type II (+37%) fibres, similarly to the effects shown in healthy elderly individuals (Frontera 1988, Häkkinen 1998). In addition to the muscular changes pertaining to single muscle fibers, strength training also induced marked alterations in muscle architecture by increasing muscle fibre pennation angle of the VL muscle compared to electrical stimulation and a standard rehabilitation regime.

References

Häggmark et al, Int J Sports Med 2(1), 1981

Frontera et al., J. Appl. Physiol. 64, 1988

Häkkinen et al.,J. Gerontol. 53B, 1998.

EFFECT OF ECCENTRIC CONTRACTION VELOCITY ON MUSCLE DAMAGE

Chapman, D., McGuigan, M., Nosaka, K.

Edith Cowan University, Australia

Controversy exists concerning the effect of contraction velocity on exercise-induced muscle damage. Some studies report greater muscle damage induced by fast velocity than slow velocity eccentric actions, but the opposite is shown by others. Our previous study (Chapman, et al. Int J Sports Med in press 2006) showed that 210°/s compared to 30°/s eccentric exercise induced greater muscle damage. However, to equate muscle tension time the number of repetitions was vastly different between velocities (30 vs 210). The present study compared a slow (30°/s) and fast (210°/s) velocity eccentric exercise for changes in markers of muscle damage by equating the number of repetitions. Eight male volunteers (26.4+/-6.2 yrs) performed 210 (35 sets of 6) eccentric actions of the elbow flexors on an isokinetic dynamometer. Dominant and non-dominant arms were randomly assigned to perform slow (SV:30°/s) or fast (FV:210°/s) velocity maximal eccentric exercise separated by 10 days. Each maximal eccentric action (60-180° full elbow extension) was followed by a passive movement to the flexed position with a 90s rest between sets. Dependent variables included maximal voluntary torque for isometric and concentric (3 velocities) contractions, range of motion (ROM), upper arm circumference (CIR), muscle thickness (MT) and B-mode ultrasound echo intensity (ULT), muscle soreness (SOR), serum creatine kinase (CK) and lactate dehydrogenase (LDH) activities. Measures were taken before, immediately post, 1 hr and 24-120 hrs after each eccentric exercise protocol and comparisons between FV and SV were made by a repeated measure ANOVA. Work performed during exercise was significantly ($p<0.01$) greater for FV (13364 J) than SV (9298 J). Both exercises resulted in significant decrements in isometric and dynamic torque ($p<0.05$), but FV resulted in a significantly ($p<0.05$) slower recovery of isometric strength at 130° and 150° elbow flexion compared with SV. Significantly ($p<0.05$) larger decrease in ROM was evident after FV than SV. MT and ULT changed significantly ($p<0.05$) larger following FV than SV. FV resulted in significantly ($p<0.05$) larger increases in CIR and SOR compared to SV. Peak serum CK activity was significantly greater ($p<0.05$) following FV (6282 IU/L) than SV (1808 IU/L), and LDH activity recorded a greater peak following FV (468 U/L) than SV (389 U/L). These results indicate that FV induces greater muscle damage than SV, and recovery of muscle function after FV was slower than SV, although the magnitude of decrease in muscle function immediately after exercise was similar. This work confirms the finding of our previous study. It would appear that the slower recovery of muscle function after FV, and the greater changes in other measures were due to fewer muscle fibres sharing the workload, resulting in greater strain on the connective elements of fewer fibres.

Oral presentation (OP)

OP3-07 Training and Testing 7/7 - "Turin ABC"

RELATIONSHIP BETWEEN HEART RATE AND OXYGEN UPTAKE IN ELITE CYCLISTS

Lounana, J., Campion, F., Medelli, J.

CHU Amiens, France

Purpose. To study the possible changes in power output (W), heart rate (HR), oxygen uptake (VO2), and HR-VO2 relationship in elite cyclists at maximal incremental exercise test during two different periods of sport season.

Methods. 20 elite male cyclists (29.5±4 years; 181±7 cm; 74.1±4.3 kg; VO2max: 72.7±5.3 ml•kg-1•min-1), including 14 professional cyclists and 6 elite amateur cyclists, performed two incremental tests (50W/3-min stages) until exhaustion on an electromagnetic bike ergometer. Gas exchange was continuously monitored (mixing chamber, sampling every 30 s.). Test 1 took place at December during the pre-training phase (OFF period), and test 2 at June in the middle of the active period of training and competition (ON period). Mean values were studied at the first and second ventilatory thresholds (VT1, VT2) and at maximum workload (MAX). The values of the last minute of each completed step were averaged and used for the HR-VO2 regression analysis with calculation of slopes and intercepts and prediction of HR or VO2 values throughout the range of exercise intensities.

Results. A duration of 5.6 ± 0.5 months on average separated test 1 and 2. In comparison to period OFF, W and VO2 were higher at VT1 (211±28 vs. 191±28 watts; 41.7±5.5 vs. 38.4±4.1 ml•kg-1•min-1; $P < 0.05$), at VT2 (308±29 vs. 288±36 watts; 53.7±5.1 vs. 48.6±5.5 ml•kg-1•min-1; $P < 0.01$) and at MAX (446±31 vs. 404±30 watts; 72.7±5.3 vs. 65.8±5.1 ml•kg-1•min-1; $P < 0.001$) during period ON. Similarly, VO2 or %VO2max values corresponding to indicated HR values set between 135 and 175 bpm were higher ($P < 0.001$). Inversely, other parameters were significantly lower during ON compared to OFF, such as the HR at VT2 and at MAX ($P < 0.05$), the target HR corresponding to any given intensity above 65% of VO2max ($P < 0.01$) as well as the slope of the HR-VO2 regression (2.19±0.3 vs. 1.76±0.2; $P < 0.001$).

Discussion and conclusion. Bland and Altman procedure have shown a level of agreement higher than 95% for every comparison paired according to the two test periods. This study shows that the power output, heart rate and oxygen uptake values can significantly change over a sport. Notably, the HR-VO2 relationship doesn't remain steady between the pre-training and the racing period, suggesting that a single athletic evaluation for the whole season is neither sufficient nor suitable for effectively monitoring and guiding the training of elite cyclists. We therefore propose that elite cyclists should perform at least two evaluations per season, one in period OFF and the other in period ON.

References

Lucia A, Hoyos J, Perez M, Chicharro JL. Heart rate and performance parameters in elite cyclists: a longitudinal study. Med. Sci. Sports Exerc. 32 (10): 1777-1782, 2000.

Hoogeveen AR. The effect of endurance training on the ventilatory response to exercise in elite cyclists. Eur J Appl Physiol. 82 (1-2): 45-51, 2000.

VERY HIGH-INTENSITY TRAINING WITH SHORT REST PERIODS DECEASES MUSCLE BUFFER CAPACITY

Edge, J., Goodman, C., Bishop, D.

Massey University, New Zealand

Previous results in our laboratory indicate that training intensity affects changes in muscle buffer capacity (Bm) and supports the hypothesis that the accumulation of H+ within skeletal muscle and blood may be an important stimulus to improve Bm. If H+ accumulation

during training is important to changes in Bm, then altering the length of the rest period between intervals (and therefore H+ accumulation) should influence adaptations to Bm. The purpose of this study was to compare the effects of a 1-min or 3-min rest interval between very high-intensity cycling intervals during training on changes to Bm and muscle metabolism during high-intensity exercise.

Twelve, moderately-trained females (mean ± SD: age 20 ± 3 y, mass 62.3 ± 10.0 kg), performed a graded exercise test to determine VO2peak and the lactate threshold (LT), followed 48 h later by a constant-intensity cycle test (CIT: 45 s at 200% pre-training VO2peak). Muscle biopsies (vastus lateralis) were taken before and after the CIT to determine Bm (in vitro) and muscle metabolites. Subjects were randomly assigned to either high-intensity interval training with 1-min (HIT-1) or 3-min (HIT-3) rest periods between intervals. Each subject had a matched partner (matched on the LT) in the opposing group, with whom they were required to complete an equal amount of work during each training interval and session (6-12 x 2 min at 150% LT, 3 d.wk-1 x 5 weeks).

There were increases in VO2peak (9-11%; $p<0.05$) and the LT (8-15%; $p<0.05$) for both groups, with no differences between groups. There was a decrease in Bm for the HIT-1 group (13%; $p<0.05$) and an increase in Bm for the HIT-3 group (6%; $p<0.05$) following the training period. Following training there were no changes to pre or post-exercise [ATP] or [PCr]. However, there was a reduction in [La-] (32-34%) and [H+] (48-50%) during the CIT for both groups ($p<0.05$), with no differences between groups.

We have shown that very high-intensity training with short rest periods (HIT-1) does not result in greater improvements in Bm, but actually decreases Bm in moderately-trained females (13%). As we have previously shown an acute decrease in Bm following very high-intensity exercise, it may be that a chronic decrease in Bm results when very intense exercise bouts are repeated over time. These findings contrast with previous results within our laboratory using a similar training protocol (2 min intervals, 1 min rest periods). The present results may be due to the higher training-intensity employed than previously (150% LT v 130% LT). In contrast, training at the same workload (150% LT), but with longer rest periods (HIT-3), resulted in a small increase in muscle buffer capacity. Therefore, during very high-intensity training, the rest period per se, does affect training adaptations to Bm. Despite the difference in changes to muscle buffer capacity between groups, there were no differences in muscle metabolism or H+ regulation during supra-maximal exercise.

RELIABILITY AND SENSITIVITY OF A CYCLING TIME TRIAL IN A GLYCOGEN DEPLETED STATE

Currell, K., Jentjens, R., Jeukendrup, A.E.

University of Birmingham, United Kingdom

It is very difficult to conduct laboratory studies into the effects on various manipulations on very prolonged endurance exercise performance (>3h). When measuring performance the protocol used must be reliable, valid and sensitive enough to detect small changes that are relevant to athletes. Little data is available on the reliability of performance trials of that duration. The aim of this study was to investigate the reliability of a protocol designed to simulate endurance events of long duration (~ 6h) by lowering endogenous carbohydrate stores the day before.

Seven male subjects were recruited (Age 27 ± 7 yrs, VO2max 66 ± 5 ml.kg-1.min-1, Wmax 367 ± 42 W). The subjects underwent four trials to determine the reliability and sensitivity of the protocol. Three of these trials were placebo trials with the final two trials being randomised and counterbalanced with a carbohydrate beverage (6.67% Maltodextrin solution). For each trial subjects entered the laboratory in the evening to undergo a glycogen depleting exercise trial lasting approximately 2.5 h. The subjects subsequently returned the following morning in a fasted state to undertake a 1h steady state ride at 50% Wmax followed by a time trial of approximately 40 min duration. During the steady state ride measures of expired gas, blood, heart rate and RPE were collected every 15min. A 600ml bolus of a placebo drink was given 5min prior to the start of the steady state period followed by a 150ml bolus every 15min throughout the steady state period and a third and two thirds of the way trough the time trial. The placebo trials were analysed for reliability of time to completion of the time trial using a coefficient of variation (CV), with 95% confidence intervals. The presence of any systematic error between placebo trials was analysed using a repeated measures ANOVA. The relationship between measurement error and time to completion was analysed using Pearsons r. A paired t-test was used to analyse any differences in time to completion between the placebo and carbohydrate trials.

The mean time to complete of the three placebo trials was 2546s, 2585s and 2568s for trials 1,2 and 3 respectively. There was no significant difference between these trials ($P > 0.05$). There was no significant correlation ($P > 0.05$) between the measurement error and the time to completion. The CV between trials 1 and 2 was 4.5% (95% CI 2.9 – 10.4%) and between trials 2 and 3, 3.8% (95% CI 2.4 – 9.9). There was no significant difference between the placebo and carbohydrate trials ($P > 0.05$). However there was a 7.7% (95% CI -6.67 – 22.06%) improvement in time to completion with the ingestion of carbohydrate.

Very few studies have investigated reliability during very prolonged exercise. The variation of the current protocol is similar to previous studies in the literature for time trial protocols with shorter duration. This is the first study to report reliability of a test designed to simulate ultraendurance performance.

MAXIMAL ECCENTRIC TRAINING HAS AN OSTEOGENIC IMPACT ON AREAL BMD IN BONES HABITUALLY UNEXPOSED TO LARGE ECCENTRIC MUSCLE CONTRACTIONS

Wulff Helge, E., Kanstrup, I.-L.

Institute of Exercise and Sport Sciences, University of Copenhagen, Denmark

From animal studies it is well known that strain rate and magnitude resulting from muscle contractions are important stimuli in mechanotransduction leading to bone formation. It is also known that force development is higher in maximal eccentric than in maximal concentric contractions. PURPOSE: Thus, we wanted to investigate the impact of eccentric training on areal bone mineral density (aBMD). The main hypothesis was that four months of maximal eccentric training three times a week would increase aBMD. Secondly, we hypothesized to find an association between increase in maximal eccentric muscle torque (MEMT) and increase in aBMD. METHODS: Subjects were 15 female recreational runners (running > 2 hrs/wk), age 23-40 years, all normal menstruating. Eight participated in the strength training and seven were controls. Training consisted of maximal eccentric knee extension and flexion, forearm supination and pronation, and hip flexion. Regional and whole body aBMD (g/cm2) were measured by DXA, and MEMT was measured as isokinetic peak torque (Nm). RESULTS: At baseline aBMD values in the non-dominant forearm were lower than in the dominant forearm ($P<0.05$) in both control and training group, but in the latter this difference disappeared after training. At four months aBMD in the trained group was significantly increased from baseline in the trained non-dominant forearm (distal ulna (+12%) and total ulna (+5%), $P<0.05$). At four months MEMT in the trained non-dominant extremities were increased in forearm pronation (+45%, $P<0.05$), knee extension (+16%, $P<0.005$), and knee flexion (+13%, $P<0.05$), but there was no site-specific association to the augmentation in forearm aBMD. CONCLUSIONS: Eccentric training is a potent stimulus in bone formation in non-weight bearing bones that habitually are unexposed to large eccentric muscle contractions.

The finding of no site-specific association between the increases in aBMD and MEMT indicate that eccentric muscle contractions leading to bone strain not necessarily lead to parallel increases in maximal isokinetic muscle torque.

COMPARISON OF SIX WEEKS OF COMPLEX TRAINING AND PERIODISED RESISTANCE TRAINING ON THE DEVELOPMENT OF LOWER-BODY STRENGTH

Schneiker, K.T., Billaut, F., Bishop, D.

The University of Western Australia, Australia

The development of strength is a crucial component in the preparation of team-sport athletes for an upcoming competitive season. Determination of the optimal combination of maximal strength and power training to develop various qualities of strength is therefore an important consideration. It has been suggested that complex training may be a superior means of developing muscular power in comparison to more conventional methods. The purpose of this study was to compare the effectiveness of a periodised (P) training protocol and a complex (C) training protocol on the development of lower-body strength during pre-season training. Sixteen state-level Australian Rules Football players (age: 19.2 ± 2.5 y, height: 182.7 ± 7.7 cm, body mass: 78.5 ± 8.8 kg) were matched on maximal strength and high-load power and separated into two training groups. The P-group performed six weeks of periodised resistance training involving three weeks of maximal strength training followed by three weeks of power training. Training for the C-group involved alternating sets of maximal strength and power exercises for the entire six-week period. Importantly, the C-group performed the same total volume of training using the same exercises at the same intensity as the P-group. All subjects were pre and post-tested using lab and field tests to determine various qualities of strength. Maximal strength was determined using the half-squat (1RM). High-load power was determined by measuring peak power output during the loaded squat jump at 30% of 1RM (LSQJ). Low-load power was determined by measuring vertical jump height (VJ), 5-m sprint time (5S), 20-m sprint time (20S) and peak-power output during a 4-s maximal cycle sprint (PP4). For both groups (P and C, respectively), there were significant improvements ($P < 0.01$) in 1RM (170.0 ± 25.1 kg to 202.2 ± 29.3 kg and 168.8 ± 13.6 kg to 202.8 ± 15.7 kg), LSQJ (3368.6 ± 520.3 W to 3661.9 ± 456.8 W and 3221.4 ± 463.8 W to 3582.5 ± 399.4 W), VJ (61.1 ± 6.7 cm to 63.4 ± 6.1 cm and 54.2 ± 4.9 cm to 57.7 ± 6.1 cm), 5S (1.25 ± 0.09 s to 1.07 ± 0.11 s and 1.24 ± 0.09 s to 1.06 ± 0.04 s), 20S (3.18 ± 0.08 s to 3.03 ± 0.10 s and 3.24 ± 0.14 s to 3.05 ± 0.09 s) and PP4 (1332.9 ± 199.5 W to 1425.4 ± 173.7 W and 1265.0 ± 158.1 W to 1347.1 ± 136.4 W). There was no significant difference between groups in changes for any of the tests ($P > 0.05$). In conclusion, this study has found that complex training is not superior to a more traditional periodised training program when matched for exercises, total volume and intensity. In agreement with prior complex training studies (Burger et al., 2000) the present results suggest that maximal strength and power can be developed concurrently and that complex training is not at a disadvantage to periodised training.

Burger, T., T. Boyer-Kendrick, and D. Dolny. Complex training compared to a combined weight training and plyometric training program. Journal of Strength and Conditioning Research. 14:S360(Abs.), 2000.

Oral presentation (OP)

OP3-08 Sports Medicine 4/4 - "Berlin DE"

EVALUATION OF THE TURNOVER RATE OF FIBROBLASTS IN LIGAMENT TISSUE BY ANALYSIS OF DNA-TELOMERE LENGTH. A COMPARISON WITH SKELETAL MUSCLE FIBRES

Kadi, F., Ponsot, E., Krogsgaard, M., Mackey, A., Kjær, M., Langberg, H.

Department of Health Sciences, Sweden

Introduction

It is well accepted that ligaments heal at a slower rate than many other tissues. It is hypothesised that the low regenerative potential of ligaments is due to their hypocellular composition and not to a poor ability of ligament cell types to regenerate. In this respect, the analysis of DNA-telomere length can serve as a biomarker of a cell's regenerative potential and ability for further cell division. The aim of this project was to compare DNA telomere length of ligament tissue to that of skeletal muscle fibres.

Methods

Skeletal muscle samples were obtained from 7 healthy young individuals and were compared to samples from the proximal anterior cruciate ligament taken during surgery from 7 young individuals. Total DNA extraction was achieved by incubation in proteinase K digestion buffer. The genomic DNA was then digested with a restriction enzyme to generate a smear of DNA fragments containing telomeres with different lengths of the TTAGGG repeat sequence. Telomeres were detected using Southern blot analysis. The telomeres were detected by hybridization to a 32P-labelled (TTAGGG)4 probe, followed by exposure to x-ray film. The signals were analysed using Scion software. The signal obtained provides a distribution profile of telomeric lengths of all myonuclei present in the tissue. Average telomere length indicates the most frequent DNA telomeric lengths of the tissue whereas the minimal telomere length indicates the shortest DNA telomeric lengths found in the tissue.

Results and conclusions

Average telomere length in ligaments was 11.4 ± 0.9 Kbp and the minimal length was 4.9 ± 0.4 Kbp. In skeletal muscle corresponding values were 11.1 ± 0.9 Kbp (average) and 5.3 ± 0.4 Kbp (minimal). We found no significant differences between the skeletal muscle and ligament tissues both with respect to the average and minimal telomere length. These results indicate that the cells present in ligaments have a similar regenerative potential than skeletal muscle fibres and suggests that the low healing capacity of the ligament tissue is not due to ligament cell types ability to proliferate and generate new cells, but rather to a low cell density.

PHYSICAL EXERCISE CONDITIONED SERUM MOBILIZES MESENCHYMAL STEM CELLS (MSCS)

Bloch, W., Bierwirth, S., Weber, S., Platen, P., Schmidt, A.

Institute for Circulation Research and Sportmedicine, Germany

Physical exercise conditioned serum mobilizes mesenchymal stem cells (MSCs)

Wilhelm Bloch, Steffen Bierwirth, Sebastian Weber, Petra Platen, Annette Schmidt.

German Sport University of Cologne, Dept. of Molecular and Cellular Sport Medicine

INTRODUCTION: Adult mesenchymal stem cells (MSCs) are commonly settled down in the bone marrow and have the distinction that they are able to differentiate in muscle, cartilage, bone and adipose tissue. Therefore MSCs are necessary for tissue regeneration but also to build up tissue. Prerequisite for such a regenerative effect is that MSCs reach their target tissue. For this stem cells have to be mobilized. At the moment it is not clear if MSCs are directly influenced by exercise. Therefore during the following study it was be analysed if the conditioned serum of exhausted athletes influence the migratory activity of MSCs.
MATERIAL AND METHODS: 6 athletes performed a warm up phase of 12 minutes and were trained until subjective exhaustion within a short time (VO2 max within 6-8 minutes). Serum was taken from the athletes before the warm up phase (pre exercise), directly after the exercise and 1 hour after the exercise. In a modified boyden chamber assay the migratory activity of the mesenchymal stem cells was analysed under influence of the serum pre exercise and post exercise.
RESULTS: Compared to the pre exercise condition a significant increase of MSC migration was observable post exercise (140±16% (p=0,004). One hour post exercise this increase was reduced little but was also significant (128±9%(p=0,03)). Whereas no influence was seen on proliferation and apoptosis of the MSCs post exercise.
DISCUSSION: In the present study we were able to show that training has a direct influence on he mobility of mesenchymal stem cells. Surprisingly was the point that this increase of motility was obvious directly after training. It seems to be probably that this mobilisation of MSCs is a kind of fast reaction on extreme physical exercise.

CORRELATION BETWEEN BMI, PHYSICAL PERFORMANCE, INSULIN SENSITIVITY, AND ADIPOCYTOKINES IN CHILDREN – BASELINE AND FINAL DATA OF THE CHILT III PROJECT

Graf, C., Koch, B., Brixius, K., Pruys, M.-L., Hofrichter, A., Manderfeld, A., Müller, A., Predel, H.-G., Bloch, W.

German Sport University, Germany

Obesity in childhood necessitates the development of effective counter strategies by changing lifestyle and reducing possible co morbidities. The aim of the present study was to examine the effect of an outpatient interdisciplinary programme for obese children and adolescents (CHILT III project – Children's health InterventionaL Trial) on BMI, physical performance, adipocytokines, and insulin-sensitivity.
Methods: The pre- and post-examination the anthropometric data of 68 children (33 boys, 35 girls) were assessed. Blood was obtained after 12 hours of fasting to analyse the adipocytokines adiponectin, ghrelin, resistin and leptin as well as insulin, proinsulin as parameters for insulin sensitivity. Homeostasis model assessment of insulin resistance was calculated classified with age- and gender-specic percentiles. Watt performance and VO2max were registered via spiroergometry.
Results: 61 children finished the program. BMI was reduced in 64.4%. Decrease in BMI was associated with a decrease in insulin (r=0.314; p=0.043), HOMA-IR (r=0.317; p=0.041), leptin (r=0.637; p<0.001) and an increase in adiponectin (r=-0.394, p=0.010). No correlation was found with changes in VO2max, ghrelin, resistin and proinsulin. Changes in HOMA-index were positively correlated with proinsulin (r=0.616; p<0.001), leptin (r= 0.592; p<0.001) and negatively with ghrelin (r= -0.339; p=0.028). Proinsulin and resistin were negatively correlated with watt per kg (r= -0.367, p=0.022; resp. r=-0.403, p=0.041), not with VO2max. At baseline 27 child (52.9%) was classified with normal glucose tolerance (HOMA < 95.p) and 24 children (47.1%) had a severely disturbed glucose tolerance (HOMA ³ 95.p). After the intervention 6 children improved their HOMA-IR, 8 impaired and 28 did not change their index. The children, which improved their HOMA-IR, decreased the proinsulin level about –5.3 ± 8.4 pmol/l; children with an impairment increased their proinsulin level about 4.3 ± 5.3 pmol/l and children with no change had a slight decrease about -0.9 ± 8.2 pmol/l (p=0.079).
Conclusions: These results suggest that an outpatient family-based program leads to BMI-reduction, associated with a decrease in leptin and increase in adiponectin as marker for a lower fat mass. An increase in watt per kg, representing a combined strength and endurance performance is associated with a decrease in proinsulin and resistin as an indication for a potential lower atherosclerotic and metabolic risk. Whether this effect may modify the risk of atherosclerosis or diabetes awaits further and long-term studies.

EXERCISE EFFECTS ON THE IMMUNE RESPONSE IN A MODEL OF EXPERIMENTAL ARTHRITIS

Vaisberg, M.W., Bacurau, F., Pontes, F., Costa Rosa, L., Navarro, F.

Federal University of São Paulo, Brazil

INTRODUCTION – Rheumatoid Arthritis, a chronic inflammatory disease of autoimmune nature, affects the immune response. Even though the kind of alteration is still a controversial topic, resources are used to act in the immune system in almost all therapies, particularly in the modern ones. The immunomodulatory function of exercise has been demonstrated in several models that showed immune response unbalance. Such reports motivate us to study a model of arthritis comparing animals submitted to exercise to sedentary ones. OBJECTIVES - We aimed at studying a model of collagen-induced arthritis comparing the immune response of animals submitted or not to physical exercise.
MATERIAL AND METHODS - Female Wistar rats, weighing between 150-200 g were kept in ideal laboratory conditions and divided into three experimental groups: control (C), arthritis (A) and swimming/arthritis (SA). Experimental arthritis was induced by the inoculation of type II collagen in complete Freund adjuvant into the right hindlimb. The training consisted of 5 weekly sessions of swimming for six weeks. Each session lasted one hour, during which a load, equivalent to 5% of the rat body weight, was attached to the tail. After the training protocol, the animals were decapitated. Their spleens were then removed and weighed, macerated and placed in culture so that it was possible to evaluate the proliferation of splenocytes. We also dosed the cytokines interleukin-1 (IL-1) and interleukin-2 (IL-2) in the culture supernatant by ELISA. RESULT - The weight of the spleen in the sedentary animals with induced arthritis had increased, while the ones of trained animals returned to a weight similar to the control (C- 0,59 g, A 1,15 g, SA 0,55g). Regarding the lymphocyte proliferation, we observed a reduction in the values obtained in the arthritis group, however, we could observe that this immunological parameter was normalized in animals that underwent training (C- 1272 +_ 120 cpm, A 697+_49 cpm, SA 1116+_213 cpm). The dosage of IL-1 (pg/ml) showed a decrease in the arthritis group; however, in the trained group there was a statistically significant correction of the values obtained (C- 23,3+-2,2, A 14,0+_0,7, SA 15,5+_1,3). The dosage of IL-2 (pg/ml) showed a marked increase in the trained group (C - 66,8+_14,8, A- 55,0+_7,9, SA- 144,7+_33,9). DISCUSSION - In accordance with medical literature, our results suggest an alteration in the immune response in the arthritis group, demonstrated by splenomegaly, decrease of the splenocyte proliferative response and changes in cytokines production. These alterations are corrected by means of a moderate physical training protocol, which suggests possible immunomodulatory mechanisms related to the improvement of arthritis in the trained group.

HYPERTHERMIA DURING COMPETITION IN ELITE ATHLETES

Calleja, J., Leibar, X., Erauzkin, J., Arratibel, I., Mora-Rodriguez, R., Terrados, N.

Universidad del País Vasco, Spain

HYPERTHERMIA DURING COMPETITION IN ELITE ATHLETES

Julio Calleja González 1, Xabier Leibar Mendarte 2, Julen Erauzkin Barrenetxea 2, Iñaki Arratibel Imaz 3, Ricardo Mora Rodríguez 4, Nicolás Terrados Cepeda 5.

1 Universidad P. Vasco. 2 Centro de perfeccionamiento Técnico. Fadura-Getxo. Dirección de Deportes. Gobierno Vasco. 3 Tolosa Kirol Medikuntza. 4 Facultad de Ciencias del Deporte UCLM, Toledo. 5 Unidad Regional de Medicina del Deporte. Principado de Asturias Fundación Deportiva Municipal de Avilés.

Introduction. Hyperthermia (increases in core temperature above 38°C) induced by intense exercise causes central fatigue ([1]) and reduces time to exhaustion in cyclists that exercise in the heat ([2]). The cited studies have been performed in a lab setting using trained subjects. However, it remains unclear if elite athletes experience hyperthermia during their regular training and competition and furthermore if that could negatively affect performance. The purpose of this study was to measure core temperature response to regular training or competition of elite athletes.

Subjects. 29 athletes (8 professional cyclists, 12 rowers, 3 endurance runners of international level and 6 triathletes of international caliper) were studied during competition.

Methods: At least 1 hour prior to the exercise subjects ingested a pill containing a telemetric temperature sensor (CorTempTM Ingestible Thermometer, HQInc. USA) which signals were collected and recorded (CorTempTM 2000 Recorder;HQInc. USA) at rest and frequently during exercise. The manufacture's reported sensitivity ranges from de 0º a 50ºC with an accuracy of ± 0.1 ºC. Dry bulb temperature and relative humidity were also recorded (Kestrel 4000 NK; Nielsen–Kelleman, USA). In addition heart rate was recorded using a telemetric unit (Accurex, Polar, Kempele, Finland).

Results. For most test temperatures averaged 25 ºC and relative humidity never exceed 60%. In one test dry temperature rose to 32.5ºC and humidity to 72 %. The highest core temperatures recorded during competition ranged from 38.1 to 42.3ºC with (average of 39.5 ºC). 5 out of the 29 athletes (17%) reached core temperatures above 40ºC. The highest heart rates during competition ranged from 185 to 203 bt/min (average 186 bt/min).

Conclusions: In endurance sports during long lasting competitions events core temperature reaches high levels in elite athletes (39.5 ºC). This high core temperature is achieved despite normothermal environmental conditions (25º C). Thus it is possible that endurance performance during competition is affected by hyperthermia.

References

1. Nybo, L., and B. Nielsen, Hyperthermia and central fatigue during prolonged exercise in humans. J. Appl. Physiol., 2001. 91(3): p. 1055-1060.

2. Gonzalez-Alonso, J., C. Teller, S.L. Andersen, F.B. Jensen, T. Hyldig, and B. Nielsen., Influence of body temperature on the development of fatigue during prolonged exercise in the heat. J. Appl. Physiol., 1999. 86: p. 1032-1039.

Oral presentation (OP)

OP3-09 Nutrition 2/2 - "Turin DE"

AWARENESS AND USE OF CAFFEINE BY ATHLETES COMPETING AT THE 2005 IRONMAN TRIATHLON WORLD CHAMPIONSHIPS

Desbrow, B., Leveritt, M., Hiller, D.

Griffith University, Gold Coast, Australia

Despite its legality, caffeine remains on WADA's monitoring program, which results in the drug be placed under heightened scrutiny for further tracking of trends in use for future prohibition list consideration1. This study assessed the knowledge and prevalence of caffeine use by athletes completing at the 2005 Ironman Triathlon World Championships. Caffeine-related questionnaires were administered to 140 (105M and 35F, 40.3±10.7 years) athletes (8% of all participants) from 16 countries throughout race registration. 50 athletes further consented to immediate post-race blood samples for analysis of plasma caffeine and paraxanthine using HPLC. 100 (71%) athletes correctly identified caffeine as being unrestricted in triathlon. Only 15 (11%) athletes were not planning on using a caffeinated substance immediatley prior to or throughout the race. Cola (78%), Caffeinated Gels (42%), Coffee (37%), Energy Drinks (13%), and No Doz Tablets (9%) were the most popular caffeinated choices. More than half the athletes (52%) stated that they did not know an optimal caffeine dose for their sport. The most common sources for information on caffeine were reported as self researched/experimentation (44%), fellow athletes (42%), magazines (38%) and journal articles (33%). Mean±SD (and range) plasma caffeine and paraxanthine levels were 22.3±20 umol/l (1.7-98.4) and 9.4±6 umol/l (1.8-28.9) respectively. Seven athletes (14%) finished with plasma caffeine levels > 40 umol/l. Plasma values from elite athletes did not differ from age group competitiors. Surprisingly, despite the prevalence of its consumption and the training experience of this athletic group many participants remained either confused or misinformed of its legality. Levels of plasma caffeine taken immediately post race indicate that athletes completing in ironman races often finish with quantities of caffeine that have been shown to improve endurance performance (i.e. approx 20umol/l or a dose of approx 3 mg/kg bw)2,3. Average paraxanthine levels would indicate that the initiation of caffeine ingestion was typically ≥3-4 hrs prior to race completion.4 This widespread use of caffeine by ironman athletes appears largley the result of self research and peer experimentation rather than by consultation with qualified professionals.

1.World Anti-Doping Agency Press Release "WADA Executive Committee: Approves the 2006 Prohibited List"Dated: September 20, 2005.

2. Graham, T., & Spreit, L. (1995). Metabolic, catecholamine, and exercise performance responses to various doses of caffeine. J Appl Physiol, 78(3), 867-874.

3. Cox, G., Desbrow, B., Montgomery, P., Anderson, M., Bruce, C., Macrides, T., et al. (2002). Effect of different protocols of caffeine intake on metabolism and endurance performance. J Appl Physiol, 93, 990-999.

4. McLean, C., & Graham, T. (2002). Effects of exercise and thermal stress on caffeine pharmacokinetics in men and eumenorrheic women. J Appl Physiol, 93, 1471-1478.

RELATIONSHIP BETWEEN BODY COMPOSITION, BONE MINERAL DENSITY AND DIETARY INTAKE IN ADOLESCENT ELITE FEMALE ARTISTIC GYMNASTS

García, A., Torres, A., Palacios, N., Garrido, G.

Faculty of Physical Activity and Sport Sciences (U.P.M.), Spain

Introduction

Artistic gymnastics is a speciality sport that must be started at an early age to achieve elite status. It is an impact sport that requires both physical (strength, speed and balance) and non-physical qualities (harmony, grace and risk). Traditionally body image and weight control are areas of concern in this sport.

We evaluated body composition, bone composition and food intake of these adolescens elite artistic female gymnasts. We looked for the relationships between certain micronutrients and bone composition.

Methods

Subjects were 16 Spanish adolescent gymnasts of National Team calibre age=15.5(1.6)yr; ht=151.6(4.2)cm; wt=43.7(4.9)kg; BMI=19.0(14.7)kg/m2; age of onset of training 6.5 (1.5)yr; time spent elite training=5.0(2.7)yr.

Diet composition was estimated by food weighing (Mettler-Toledo scale with 1g accuracy) for a 5 day period. During the same 5 day period, they completed a 24h activity questionnaire. Bone mineral density (BMD), bone mineral content (BMC), and body composition were measured by Dual-Energy X-ray Absorptiometry (DEXA) with a Norland XR-46 densitometer. Bone age was determined by X ray analysis of the non dominant hand.

Results

Energy intake (kcal/d) was 1768(261) and percentage of energy from macronutrients=20%P, 54%CH, 26%L. Percentage of energy at differents meals= 28%Breakfast, 30%Lunch, 30%Dinner, 12%Snacks. We found marginal intake with respect to the recommendations for: calcium (mg)=1137.1(245.3); magnesium (mg)=259.5(50.4) (both related to bone composition); vitamin E (mg)=8.4(2.2) and fiber (g)=15.7(4.1). Regarding the different meals calcium intakes come from (40%B; 14%L; 34%D; 12%S) and magnesium (28%B; 30%L; 33%D; 19%S); main food group for calcium and magnesium intake were dairy (75%) and cereal groups (28%) respectively. Gymnasts showed a retardation in bone aged of 1.2(1.2)yr; menarche aged=15.5(2.1)yr. Body composition was lean body mass LBM(g) =36096(3344); fat mass FM (g)=5933(1728); percentage of fat %F=13%; and total Body mineral content BMC(g)=1993.3(515.1). Different anatomical areas (L2-L4, femoral neck, proximal forearm) showed BMD (g/cm2) 0.9792(0.1294), 1.0367(0.1274), 0.6840(0.0639) and BMC (g) 35.792(6.100), 2.698(0.424), 1.825(0.215) respectively. No significant correlation was found between micronutrient intakes (calcium and magnesium) and bone composition. A positive relationship ($p<0.05$) was found between energy intake and FM but not to LBM.

Discussion/Conclusion

Energy intake (kcal/d), calcium and magnesium were lower than recommended but similar to the values reported by others for similar populations (1). BMD and BMC were higher than sedentary peers, specifically in high impact areas. To increase calcium and magnesium content in the diet we propose a serving more per day of dairy calcium fortified and whole cereal products.

1. Bricout, V.A. (2003). Science and Sport, 18, 65-73.

2. IOM. Dietary Reference Intakes (1997; 2000; 2002). Washington (DC): National Academy Press.

THE GLYCEMIC INDEX AND PHYSICAL ACTIVITY

Mettler, S., Lamprecht-Rusca, F., Stoffel-Kurt, N., Wenk, C., Colombani, P.C.

ETH Zurich, Switzerland

Background: A food's GI is a percentage representing the area under the blood glucose response curve (over two hours and measured at defined intervals) relative to the blood glucose response curve of a reference food (glucose or white bread). One of the GI's characteristics is that it describes a specific food and does not seem to be related to subject specific factors such as age, gender, body mass index, ethnicity or absolute glycemic response. However, we recently have detected a substantial 25 GI unit difference in a commercially available breakfast cereal's GI when comparing endurance trained to sedentary subjects (Mettler et al, in press).

Objective: We therefore intended to validate the results and to further investigate the possible impact of the subjects' training status on the glycemic index.

Subjects and design: Young, adult males of normal body mass index and normal glucose tolerance were tested twice with a 50 g reference glucose solution and twice with a breakfast cereal containing 50 g of available carbohydrates in a randomized order. Ten subjects were sedentary (SE), 12 were moderately trained (MT) and 12 were endurance trained (ET). Blood glucose and insulin were measured.

Results: The GI (80±22, 63±18, 57±15 for SE, MT and ET respectively, mean±SD) differed significantly between SE and ET subjects ($p=0.02$, mean difference: 23 GI units, 95 % CI = 3 42 GI units). The GI of the MT subjects was intermediary, but did not differ significantly from the SE or ET subjects. The insulin index did not differ significantly between the groups ($p=0.65$).

Conclusion: In accordance with our previous results (Mettler et al, in press), we observed a GI dependence of the commercially available breakfast cereal on the training state of the healthy males. The training state is the first reported factor influencing the GI that is subject specific and not food specific.

References: Mettler S, Wenk C and Colombani PC (in press): Influence of the Training Status on the Glycemic Index. Int.J.Vitam.Nutr.Res.

POST-CIRCUIT RESISTANCE EXERCISE GLUCOSE FEEDING ON GHRELIN RESPONSES IN MALE COLLAGE STUDENTS

Ghanbari-Niaki, A., Fathi, R.

Tarbiat Modares Universit (TMU), Iran

Ghrelin has been reported to increase food intake and acts on energy balance in human and animals. Plasma ghrelin is changing in several circumstance such as fasting, weigh reduction, obesity, nutrition disorders, macronutrient intake, glucose and insulin injection and after a concentric exercise. A changes in plasma ghrelin in several circumstance such as fasting, weigh reduction, , macronutrient intake, glucose injection and after a concentric exercise. The purpose of this study was to investigate the effect of glucose (0.5g/kg of weight) feeding immediately after a single bout of circuit resistance exercise %60 1RM, 10exercise, 20s for each 3 circuits) . Fourteen college students (18-23 year in age, 160-184 cm in height, 62-99kg in weight and 21.4-29.3 in BMI) volunteered in this study. Blood samples were taken immediately , 30min, and 60min of either glucose (0.5g/kg of weight) or equal volume of water ingestion in overnight fast state . The results indicate that during first 30min of recovery ghrelin significantly increased in both groups(from 97 ± 16,and 79 ±

11.3pg/ml to 131± 19 and 135 ± 16.6 pg/ml in glucose and water group respectively). However, during the 60min of recovery plasma ghrelin was decreased in glucose group (from131± 19 pg/ml to 112.3± 28 pg/ml) but it increased in water group(from 135 ± 16.6 pg/ml to 255 ± 63 pg/ml). This is the first finding indicate that glucose feeding immediately after a single circuit resistance exercise reduces plasma ghrelin.

EFFECT OF SMALL DOSES OF ALCOHOL ON THE ENDURANCE PERFORMANCE OF TRAINED CYCLISTS

Lecoultre, V., Schutz, Y.

University of Lausanne, Switzerland

Introduction: Alcohol (OH) is considered among athletes as deleterious to endurance performance. However, athletes' OH consumption in most western countries is similar to their non-athletes counterparts, and sometimes it occurs before training session/competition. The effect of OH may be detrimental to performance, as onset of early hypoglycemia, alteration of cardiac work, increase of diuresis or alteration of neuro-muscular excitability. Nevertheless, some effects of OH could be beneficial to performance, i.e. by an increase of self confidence and a decrease in pain perception and anxiety.

The aim of this study was to investigate the acute effect of a small alcohol dose (approximately one standard dose) on endurance performance and metabolic response of trained amateur cyclists.

Methods: 13 male well-trained cyclists took part to this study. After measurement of maximal aerobic power and VO2max, they familiarized with a 60 minutes time-trial (TT). Subjects then came twice to the lab in standardized nutritional conditions and completed the TT in a randomized single blind condition. The TT was performed in a calorimetric chamber 30 minutes after drinking a cold fruit juice solution containing 0.5 ml OH per kg fat free mass (25 g OH) and 50 g of carbohydrates (CHO) or a control (C) solution of the same volume and containing the same amounts of CHO. Power, heart rate, pedaling cadence, VO2, VCO2, energy expenditure (EE) were continuously recorded. Blood alcohol level, glycemia, blood lactate and ratings of perceived exertion (RPE) were measured at regular intervals.

Results: At the start of the TT, blood alcohol levels reached 0.18 ± 0.6 ‰.

OH induced a significant ($p< 0.01$) decrease of global performance vs. C, as assessed by average power (OH: 233 ± 23 W vs. C: 243 ± 24 W). Time course of mechanical power was influenced by OH, the latter inducing an early decrease of power during the TT compared to control ($p<0.01$). In OH condition, VO2, VCO2, EE and glucose oxidation were significantly lower ($p< 0.05$) compared to C. However, this is related to the lower power output observed during the OH trial. In contrast, OH did not influence gross efficiency, global heart rate, RPE, glycemia and blood lactate concentration.

Discussion: These results show that consecutive to acute low dose of OH ingestion, a decrease of high intensity endurance performance occured. This decrease was not related to modifications of metabolic or physiologic parameters such heart rate, glycemia or blood lactate concentration. These results suggest a central effect of OH affecting either integrated peripheral feedback or central drive. A cephalic response after the ingestion of OH and/or a metabolic effect after intestinal absorbtion may affect performance.

Conclusion : Performance of well trained amateurs cyclists during a 1 hour TT was significantly decreased by low acute dosage of OH producing alcoolemia much below 0.5 ‰. The absence of OH induced metabolic alterations suggest that the decreased performance may be due to a modulation of central drive or peripheral feedback.

Oral presentation (OP)

OP3-10 Psychology 5/5 - "Turin FG"

THE COACH-ATHLETE RELATIONSHIP: WHEN INTENSIVE TRAINING BECOMES EMOTIONAL ABUSE

Kerr, G.K., Stirling, A.

University of Toronto, Canada

The coach-athlete relationship can be one of the most important and influential relationships experienced by a young athlete within a competitive sport environment. In elite sport, it is not uncommon for athletes to identify their coach as a primary mentor and for athletes to spend more time with their coach than with their family. With coaches today pushing athletes to physiological and psychological extremes in pursuit of sporting excellence it is important to continuously question the means by which the end goal of optimal performance is reached. What stands as appropriate and inappropriate coaching behavior is currently an issue of controversy within sporting communities. Elite sport has traditionally been predominated by an authoritarian approach to coaching athletes in which yelling, directing or disparaging comments are often viewed as a required part of the coaching process to 'toughen up' high-performance athletes. It is curious that these commonly used coaching practices would not be tolerated from teachers or other instructors of young people. Interestingly, very little research has attempted to explore the topic of emotional abuse in sport. This presentation will report on the findings of a study designed to investigate elite athletes' experiences of the coach-athlete relationship. Semi-structured interviews were conducted with 5 retired elite female gymnasts and 5 retired elite female swimmers. Results revealed that the coaches exerted substantial power over the athletes, and that this power extended beyond athletic endeavours to other areas of the athletes' lives. The significant influence a coach has over his or her athlete ultimately creates a position of vulnerability to the abuse of the athletes. The major forms of emotional abuse reported by the retired elite athletes included shouting, belittling, humiliation, and avoidance, all of which had a negative impact on the athlete's sense of self. Findings of the current study also revealed that the athletes interpreted coaching practices as 'normal' during their athletic careers but relabeled specific coaching behaviors as emotionally abusive once retired from sport. These findings are interpreted to suggest that potentially emotionally abusive methods are often used in the coach-athlete relationship in order to produce successful performances in elite sport. This presentation will address the types of emotional abuse experienced by the athletes, the process by which this abuse occurs, and criteria for establishing appropriate coaching behavior in sport. Furthermore, this presentation will propose an innovative approach to coaching, the education and mentoring of coaches, and the development of elite athletes.

LEADER BEHAVIORS IN OUTDOOR ADVANTURE PROGRAMS IN TURKEY (A CASE STUDY)

Dinç, S.C., Bulgu, N.

Hacettepe University, Turkey

Over a period of 25 years, recreational outdoor adventure popularity has increased in Turkey, especially around mountain environment. Because of its excitement and fun, more and more people are participate in a series climbing party. According to Graydon (1992), the safety, success and fun of a climb depends for the most part on leadership and organization. Thus, the purpose of the study was to determine leader behaviour which are exhibited by the climbing party leaders, and perceived and preferred leader behaviour that are desired by participants which match the situational requirements throughout the outdoor activity. The present results serve as a pilot study to refine an outdoor leadership scale in Turkey.

The method applied in this study was qualitative in which data were collected through observation, focus group and interviews. A total of 63 activity participants (22 female, 41 male) whose age ranging from 24 to 46 years, attended to 8 focus group sessions which were recorded with video camera and individual in-depth interviews were made with their 11 male climbing leaders (28-37 years) after observations on the climbing party.

The responses and observation field notes were transcribed word for word and distributed to four faculty members in sport recreation program. The evaluators categorized each response of leaders and activity participants into 8 meaningful category in leadership behaviour which contains aware of risks and manage it, decision making in activity, social interaction and teamwork, personal interaction with participant, mutual trust, excitement associated with activity, wilderness and environmental ethics and role modelling.

As a conclusion the findings of this study indicated that both leaders and activity participants agree with each other in opinion that the outdoor leader experience is essential to reach objectives in outdoor pursuit safety. It also indicated that leader behaviour determine participant activity satisfaction, motivation, knowledge, low impact practices during the activity. It is remarkable another findings that were discrepancy between participant preference and leader favour about risk perceptions in the same situation during the activity. These different perceptions might cause discrepancy in terms of leadership style.

Graydon, D. (1992). MOUNTAINEERING The Freedom of the Hills. 5th Edition, Seattle: Mountaineers.

TEAM VALUE AND PERFORMANCE IN SPORT TEAMS

Sjovold, E., Hoigaard, R.

Norwegian University of Science and technology, Norway

Team culture and team values are assumed to have significant impact on team performance. Team culture can be defined as the extent of values shared by team members and moreover Bales (1999) defined values as, "a mental process in the mind of an individual that relates perceptions, images, fantasies, and concepts to each other" (p. 86). Given the importance of team value there is somewhat surprising when Kao and Cheng (2005) states that no empirical attempt has been made to assess team culture, and furthermore that there is a lack of measurements to make such assessing. We argue that the culture and values of high performance teams fit their specific task and context. No general approach will benefit team development and therefore the need for carefully measurement and feedback is mandatory for success.

At least in Norway most practitioners base their interventions on a "one-size-fit-all approach" stemmed either from fixed phase models like Tuckman's (Tuckman 1965, Tuckman and Jensen 1977), role preference model like Belbin (1981) or both in combination. Having worked with high performance teams and studied groups for more than 25 years, we still have not found any group that have developed according to a fixed phase model, or identified an "ideal" role structure in any high performing team. Quite contrary is our experience that most groups very quickly adapt to the level of development (maturity) and arrange their role structure to fit their task and the context in which they operate. It is very rare to find two teams showing the same role-structure or level of maturity. This is especially true even when looking at high performance teams. However, there is no reason to doubt the findings of neither Tuckman nor Belbin. Tuckman's therapy groups surely followed a sequence "forming", "storming", "norming" and "performing". But they were therapy groups, not managerial, project or sport teams. Belbin's groups of managers conducting their highly structured business-game surely performed best with what he suggested as the ideal role structure. But that was in the context of that particular business game, not as managers operating in a complex business environment or players in a world class sports team. There exists no documentation that supports the assumption that all groups follow the same sequences of development. Neither so the assumption that one type of role-structure is best to meet all situations. McGrath (1991) states that such assumptions rise from the fact that most researches have studied ad hoc students groups, and not "real-life" groups in real settings.

Based on the lack in value research in sport the purpose of this study is two fold. First, give an overview of The Systematizing Person-Group Relations (SPGR) (Sjøvold, 1995) as one appropriate theory and method for assessing team culture and values. Secondly, illustrate the use of SPGR in measuring the future effective team value in a world class handball team.

WHEN LESS IS MORE - DECISION MAKING IN TEAM SPORTS

Raab, M., Lempertz, C., Gärtner, K., Zastrow, H., Arnold, A., Tielemann, N.

University of Flensburg, Germany

In team sports decision making receives growing interest in research. Whereas there are many empirical findings and paradigms present a unified theory explaining the majority of phenomena is still absent. We apply a dynamic theory because it is better capable in principle to describe team sport relevant phenomena such as time-pressure decisions, predictions of decision times, or preference reversals.

One development in particular will be demonstrated in this abstract, namely the integration of paradigms such as eye-tracking and option-generation tests evaluating theoretical assumptions. Previous work has shown that generating few options in an attack situation such as in handball and choosing the first option results in better decisions than generating more options and choosing options later in the generation process (Johnson & Raab, 2003). However how these effective strategies are learned and dependent on gaze behavior is unknown and will be tested in this study.

It is assumed that visual strategies with more fixations in different segments of the presented attack situation will result in more options generated and poorer choices compared to visual strategies implementing a lower amount of fixations by a selected spatial distribution. These spatial strategies should be more present in experienced players compared to more novice players.

Four age groups in handball (n = 59) with different expertise are tested in regard of their individual decision making competences using eye-tracking method and an option generation test. In a handball video test participants decided by verbal recording intuitive choices in an attack situation, generated alternative choices and finally decided for the best option. During this test the number of fixations, fixation duration and fixation sequence was recorded.

The results demonstrate that (a) an expertise effect for decision time, $F(3, 57) = 2.95$; $p < .05$; (b) more fixations of less experienced players, $F(3, 57) = 2.75$; $p < 05$, (c) a less-is-more effect support that less options generated result in better choices, $F(3, 57) = 73.01$; $p = .001$ that is more prominent in experienced players. In addition gaze strategies that concentrate particular on the predicted segments of the display result in better choices than distributed fixation strategies. Again evidence for a less-is-more effect on the physiological level, indicating potentially a causal relation between these two measures was found.

These results demonstrate that lab simulated decision making can be described by a less-is-more effect coming from a dynamic theoretical perspective of sampling important information. Conclusions from the project in regard on visual training and decision making training are provided.

References

Johnson, J. & Raab, M. (2003). Take The First: Option generation and resulting choices. Organizational Behavior and Human Decision Processes, 91, 215-229.

PREVALENCE OF COACH BURNOUT IN ELITE SOCCER

Hjälm, S., Hassmén, P., Kenttä, G., Gustafsson, H.

Örebro University, Sweden

Introduction

Burnout is a multidimensional syndrome that affects not only those working in traditional helping professions but also athletic coaches are afflicted (Raedeke, 2004). Little is, however, known in regard to the prevalence of burnout among coaches, especially among those coaching at the elite level (Goodger, Gorely, & Harwood, 2004). The purpose of this study was therefore to examine the prevalence of burnout in a population of elite soccer coaches, active either in the First or Second league for men or the First league for women.

Methods

In a population of 53 elite soccer coaches in Sweden, 13 coaching in the First league for men, 14 in the First league for women, and 20 in the Second league for men volunteered to participate (89%). Burnout levels were measured using the Maslach Burnout Inventory Educators Survey (Maslach, Jackson, & Leiter, 1996), slightly modified by substituting the word "student" with "athlete".

Results

Significantly ($F2,44=4.88$, $p<.02$) more coaches in the First league for women (71%) experienced a high level of Emotional Exhaustion as compared to those coaching in the First league for men (23%) or in the Second league for men (45%). More coaches in the First league for women also experienced problems associated with Depersonalization and Personal Accomplishment than coaches in the other two groups, although these differences were not statistically significant ($ps>.09$). All coaches in the First league for men reported being on fulltime coaching contracts, in contrast to only 10% in the First league for women and 50% in the Second league for men. Support staff was also more frequent in the First league for men (5-6) than in the league for women (3-4) or Second league for men (4-5).

Discussion

More coaches active in the Premier league for women suffer from signs of burnout than either of the groups coaching men. Higher financial strain, limited support, and possibly conflicting demands from female and male soccer players can explain these differences in burnout prevalence. Because coach turnover is a serious problem in most sports (cf. Raedeke, 2004), further research to detect precursors of burnout and whether teams with men or women places different demands on their coaches is warranted. We suggest that both coaches and athletes are included in future studies to also cover the interplay between coach and athlete and the complex communication process inherent in most sports.

References

Goodger, K., Gorely, T., & Harwood, C. (2004). A systematic review of burnout in sport. Paper presented at the meeting of the 19th Annual Conference of the Association for the Advancement of Applied Sport Psychology (AAASP), Minneapolis, MN, USA.

Maslach, C., Jackson, S. E., & Leiter, M. P. (1996). Maslach Burnout Inventory: Manual (3rd ed.). Research edition. Palo Alto, CA: Consulting Psychologist Press.

Raedeke, T. D. (2004). Coach commitment and burnout: A one-year follow-up. Journal of Applied Sport Psychology, 16, 333-349.

14:15 - 15:15

Poster presentation (PP)

PP3-01 Physiology 1-9 - "Exhibition Hall"

INCREASES OF STRENGTH AND RESISTENCE TO FATIGUE IN RESPONSE TO STRENGTH TRAINING PROGRAMS WITH DIFFERENT EXTERNAL LOADS

Bravy, Y., Netreba, A., Vinogradova, O.

State Research Center of The Russian Federarion Institute for Biomedical Problems RSA, Russia

The aim of investigation is to reveal the effects of three strength training programs upon contractile properties of knee extensors.

30 young physically active males gave their informed consent to participate in the experiment. Their hip and knee extensors were trained using training device "leg press" with pneumatic drive. They were divided into three equal groups trained with different intensities: low – 20-30% of maximal voluntary contraction (MVC, LI-group), medium – 60%MVC (MI-group), and high – 90% MVC (HI-group). The characteristic property of MI-training regime was that the movement was stopped before reaching the end point and the countermovement began immediately. The subjects were trained for 9 weeks, three times a week. On the first day the heavy session (high volume of load)

was performed and on the third and fifth days the "maintaining" sessions (low volumes of load). Before, during (every other week) and after 9 week training the legs strength was tested using 1 RM approach. The resistance to fatigue during 45 maximal isokinetic knee extensions at the angular velocity of 120 degrees per s was recorded before and after training period.

After 9 weeks strength training increases of maximal voluntary contraction in training regime (1 RM) were recorded in all training groups. The highest increment was recorded for HI-group. The increment in MI-group was 31% and did not differ significantly from that in HI-group. LI-group demonstrated the lowest increment of 18%. The strength in HI- and LI-groups increased rapidly during the first period of training and at the third week it was comparable with the post-training value. The MI-group demonstrated an even dynamics during the whole training period. The differences in the strength dynamics between groups might be related to the differences of training effects upon central and peripheral parts of the neuro-muscular system. The HI- and LI-groups were motivated to move leg as quickly as possible that is to improve central control mechanisms, whereas MI-group performed the extension with very low speed, and the movement was associated with a considerable accumulation of metabolites in working muscle groups which is believed to trigger the muscle hypertrophy.

Resistance to fatigue of knee extensors significantly increased after 9 weeks training in MI-group. The observation might be related to the fact that the subjects were motivated for overcoming the pain sensation in working muscles arising as a result of metabolic changes, accumulation of hydrogen ions in particular. Thus the increase of muscle strength caused by moderate training without relaxation is comparable to the increase achieved with higher training loads, moreover this training mode allows to improve resistance to fatigue.

RELATION BETWEEN THE RECOVERY AND PERFORMANCE VARIBLES IN SPANISH ELITE CYCLISTS

Benito, P.J., Meléndez, A., Calderón, F.J., Martín, C., Díaz, V., Peinado, A.B., Morencos, E.

Politecnical University of Madrid, Spain

INTRODUCTION Besides being useful as an alternative indicator of the assimilation of training loads, the variables controled during the recovery (REC) provide information about the state of preparation for aerobic endurance trials(Hautala y col., 2006, Martinmaki y col., 2006). The Excess Postexercise Oxygen Consumption (EPOC) is also considered to be a great indicator of the load magnitude. The principal aim of this study was to analyse the evolution of the ventilation (VE), Heart rate (HR) and the EPOC, during the following 20 min. to a maximal ergospirometric trial. SUBJECTS AND METHODS Twenty cyclists and 12 triathletes participated in this study. They were chosen from the group of cyclist and triathletes of the Comunidad de Madrid (Spain), to achieve an incremental trial in a cicloergometer. Their age was 23,8(4,54) years old and the VO2 max, 76,54(10,20) ml kg min-1 of VO2 max. The protocol consisted of 15 min to establish the base line and a trial that started with 30w of load, the increments were o 5w s-1 in a cicloergometer, followed by a REC period of 20 min. The REC during the first two min. was done actively at 50 w and 70 rpm. RESULTS The EPOC, HR, as well as the Lactate (LH) concentration kept increased after the 20 min. of REC. The CO2 production and the VE rates have come back to rest levels. In the 5th minute the athletes have recovered the 85,1(4,56)% of the ventilatory reserve, calculated as the difference between the maximum VE obtained and the basal rates (6). The HR recovered was the 73,3(6,4)% of the reserve calculated with the previous procedure. It takes place dissociation between the VE and the LH REC, which remains increased once ended the 20 min of REC. There were not found any significant relation between the VO2 max (l m-1) or relative to weight (ml kg m-1),the maximun load obtained during the trial expressed in absolute values or relative to weight and the REC variables analysed. DISCUSSION The REC of the HR resulted to be faster in the firsts min. (first 2 min) and then it became slower. This agrees with previous papers(Thornton y Potteiger, 2002), but they differ in the moment in which the slow REC starts, what can provide information about the specificity of sport and level o training(Cruz y col., 2001).Bush et al. have demonstrated that the higher the exercise intensity the longer the REC and the higher the concentrations of LH in capillary blood (Bush y col., 1999). In this way it seems that the most effective way to accelerate the REC is through a combine method between active REC and massage (Monedero y Donne, 2000), but to achieve an active REC at the 50% of VO2 max. has resulted to be positive and is well-advised in most of the papers (Hautala y col., 2006, Martinmaki y col., 2006). CONCLUSIONS The REC process during the 20 first min. of a maximum trial is different for the breathing patterns with regard to the cardiac ones. At the end of the mentioned REC the VE has come back to rest levels, while the cardiac factors still remain increased.

FUNCTIONAL MODEL OF ITALIAN ICE HOCKEY

Galvani, C., Colombo, I., Cavalazzi, E., Marini, C., Sanbiase, C., Casolo, F., Faina, M.

Catholic University of Milan, Italy

It is actually accepted that, because of the shifts' high intensity, hockey players require to develop muscle strength, anaerobic power and anaerobic endurance; the duration of the game and the need to quickly recover also demands a good aerobic system. The functional model of ice hockey has been particularly studied in United States and Canada; on the contrary physiological qualities of European ice hockey players are not well known. Therefore the purpose of this study is to verify the actual energy expenditure of Italian ice hockey and the actual physiological qualities of ice hockey players.

18 ice hockey players, belonging to a middle rank club of Italian championship, volunteered to participate in the study and underwent both laboratory tests (incremental test to exhaustion on treadmill), and field test (modified repeated sprint skate test –RSS) in order to identify, respectively, V'O2max, peak blood lactate concentration (LApeak), anaerobic threshold (AT) and anaerobic power and capacity. Moreover 3 players played a simulated on-ice hockey match during which oxygen consumption and heart rate were continuously monitored, while blood lactate was detected at baseline and every 2 min (V'O2, HR, LA).

Physiological parameters of the studied hockey team are statistically lower for V'O2max (14%), anaerobic power (40%) and capacity (30%) if compared with USA ice hockey players (53.2vs60.4 ml/kg/min, $p<0.05$; 7.5vs11.5 W/kg, $p<0.005$; 6.1vs9.3 W/kg, $p<0.005$, respectively). The players performed for 6.03±0.49min of a 20-min game. Each shift lasts 54.07±5.27sec with an average of 7 shifts per game. V'O2 during the shifts reached 72.84±12.32% of V'O2max with average on-ice values of about 56.56±5.01% of V'O2max. Blood lactate remained elevated above resting values (average LA 4.98±0.74mM) with peak values of about 6.87±1.45mM.

These preliminary results on Italian ice hockey players demonstrate that they possess lower physiological qualities if compared with elite American or Canadian ice hockey players. Such a difference can be partly explained by the fact that the studied players don't practice any specific off-ice training session to enhance aerobic or anaerobic components. Besides this energy demand of the game doesn't seem high enough to stimulate to the maximum extent and in the optimal required amount both aerobic and anaerobic energy systems. Not taking into consideration the technical and tactical abilities, it could be concluded that low physiological qualities are the main limiting factors of Italian ice hockey players. Therefore attention should be given to the physical preparation both on-ice and off-ice.

1) Dreger RW, George JD (1999). Can J Appl Physiol, Dec, 24(6):559-69.

2) Montgomery DL (1988). Sports Med, Mar, (5):99-126.
3)Watson RC, Sargeant TL (1986). Can J Appl Sport Sci, (11) :218-224.

ANALYSIS OF BODY-BALANCE FUNCTIONS OF BALLET-DANCERS

Petfi, Á. 1, Ángyán, L. 2

1 University of Pécs, Medical Faculty, 2 University of Pécs, Faculty of Adult Education and Human Resou, Hungary

Background Dance as a conscious effort to move the body through a series of poses and pattern tracings, requires improving body-balancing functions parallel with other motor abilities (flexibility, endurance, speed, strength and power). Objective The aim of this study was to compare the effects of body size and physical endurance to body-balancing functions of ballet-dancers with a group of athletes. Methods The subjects were ten female ballet-dancers aging 18.9±1.4 years, and ten female athletes (5 basketball players and 5 football players) aging 18.3±1.2 years. Body weight, height, and fat (%) was measured, and body mass index (BMI) as well as waist-to-hip ratio was computed. Heart rate and arterial blood pressure was measured. The body-balancing functions were tested on one leg standing on a beam 50 cm long, 4 cm high and 3 cm wide. The subject should keep balanced in this position for one minute. Each time the subject lost her equilibrium, a new attempt started again. The number of attempts needed to keep in balance was computed. Dynamic balance was tested by walking on a sport beam 6 m long, 5 cm wide and 8 cm high. The postural sways were recorded during standing on two legs on a computerized stabilometer for 30 seconds. All measurements were done before and after a 20 meter shuttle run test. Results The BMI for ballet-dancers was 19.2, and 21 for the control group, respectively. This difference was statistically significant (p<0.04). The resting heart rate and arterial blood pressure values were in the normal range for both groups, no significant differences were found between them. The ballet-dancers performed better the different body-balance tests than the control group (Table I.)
Table I. Differences between ballet-dancers and controls performing body-balance tests
Body-balance test Difference p
One leg standing 3.8 attempts/min 0.02
Walking on the sport beam 1.1 attempts 0.05
Body sways 1.7◦ 0.002
The ballet-dancers showed no significant changes in the body-balancing functions after endurance test (shuttle run). Conclusions The present results show that both static and dynamic body-balancing functions of ballet-dancers are significantly better than that of the control group. Furthermore, the physical exercise (shuttle run) does not disturb the body-balancing functions.

LONGITUDINAL PROFILING OF URINARY STEROIDS BY GAS CHROMATOGRAPHY/COMBUSTION/ISOTOPE RATIO MASS SPECTROMETRY: DIET CHANGE MAY RESULT IN CARBON ISOTOPIC VARIATIONS

Saudan, C., Kamber, M., Barbati, G., Robinson, N., Desmarchelier, A., Mangin, P., Saugy, P.

Institut Universitaire de Médecine Légale, Switzerland

Longitudinal profiling of urinary steroids was investigated by using a gas chromatography/combustion/isotope ratio mass spectrometry (GC/C/IRMS) method. The carbon isotope ratio of three urinary testosterone (T) metabolites: androsterone, etiocholanolone, 5b-androstane-3a,17b-diol (5b-androstanediol) together with 16(5a)-androsten-3a-ol (androstenol) and 5b-pregnane-3a,20a-diol (5b-pregnanediol) was measured in urine samples collected from three top-level athletes over two years. Throughout the study, the subjects were living in Switzerland and were residing every year for a month or two in an African country. 13C-enrichment larger than 2.5 ‰ was observed for one subject after a two-month stay in Africa. Our findings reveal that 13C-enrichment caused by a diet change might be reduced if the stay in Africa was shorter or if the urine sample was not collected within the days after return to Switzerland. The steroids of interest in each sample did not show significant isotopic fractionation that could lead to false positive results in anti-doping testing. In contrast to the results obtained with the carbon isotopic ratio, profiling of urinary testosterone/epitestosterone (T/E) ratios was found to be unaffected by a diet change.

USE OF ISOTOPE RATIO MASS SPECTROMETRY TO DETECT DOPING WITH ORAL TESTOSTERONE UNDECANOATE: INTER-INDIVIDUAL VARIABILITY OF 13C/12C RATIO

Saudan, C., Baume, N., Desmarchelier, A., Strahm, E., Sottas, P.-E., Bagutti, C., Cauderay, M., Schumacher, Y.O., Mangin, P., Saugy, M.

Institut Universitaire de Médecine Légale, Switzerland

The metabolic effect of multiple oral testosterone undecanoate (TU) doses over 4 weeks was assessed in 7 voluntary men. The protocol was designed to detect accumulation of the substance by choosing the appropriate spot urines collections time and to study the urinary clearance of the substance after weeks of treatment. Urines were analysed by a new GC/C/IRMS method to establish the d13C-values of testosterone metabolites (androsterone and etiocholanolone) together with an endogenous reference compound (16(5a)-androsten-3a-ol). The significant differences in inter-individual metabolism following TU intake was illustrated by large variations in d13C-values of both T metabolites (max D d13C-values = 5.5 ‰), as well as by very stable longitudinal T/E profiles and carbon isotopic ratios in the first hours following administration. According to T/E ratios and d13C-values, the washout period after 80 mg TU intake was less than 48 hours for all subjects and no accumulation phenomenon was observed upon chronic oral administration.

HYSTERESIS OF FORCE AND SURFACE MECHANOMYOGRAM DURING MUSCLE STIMULATION

Orizio, C., Diemont, B., Gobbo, M.

University of Brescia, Italy

Aim of the work was to analyse the hysteresis of the force and of the surface mechanomyogram (MMG) signals in human tibialis anterior (TA) during a triangular, increasing-decreasing, linear variation of the stimulation rate. The MMG describes the muscle transverse thickening during contraction.
The TA of 8 healthy sedentary subjects (age 25-35 years) was supra-maximally stimulated at the most proximal motor point. The stimulation train lasted 12 s: during this period the frequency varied linearly, following a triangular fashion (2 Hz  fusion frequency (FF)  2Hz). FF provided force ripple ≤ 5% of the single twitch amplitude. The triangular stimulation train trailed a potentiation

phase. Force was detected by a load cell connected to a wooden plate strapped to the subject's foot. Muscle surface displacement was detected by a laser distance sensor pointed at the muscle belly. During the stimulation triangle the first and the last 5 mechanical responses, which presented isolated single twitches, were averaged to find the following parameters: peak of force (peak twitch, Pt), maximal contraction/relaxation rate (MCR, MRR) from the force signal; peak of displacement (Pd), maximal shortening/elongation rate (MSR, MER) from the MMG signal. Paired t-test was performed to verify significant changes in the twitch parameters at the beginning and at the end of the stimulation frequency triangle (significance $p< 0.05$). During the triangular stimulation the average force and MMG were calculated per each stimulation frequency. After this the area beneath the force-frequency relationship was calculated for both the on-going (OG) and the down-going (DG) phases of the stimulation triangle. The ratio between DG/OG areas was an estimation of the hysteretical process.

Results. OG phase: Pt= 4.73 ± 1.80 N, MCR= 22.37 ± 2.88 %Pt/s, MRR= 10.97 ± 1.81 %Pt/s, Pd= 1.05 ± 0.32 mm, MSR= 21.07 ± 3.90 %Pd/s, MER= 10.39 ± 1.63 %Pd/s; DG phase: Pt= 3.77 ± 1.52 N, MCR= 23.07 ± 4.60 %Pt/s, MRR= 10.01 ± 1.88 %Pt/s, Pd= 0.93 ± 0.33 mm, MSR= 21.88 ± 4.41 %Pd/s, MER= 11.69 ± 2.79 %Pd/s. Differences in the OG and DG twitch parameters were statistically significant for Pt and Pd. In all subjects a counterclock-wise hysteresis was present for force and MMG. This led to area ratios of 142.75 ± 21.39 (force) and 124.53 ± 14.13 (MMG).

Comments. The force hysteresis could have been explained by muscle activity potentiation or lengthening of the relaxation processes. Our results about force and MMG parameters during OG and DG single twitches do not support this hypothesis. More likely it seems that hysteresis may be due to the faster rise of tension than decay (because calcium release rate is larger than re-uptake and cross-bridges binding is faster than detaching). This conclusion is confirmed by the parallel MMG hysteresis showing that muscle contractile elements are shorter, at each stimulation frequency, and, as a consequence, more tension is generated.

MUSCLE STIMULATION TECHNIQUES UNDERESTIMATE CENTRAL CONTRIBUTIONS TO FATIGUE DURING MAXIMAL VOLUNTARY CONTRACTIONS

Swart, J., Tucker, R., Harley, Y., Albertus, Y., Noakes, T.D., St Clair Gibson, A.

Sports Science Institute of South Africa, South Africa

Percutaneous stimulation of muscle has been used to evaluate muscle fatigue and to estimate changes in the central nervous system which reduce force output, otherwise known as central activation failure (CAF) (1;2;5). Recently this technique has been promoted as an accurate measure of quantifying central and peripheral components of fatigue (3;4). We re-examine this interpretation and test the hypothesis that changes in central activation might contribute more to the force reduction measured during a 2 minute MVC than is currently believed. Twelve healthy male subjects performed a series of maximal voluntary contractions (MVC) of their right biceps brachii muscle. An initial 5 second MVC was followed by muscle stimulation of the biceps brachii. A two minute MVC was then performed, following which a second 5 second MVC and muscle stimulation were performed. Torque produced by muscle stimulation before and after the 2 min MVC declined from 13.1 ± 4 NM to 5.4 ± 2 NM (59%). Torque during the 2 minute MVC declined from 56.34 ± 11 NM to 18.7 ± 7 NM (67%). Central activation failure during the 2 minute MVC as calculated by muscle stimulation techniques was 12%. However, torque recorded during a 5 second MVC (36.1 ± 8 NM) which followed immediately after the 2 minute MVC was approximately double the average torque recorded at the end of the 2 minute MVC (18.7 ± 7 NM). There were no associated changes in stimulated muscle force before and after the 5 second MVC, indicating that recovery of peripheral fatigue did not contribute to the increase in force during the 5 second MVC. The increase in voluntary force production following the 2 min MVC was more than twice that expected if the calculated degree of central activation failure had been completely reversed. The results indicate that muscle stimulation techniques may significantly underestimate the reduction in force output resulting from central activation failure at the end of a 2 minute maximal voluntary isometric contraction.

Reference List

1. Kent-Braun, J. A. Central and peripheral contributions to muscle fatigue in humans during sustained maximal effort. Eur.J.Appl.Physiol Occup.Physiol 80: 57-63, 1999.

2. Merton, P. A. Voluntary strength and fatigue. J.Physiol 123: 553-564, 1954.

3. Schillings, M. L., W. Hoefsloot, D. F. Stegeman, and M. J. Zwarts. Relative contributions of central and peripheral factors to fatigue during a maximal sustained effort. Eur.J.Appl.Physiol 90: 562-568, 2003.

4. Schillings, M. L., D. F. Stegeman, and M. J. Zwarts. Determining central activation failure and peripheral fatigue in the course of sustained maximal voluntary contractions: a model-based approach. J.Appl.Physiol 98: 2292-2297, 2005.

5. Todd, G., J. L. Taylor, and S. C. Gandevia. Measurement of voluntary activation of fresh and fatigued human muscles using transcranial magnetic stimulation. J.Physiol 551: 661-671, 2003.

THE INFLUENCE OF CARBOHYDRATE CONSUMPTION ON ALTERATIONS IN LEUKOCYTES AND CYTOKINES FOLLOWING EXERCISE IN TEMPERATE AND HOT CONDITIONS

Peake, J., Abbiss, C., Peiffer, J., Nosaka, K., Laursen, P., Suzuki, K.

University of Queensland, Australia

Purpose: Consumption of carbohydrate during endurance exercise attenuates alterations in leukocyte counts and systemic cytokine concentrations. However, exercise in the heat may modify these effects, via lower oxidation of exogenous carbohydrate and greater muscle glycogenolysis. Therefore, we compared the influence of carbohydrate consumption on immune changes following exercise in temperate versus hot conditions. Methods: Subjects were 10 well-trained male cyclists (mean +/- SD VO2max 4.7 + 0.2 L/min). Each cyclist completed a placebo and a carbohydrate exercise trial in both temperate (18.1 +/- 0.4 deg C, 58 +/- 8% relative humidity [RH]) and hot conditions (32.2 +/- 0.7 deg C, 55 +/- 2% RH). The protocol for each trial involved steady-state cycling at 60% VO2max for 90 min, and then a 16-km time trial at each cyclist's fastest self-selected pace. The placebo and carbohydrate treatments consisted of a jelly solution (25% w/v) of low calorie content or sucrose, respectively. The cyclists consumed 0.48 g of placebo/carbohydrate jelly per kg body weight 15 min before exercise, and then 0.24 g jelly per kg body weight every 15 min up to and including 75 min during exercise. The cyclists consumed water ad libitum during exercise. Blood was sampled 30 min before exercise, as well as immediately after 90 min of steady-state exercise and the time trial. Results: Plasma glucose concentration increased significantly ($P<0.01$) following all four exercise trials, and was higher ($P=0.0002$) in the carbohydrate than the placebo trial following exercise in the heat. Total leukocyte, neutrophil, lymphocyte and monocyte cell counts increased following all exercise trials ($P<0.0001$). Carbohydrate attenuated total leukocyte and neutrophil counts ($P<0.05$) following exercise in both temperate and hot conditions, but this effect appeared to be greater in the heat. The

serum concentrations of the cytokines interleukin (IL)-6, IL-8, IL-10 and tumor necrosis factor (TNF)-alpha were elevated following all exercise trials (P<0.01). IL-8, IL-10 and TNF-alpha were all higher (P<0.05) following exercise in the heat; serum IL-1 receptor antagonist (IL-1ra) concentration increased only after the hot trials. Carbohydrate did not influence changes in any cytokines following exercise. Plasma norepinephrine concentration increased (P<0.0001) following all exercise trials, and was higher following exercise in the heat than the cold. Carbohydrate attenuated norepinephrine (P=0.02) following exercise in the heat. Conclusion: Carbohydrate appeared to attenuate the mobilisation of leukocytes during exercise in the heat, possibly by reducing blood flow, resulting in less demargination of leukocytes from endothelial surfaces into the circulation. The lack of any effect of carbohydrate on cytokine responses to exercise contrasts with previous findings. This disparity could possibly be attributed to differences in exercise intensity and/or the absorption of carbohydrate jelly versus drink.

A COMPARISON OF MUSCLE DAMAGE AND SYSTEMIC INFLAMMATORY RESPONSES TO SUBMAXIMAL VERSUS MAXIMAL ECCENTRIC EXERCISE

Peake, J., Nosaka, K., Muthalib, M., Suzuki, K.

University of Queensland, Australia

Purpose: Maximal eccentric exercise causes greater muscle damage than submaximal exercise. However, it is unknown whether there is also a greater systemic inflammatory response. Therefore, we compared alterations in markers of inflammation and muscle damage after submaximal versus maximal eccentric exercise. Methods: Using a cross-over design, 10 healthy young men not involved in regular resistance training firstly performed submaximal and then maximal eccentric exercise, separated by 2 weeks. The submaximal exercise protocol involved 10 sets of 60 eccentric actions of the elbow flexors of one arm at 10% of maximal isometric strength on an isokinetic dynamometer. Each set was separated by 1 min of rest. The maximal exercise protocol involved 10 sets of three maximal (100% strength) eccentric actions of the elbow flexors of the other arm on the dynamometer. Each set was separated by 3 min of rest. The range of motion and velocity of muscle action was 60–0 deg and 30 deg/s, respectively, and each muscle action was followed by 2 s of passive recovery. Thus, the total working time was 20 min for the submaximal trial and 60 s for the maximal trial. Blood was sampled, and maximal isometric strength and range of motion (ROM) were assessed before, immediately after, 0.5 h, 1 h, 3 h, 1 d, 2 d, 3 d and 4 d after exercise. Blood was analyzed for differential leukocyte counts, cytokines, C-reactive protein, myoglobin and creatine kinase. Results: Maximal isometric strength and ROM decreased significantly (P<0.0001) after both exercise trials. The decrease in strength and ROM were significantly greater (P < 0.01) following the maximal trial than the submaximal trial. Plasma myoglobin concentration and creatine kinase activity increased significantly (P=0.001) after both trials, however no significant differences existed between the trials. Total leukocyte and neutrophil counts were significantly elevated (P<0.01) 3 h after both trials, with no significant differences between the trials. Serum interleukin (IL)-6 concentration increased significantly (P<0.05) up to 3 h after the submaximal trial, but not after the maximal trial. In contrast, the serum concentration of the soluble receptor 1 for tumor necrosis factor (TNF)-alpha increased significantly (P<0.01) up to 1 d after the maximal trial, but not after the submaximal trial. The serum concentrations of IL-1 receptor antagonist (IL-1ra), IL-10, TNF-alpha, granulocyte-colony stimulating factor and C-reactive protein did not change significantly after either exercise trial. Conclusion: The larger decline in maximal isometric strength and ROM suggests that muscle damage was greater after maximal than submaximal eccentric exercise. However, the greater muscle damage was not associated with a stronger inflammatory response, at least at the systemic level. Inflammation may be restricted to local areas of damaged muscle tissue where leukocyte infiltration and pro-inflammatory cytokine production occur.

THE EFFECT OF REST ON RUNNING ECONOMY FOLLOWING ECCENTRICALLY INDUCED MUSCLE DAMAGE

Paschalis, V., Koutedakis, Y., Baltzopoulos, V., Mougios, V., Jamurtas, A.Z..

University of Thessaly, Greece

Introduction

Runners, in order to maintain their strength, use resistance training regularly in their training program. However, resistance training, especially when involving eccentric contractions, can result in muscle damage, which leads to muscle performance decline (3). Running economy has been shown to be negatively affected by downhill running 48 hours post-exercise (1) but this finding has not been confirmed by a study from our laboratory (4). It has been suggested that, compared to immobilization, engagement in activities with sore muscles after strenuous exercise leads to faster force recovery and provides some relief of delayed onset muscle soreness (DOMS) (5). On the other hand, light immobilization has been found to have no effect on enhancing recovery of muscle function and DOMS after eccentric exercise-induced muscle damage (6). Given the dearth and contradictory nature of the existing data, the purpose of this study was to examine whether rest, following an exercise session designed to cause muscle damage, can affect running economy.

Methods

Ten healthy male volunteers performed 120 maximal voluntary repetitions at an angular velocity of 1.05 rad∙s-1 applied in both legs. Following this session, subjects rested completely for 48 hours. Muscle damage indicators [Creatine kinase, DOMS], muscle performance indicators [eccentric, concentric and isometric peak torque at 60o and 110o knee flexion] and running economy indicators [oxygen consumption, pulmonary ventilation, respiratory exchange ratio, respiratory rate and heart rate during treadmill running at 2.2 and 3.3 m.s-1) were assessed pre- and 48 hours post-exercise.

Results

All studied muscle damage and performance indicators (table) revealed significant changes compared to pre-exercise data (p<0.05). However, except for a significant decline of heart rate (p<0.05), none of the other running economy parameters disclosed any significant changes (p>0.05).

Discussion

It is concluded that rest following intense eccentric exercise does not affect the development of muscle damage, muscle performance or running economy. Short-term immobilization after injury is believed to allow newly formed granulation tissue to achieve a more rapid increase in tensile strength, allowing it to better withstand the forces created by contracting muscle (2). The role of exercise in relation to rest following muscle damage-induced eccentric exercise should be further investigated.

References

1. Braun WA and Dutto DJ (2003) Eur J Appl Physiol 90: 29-34

2. Jarvinen TA, Kaariainen M, Jarvinen M, Kalimo H (2000) Curr Opin Rheumatol 12: 155-61

3. Linnamo V, Bottas R, Komi PV (2000) J Eloctromyography and Kinesiology 10: 293-300
4. Paschalis V, Koutedakis Y, Baltzopoulos V, Mougios V, Jamurtas AZ, Theoharis V (2005) Int J Sports Med.26:827-31
5. Sayers SP, Clarkson PM, Lee J (2000) Med Sci Sports Exer 32: 1587-1592
6. Zainuddin Z, Hope P, Newton M, Sacco P, Nosaka K (2005) J Athl Train 40: 197-202.

GROWTH HORMONE RESPONSE TO 30 AND 50HZ WHOLE-BODY VIBRATION IN HEALTH YOUNG MEN AND WOMEN

Howard, K., Miller, O., Dowling, I., Hunter, A., Jakeman, P.

University of Limerick, Ireland

Little is known of the hormonal response to whole-body vibration (WBV) in humans. The neurogenic effect of vibration stimulates muscle afferents, reflex activation of alpha motoneurons and muscle contraction, i.e. a tonic vibration reflex (Cardinale and Bosco, 2003). Neurotransmitter pathways, including collaterals of the central motor command stimulated by WBV, could augment growth hormone (GH) secretion by acting directly on the anterior pituitary gland and/or by modulating the hypothalamic secretion of GH-releasing hormone (GHRH) or GH release-inhibiting hormone, somatostatin. Proprioceptor feedback from peripheral skeletal muscle subjected to vibration may also modulate pituitary GH release (McCall et al, 2000).

The aim of this study was (i) to investigate whether the growth hormone response to short-term whole-body vibration was dependent on the vibration load applied and (ii) whether the growth hormone response to whole-body vibration differed between the sexes. As the measured GH response has been shown to be assay dependent comparison with a second assay of 'biologically active' growth hormone (Strasburger et al, 1996) was performed.

Healthy young male (n=22) and female (n=19) subjects were exposed to vibration loads of 2mm displacement at a frequency of 30Hz and 50Hz that exerted a measured r.m.s. acceleration of 14 and 40 ms-2, respectively. Serum growth hormone was measured prior to and immediately following ten, 60s bouts of WBV in a standing position and the results compared to a resting control.

The GH response to WBV was found to be highly variable. All data are reported as the mean (SD) and analysed by paired Student's t-test. A positive increase in GH was observed in response to 30Hz WBV in 9 of the female (DGH 4.0(2.8) ng.ml-1; $P<0.05$) and 3 of the male (DGH 6.1(1.4) ng.ml-1; $P<0.05$) subjects. Subjects who responded to 30 Hz WBV also responded to 50Hz WBV but no significant difference in GH response to 50Hz was observed for either female (DGH 3.7(2.3) ng.ml-1) or male (DGH 4.5(1.5) ng.ml-1) subjects.

These data indicate WBV is more likely to induce a GH response in female than male subjects. It is not know whether the growth hormone response to vibration is frequency and/or acceleration dependent but exposure to a 3-fold increase in accelerative load of a 50Hz vibration stimulus was no more effective in inducing a GH response than a 30Hz stimulus in these subjects. Whether the benefit to muscle function purported to occur following long-term exposure to whole-body vibration is attributable to the enhanced secretion of this anabolic hormone remains to be determined.

REFERENCES

Cardinale M and Bosco C. Exerc. Sport Sci Rev. 2003;31(1):3-7.

McCall GE, Grindeland RE, Roy RR, Edgerton VR. J. Appl. Physiol. 2000;89:1137-1141.

Strasburger CJ, Wu Z, Pflaum C-D, Dressendorfer RA. J Clin Endocrinol Metab 1996;81:2613-2620.

Supported by an unrestricted loan of a vibration plate from Power Products (Global) Ltd, UK.

ANTHROPOMETRIC MEASURES, AGE AND GENDER AS PREDICTORS OF PERFORMANCE IN SIMPLE MOTOR SKILLS DURING CHILDHOOD AND ADOLESCENCE

Gortsila, E., Maridaki, M., Kellis, S., Kotzamanidis, C.

Univeristy of Athens, Greece

The present study investigated whether in childhood and adolescence performance in simple motor skills can be predicted from the age and gender of the subjects, as well as from the simple anthropometric measures of height, weight and their derivative BMI.

The study sample included 3911 school boys and girls aged from 7 to 13 years from the whole of Greece, randomly chosen through a stratified proportional sampling procedure. The motor skills measured were the height of a vertical jump with one hand from a standing position, the length of a horizontal overhead throw from a sitting position of a 1Kg ball and the average length covered during 1 second during a 20 meter sprint. For each of these dependent variables stepwise regression models were applied with age, gender, height, weight and BMI as the independent variables. BMI was categorized into lean, overweight and obese. The same procedures were repeated with the performance of the three motor skills adjusted for the subjects' height.

The results showed that performance in horizontal overhead ball-throwing can be fairly well forecasted from the predictors. The coefficient of determination (r-squared) was 58.0% with height, weight, gender, BMI group and age entering in this order the regression equation. The coefficient of BMI group was negative in all regression equations. With standing vertical jumping r-squared was 52.7%, with height, age, gender and BMI group entering the regression equation. The relation was weaker in the case of the speed of a 20 meter sprint (r-squared =28.6%, with height, gender, BMI group and age entering the regression equation). When the kinetic variables were adjusted for the subjects' height the regression model remained strong only for the horizontal overhead ball-throwing (r-squared =52.3%). For the vertical jump r-squared dropped to 9.0% and for the speed of a 20m sprint r-squared was 9.6%.

Height was the most important predictor in all cases. Boys performed better than girls in all three motor skills, while obesity had a negative effect on performance. Age was an important predictor but not a decisive one, which may be an indication that performance in the particular motor skills is not expected to exhibit a spectacular improvement during the age span under consideration.

The findings show that in childhood and adolescence performance in simple motor skills like horizontal overhead ball-throwing, where neuromuscular coordination does not play a significant role, can be fairly well predicted by the simplest anthropometric variables of height, weight and obesity as well as by the children's sex and age. A slightly more complex task like vertical jumping from a standing position does not fare as well in its prediction, while the performance in more compound tasks like running requires much more than the simple information given by anthropometric measures to be adequately explained.

THE IMPORTANCE OF IL-6 IN THE RESPONSE TO SHORT-TERM INTERMITTENT IMMOBILISATION STRESS IN RATS, BOTH IN CIRCULATION AND DOWNSTREAM: ILLUMINATED USING AN IL-6 ANTIBODY

Smith, C., Wilson, N.W., Louw, A., Myburgh, K.H.

Stellenbosch University, South Africa

The importance of interleukin (IL)-6 in a) the stress-induced activation of the HPA-axis, c) the immune cell inflammatory response, and c) the downstream tissue responsiveness to glucocorticoids (GC) was investigated, using an antibody to IL-6 (Ab, 1ug/rat/day i.p.) in a model of intermittent immobilisation stress in male Wistar rats. Four experimental groups (each n=10) were used: non-stressed placebo-treated (saline i.p.) rats (CP), non-stressed Ab-treated rats (CA), placebo-treated rats subjected to 2hr/day of immobilisation (IP) and Ab-treated immobilised rats (IA). Rats were sacrificed by decapitation after 4 days, 24 hours after the last intervention procedure. Data show that immobilisation stress significantly increased serum corticosterone (CORT) levels. Ab treatment delayed body mass loss and attenuated the stress-induced increase in [CORT] ([Mean±SD]: CP 21.2±17.7; CA 26.0±21.8; IP 50.3±14.9; IA 35.7±24.4 ng/ml). Serum IL-1 was significantly lower in IA compared to all other groups. Neither immune cell counts, nor non-stimulated reactivity of PBMCs in vitro differed between groups. However, Ab resulted in increased LPS-induced IL-6 secretion by PBMCs in vitro, independent of immobilisation. Peripherally, Ab augmented the stress-induced downregulation of GC receptor levels, and upregulated tyrosine aminotransferase (TAT) and glutamine synthetase (GS) activity in both skeletal muscle and liver (e.g. TATliver (U/mg protein/min): CP, 226.5±57.7; CA, 287.8±90.4; IP, 599.5±186.8; IA, 756.9±201.2), indicating that IL-6 antagonizes peripheral GC action during the stress response. Results show that a) stress-induced activation of the HPA-axis is dependent on IL-6, b) IL-6 plays a major role in maintenance of IL-1 levels during stress, c) IL-1 plays a role in PBMC function that is usually obscured by IL-6, and d) IL-6 antagonizes GC action in skeletal muscle and liver, suggesting that IL-6 may function as a molecular brake to prevent an overshoot of GC action.

CARDIORESPIRATORY RESPONSE TO 20 KM OF ROAD RUNNING ESTIMATED BY THE COSMED K4B2

Kinoshita, N. 1, Tadokoro, K. 2, Ando, J. 3, Onishi, S. 1, Yamazaki, H. 1, Oguma, Y. 1, Katsukawa, F. 1

1 Keio University, 2 Kanagawa Prefectural Board of Education, 3 Ogusu Highschool, Japan

It is a scientific challenge to measure the energetics of 20 km of road running and there is no evidence by direct measurement for such long distance in a real condition. We estimated cardiorespiratory and metabolic responses to running a 20 km road race and assessed it by laboratory data.

The subject was a 37 year-old male runner (181 cm, 75 kg) who used to competitively participate in decathlon in his university and afterwards had been running 5 km on average everyday. He had participated in full marathon races and the best record was 3 hours and 29 min. VO2max was estimated by graded exercise test on treadmill in laboratory and on a separate day, submaximal and steady state VO2 were measured by multiple stages of 5-min running tests (between 10 and 12.6 km/hr) with 10-min recoveries between the stages on a 400-m outdoor track to yield a formula calculating O2 demand at given running velocity (Medbo, et al). The 20 km road race for the measurement was held on a calm day with 40% of relative humidity and 750 mmHg of barometric pressure. VO2, VCO2, minute ventilation (VE) and heart rate (HR) were measured by the Cosmed K4b2 and averaged by 30 sec. The running velocity was obtained by GPS and verified by lap times recorded using the wristwatch, both of which were worn by the subject. Aerobic energy expenditure was calculated according to Jeukendrup, et al., for every 30 sec and integrated for the entire race. O2 cost of running (Cr) was calculated by (VO2-VO2rest)/[running velocity].

VO2max and HRmax were 61.7 ml/kg/min and 202 bpm, respectively by laboratory test. The formula for the O2 demand was VO2 = 0.181*[running speed (m/min)] + 4.951 (r square = 1.0). The race time was 1 hour and 29 minutes. Running velocity, VO2, Cr and respiratory quotient were 216+/-21 m/min, 45.8+/-4.5 ml/kg/min, 189+/-23 ml/kg/km and 0.99+/-0.05, respectively and were relatively constant throughout the race. Despite of the constancy of VO2 (74.3+/-7.3% of VO2max), HR increased towards the end of the race; average %HR reserves of each 5 km were 79, 87, 91, and 95% in a row. VE, VE/VO2 and VE/VCO2 were 106+/-12 l/min, 31+/-2, and 31+/-2, respectively and gradually increased towards the end of the race. Measured VO2 were larger (5% on average) than predicted O2 demand besides the initial acceleration phase. Total aerobic energy expenditure was 1532 kcal (363 g of carbohydrate and 518 g of fat).

The Cosmed K4b2 was applicable for measurement in long distance road running. The results indicated that a good runner maintained a speed and O2 cost with larger VO2 expected from the track study during 20 km of road race. The ventilatory and O2 uptake efficiency slightly deteriorated towards the end of the race. The large difference between %VO2max and %HR reserve indicated that metabolic responses can not be accurately estimated by HR for such long distant road race.

REFERENCE

Medbo, et al (1988). J Appl Physiol 64:50-60.

Jeukendrup, et al (2005). Int J Sports Med 26: S28-37.

CONSISTENCY OF THE COSMED K4B2 WITH QUARK B2 IN MAXIMAL EXERCISE TEST FOR ENDURANCE ATHLETES

Kinoshita, N., Oguma, Y., Katsukawa, F., Onishi, S., Yamazaki, H.

Keio University, Japan

The purpose of the study was to compare the Cosmed K4b2 with the Quark b2 and to evaluate the change of consistency of K4b2 measurement.

The first trial was performed 2 months after the O2 sensor of the K4b2 was replaced. Maximal exercise tests were performed to 6 triathletes (20+/-1.8 yrs, 170+/-6 cm, 59.6+/-7.5 kg, VO2max; 4007+/-634 ml/min or 67.1+/-6.0 ml/kg/min) on treadmill. We used 3 K4b2s, each of which was randomly assigned to 2 subjects. Breath-by-breath analysis was performed by using a Cosmed kit for testing the K4b2 and Quark b2 simultaneously using the same turbine flowmeter which allowed independent gas analyses by each instrument using the same value of ventilatory parameters for each breath. The same tests were repeated to 2 triathletes 3 months after the first with the same 2 K4b2s and the Quark b2 as in the first. All calibration results were within the acceptable range in both trials but response time (T90) of O2 sensor in the K4b2 were 50 msec in the first and 200 msec in the second. Measured values averaged by 10sec were compared between the 2 instruments by Bland-Altman plots for each test where systemic and random biases were quantified by a log/log transformation.

In the first trial, the random biases of VO2, VCO2, and respiratory quotient were proportional to the size of measured values but not for the systemic biases which were within acceptable range; 2.4+/-1.1%, 2.5+/-1.7%, and 3.3+/-2.2%, respectively. No significant differences were observed in systemic biases for VO2 or VCO2 among 3 K4b2s. When these small systemic biases were neglected, random biases

were 3.6+/-0.8 %, 3.5+/-0.7%, and 2.5+/-0.3%, respectively. In the second trial, large systemic bias was evident in VO2 (9.2%) but not in VCO2 (2.7%) and the K4b2 underestimated VO2 proportionally to the size of measured values.

Systemic bias was evident only for VO2 in 5 months after the replacement of O2 sensor in the K4b2. Since the chemical property of the O2 sensor of the K4b2 (galvanic fuel cell) was time-dependent while that of the Quark b2 (zirconia) was highly stable, the large bias for VO2 in the second trial could be attributed to the change of the O2 sensor property and indeed, we observed prolongation of T90 despite of being within the acceptable range. Respiratory frequencies of the subjects were very high at the peak level (65+/-5/min) where the influence of T90 prolongation would be significant even if it was still within acceptable limits. This phenomenon might explain inconsistent results of the former studies about the accuracy of the K4b2.

We concluded when a newly installed O2 sensor was used or T90 of the O2 sensor was optimally adjusted, the K4b2 would provide closely comparable data with reliable values measured by the Quark b2 for the maximal tests of highly capable athletes. This concern might not be necessary for sedentary subjects or submaximal tests.

REFERENCE

Bland and Altman (1999). Stat Methods Med Res 8: 135-160.

MAXIMAL LACTATE STEADY STATE IN ALLOXAN DIABETIC RATS

Oliveira Camila, A.M., Ribeiro, C., Mota, C.S., Araújo, M.B., Zanirato, N.S., Luciano, E., Mello, M.A.

Unesp, Brazil

Several studies with animal models have demonstrated that physical activity counteracts the complications caused by diabetes, preventing cardiac dysfunctions, as well as improving glucose tolerance and homeostasis. However, the study of the metabolic effects of exercise in rats is frequently questioned due the lack of information about the intensity of effort performed by the animal during exercise. The ´maximal lactate steady state´ (MLSS), the higher concentration during exercise at which lactate entry in blood equals its removal, is considered the gold standard to determine the endurance exercise capacity and exercise intensity. Therefore, the aim of the present study was to determine the MLSS in diabetic rats during swimming exercise. Diabetes induction was made by intravenous alloxan administration (30 mg/Kg b.w.) in adult male Wistar rats after a 15-hour fasting (D, n = 10). Vehicle (citrate buffer) injected rats were used as control (C, n = 11). After diabetes induction rats were adapted to water for two weeks. At the end of this period blood samples were collected after a 15-hour fasting to confirm diabetes. After 48 hours, the MLSS tests started. The MLSS test, adapted to rat conditions by Gobatto et al. (2001), consisted of swimming sessions of 20 min in 100x80x80 cm swimming pools, supporting a load attached to chest of 4% b.w. in the D group and 5% b.w. in the C group in the first session. Then, depending on the result of the previous test the load was reduced, if the blood lactate rose continuously without stabilizing, or increased, if it did stabilize, in 0.5% b.w.. There was an interval of at least 48 hours between each evaluation and three to four tests were necessary to find the MLSS. Blood lactate was determined at rest and at each 5 min until the 20th min to find the MLSS. Blood lactate stabilization was defined as a lactate variation between the tenth and twentieth minute smaller than 1 mmol/l; and the MLSS, as the highest workload at which the blood lactate stabilized. Results were analyzed statistically by test t-student, with a level of significance of 5%. Confirming diabetes induction, the fasting blood glucose was higher in D than in C rats (C = 93.79 + 8.76; D = 328.57 + 63.69* mg/dl). The load corresponding to the MLSS was lower in the D group than in the C group (C = 5.80 + 0.80; D = 4.60 + 1.13* % b.w.). On the other hand, blood lactate stabilized in higher concentration in the D animals compared with the C animals (C = 5.13 + 1.50; D = 6.40 + 0.97* mmol/l). In short, we conclude that diabetes reduced the endurance capacity of the animals, what must be taken into account when submitting such animals to experimental protocols that use exercise.

Financial support: CAPES, CNPq and FAPESP (process 05/02139-0).

Gobatto, C. A.; Mello, M. A. R.; Sibuya, C. Y.; Azevedo, J. R. M.; Santos, L. A.; Kokubun, E. Maximal lactate steady state in rats submitted to swimming exercise. Comp Biochem Molecular Pathol Part A, v. 130, p.21-7, 2001.

BOVINE COLOSTRUM AND GOAT MILK POWDERS REDUCE HEAT-INDUCED "LEAKY GUT" IN RATS

Cummins, R.A. 1, Prosser, C. 2+3, Stelwagen, K. 2, Gill, N. 1, Milne, C. 4

1 Waikato Institute of Technology, 2 AgResearch Ruakura, 3 Dairy Goat Co-op(NZ) Ltd, 4 Anglesea Sp Med, New Zealand

'Leaky gut' is a condition in which hyperpermeability of the intestine compromises the gut's barrier function. Both heat and exercise can cause leaky gut. Leaky gut can be accompanied by nausea, cramps and diarrhoea and has been postulated to be a trigger for heat stroke under extreme conditions (Mosely and Gisolfi, 1993, Lambert 2004). Athletes who exercise for prolonged periods at high intensity in the heat may therefore be at risk of developing exertional heat stroke due to leaky gut. We report on two linked studies which assess the efficacy of supplementation with bovine colostrum and goat milk powder in reducing leaky gut.

In the first study we determined that bovine colostrum and goat milk powder each enabled a monolayer of cells grown in culture to maintain its integrity when challenged with EGTA. In the absence of colostrum or goat milk the trans-epithelial resistance of the cells fell to 60% of baseline when so challenged. In the second study, male rats were assigned to one of three dietary groups: standard diet (control group, n=8); standard diet plus bovine colostrum powder (1.7 g/kg; colostrum group, n=8) or standard diet plus goat milk powder (1.7 g/kg; goat milk group, n=8). Elevation of core body temperature of the control group to 41.5 degrees C increased transfer of Cr-EDTA from gut into blood 34-fold relative to ambient temperature conditions ($P<0.05$) indicative of increased gastrointestinal permeability. Significantly less ($P<0.01$) Cr-EDTA was transferred into blood in rats in either the colostrum group (27% of control value) or goat milk group (10% of control value) after similar heating. The changes in the colostrum group were not significantly different than those of the goat milk group ($p>0.05$). In view of the results of the cell culture study we suggest that the mechanism of the protective effect of bovine colostrum and goat milk powders involves direct modulation of tight junction permeability in the intestinal epithelium.

In summary, both bovine colostrum powder and dairy goat milk powder can attenuate heat-induced gastrointestinal hyperpermeability in rats. The next crucial step is to determine whether these supplements can prevent leaky gut in human athletes who are at risk of developing exertional heat stroke.

Acknowledgements

We thank Tatua Co-opertive Dairy Co Ltd. for bovine colostrum powder and Dairy Goat Co-operative (NZ) Ltd. goat milk powder. We acknowledge funding from Waikato Medical Research Foundation, Waikato Institute of Technology, Foundation for Research, Science and Technology and Dairy Goat Co-operative (NZ) Ltd.

References

Moseley P.L, and Gisolfi C.V. (1993) New frontiers in thermoregulation and exercise. Sports Med 16, p 163-167

Lambert, G.P. (2004) Role of gastrointestinal permeability in exertional heatstroke. Ex Sp Sci Rev 32, p 185-190Prior publication
These data have been published (Prosser, C., Stelwagen, K., Cummins, R., Guerin, P., Gill, N. & Milne, C., 2004, J Appl Physiol 96 p 650-654).

MASKED INCREASE IN THE CONCENTRATION OF SERUM DEHYDROEPIANDROSTERONE SULPHATE AND TESTOSTERONE AFTER A PROLONGED EXHAUSTIVE EXERCISE IN SEDENTARY WOMEN

Enea, C., Boisseau, N., Millet, C., Bounaud, J.Y., Díaz, V., Dugue, B.

Faculty of sport sciences, Poitiers teaching hospital, France

The purpose of this study was to examine whether the concentrations of anabolic steroids in blood such as serum dehydroepiandrosterone sulphate (DHEAs) and total testosterone are affected after a prolonged exercise leading to exhaustion in young sedentary women.

Eight sedentary women (21.9 +/- 1.6 years), under similar oral contraception (monophasic, ethinyl-estradiol < 0,05 mg) performed a control session (C) and a limited-time exercise (LT) in a randomised order. The two sessions were separated by one week. All the sessions started at 9.00 am after the volunteer got a standardized breakfast. The LT session consisted of a cycling exercise at 75% of maximal oxygen consumption until exhaustion (mean cycling time 22.3 +/- 2.6 min). During the control session, subjects rested at the laboratory. Blood specimens were drawn in standardized condition, before (T0), 30 min (T30) and 90 min (T90) after the end of the exercise. Specimens were taken during the control and the exercise sessions at the same time of the day. Serum DHEAs and total testosterone were assayed using RIA kits (Immunotech, France and Orion Diagnostica, Finland; respectively). Plasma volume shifts were estimated using haematocrit values for T30 and T90. The data were analyzed using the Wilcoxon signed-rank test for paired data.

When expressed using raw or corrected values for hemoconcentration/hemodilution, neither DHEAs nor testosterone concentration variation appeared at 30 or 90 minutes of recovery. However, total testosterone concentration tended to decrease during the course of the control session, with a significant reduction at T90 ($p< 0,05$). When considering the changes due to biological variations and plasma volume shifts, a significant increase in the total testosterone and DHEAs was found 30 minutes after the end of the exercise ($p< 0,05$).

Altogether, our results indicate that a prolonged exercise leading to exhaustion can increase the serum concentration of anabolic hormones in sedentary women. Even if it is worth to know the real concentration of anabolic hormones potentially active on target tissues after exercise, our study stresses the importance of taking into account the changes due to plasma volume shifts and biological variations. Such strategy is unfortunately not common in studies dealing with exercise endocrinology.

HIGHER OXYGEN CONSUMPTION DURING ACTIVE RECOVERY FROM INTENSE EXERCISE IN SOCCER PLAYERS

Omori, K., Okumoto, T., Ebsshi, H.

University of East Asia, Japan

Introduction: It is well known that low-intensity active recovery immediately after intense exercise enhances blood lactate removal and increases oxygen consumption (VO2) during recovery. Most ball games (e.g. soccer) can be characterized as "intermittent" exercise, thus, repeated high and low intensity exercise occurs in ball games. It is assumed that intermittent exercise must relate to the athletes' potential for physiologically recovery from intense exercise, suggesting that this is required for success in soccer. It was also hypothesized that the VO2 during active recovery in soccer players is higher than in athletes who habitually perform continuous exercise. The purpose of this study was to compare the VO2 and blood lactate concentrations during active recovery immediately after intense exercise in soccer players and recreational runners.

Methods: Five college soccer players and five college recreational runners participated in this study. All subjects performed cycle ergometer exercise twice at 80% ventilation threshold lasting 12 min after 4 min exercise at 25 W. After the first submaximal exercise, defined as the control exercise, the subjects rested for 10 min before completing three 30 s bouts of an all-out sprint cycling test separated by 4 min rest. After the third sprint, the subjects performed the second low-intensity exercise, defined as active recovery. VO2 was monitored during active recovery and the control exercise. The change in the mean VO2 (delta-VO2) was calculated by subtracting the mean VO2 during the control exercise from the mean VO2 during active recovery each subject. Blood samples were taken from the fingertip during active recovery, and the blood lactate area under the recovery curve (La AUC) was also calculated.

Results: Blood lactate peaked after completing the third sprint, and then decreased during active recovery in both groups. There was a higher value of La AUC (60.6±4.3 mmol/L･min) in the soccer players than in the runners (47.5±13.2 mmol/L･min), although it was not significant ($p=0.06$). There were no significant differences in the mean VO2 during the control exercise (Soccer; 1073.8±80.9 ml/min, Runner; 1000.3±202.5 ml/min). In the soccer players, the mean VO2 during active recovery was significantly higher than in the control exercise ($p<0.001$), while it was not significantly different in the runners. The delta-VO2 in the soccer players (166.0±33.6 ml/min) was significantly greater than in the runners (57.4±59.4 ml/min, $p<0.01$). A significant correlation ($r=0.731$, $p<0.01$) was observed between delta-VO2 and La AUC when the data obtained from the two groups were combined.

Discussion: This study was particularly characterized by the fact that higher delta-VO2 was observed in the soccer players and was positively related to the La AUC. These results indicated that intermittent exercise could improve the aerobic energy system while removing the accumulated blood lactate during active recovery.

THE EFFECTS OF CALORIC RESTRICTION AND EXERCISE ON LEARNING AND OXIDATIVE STRESS MARKERS OF THE BRAIN

Szabo, Z., Jakus, J., Nyakas, C., Radák, Z..

Faculty of Physical Education and Sport Science, Semmelweis University, Hungary

It is known that caloric restriction (CR) increases both the mean and maximal life spans of laboratory rodents. Exercise enhances the caloric utilization and has subservient effects on physiological functions of the organism including brain function and oxidative metabolism too. We tested the effects of CR and exercise on brain function, brain derived neurotrophic factor (BDNF) and oxidative challenge. Wistar rats (10 months old) were assigned to control, CR (40% restriction of control), trained (1h swimming with loading, 5 times a week, for 8 weeks) and CR-trained groups. The results of passive avoidance and Morris maze tests revealed that both CR and exercise training have positive effects on brain function, however the effects of CR was more significant on memory, while exercise improved the learning more notably. Electron spin resonance data suggests that exercise significantly reduced the level of free radicals in the cerebellum of rats.

The content and mRNA expression of BDNF increased in the brain of CR trained rats compared with control animals, while the BDNF receptor TrkB did not change significantly in any group.
The results of the present study indicate that both exercise and CR have positive effect on brain function, free radical content and BDNF concentration.

THE INFLUENCE OF FATIGUE ON TEMPERATURE REGULATION DURING PROLONGED EXERCISE

Kacin, A., Golja, P., Tipton, M.J., Eiken, O., Mekjavic, I.B.

University of Ljubljana, College of Helath Studies, Slovenia

Background: Findings from our pervious studies on graded ischaemia in the working muscles (Eiken and Mekjavic, 2004; Kacin et al., 2005) and on acclimation to a hypoxic environment (Kacin et al., 2004) suggest that non-thermal physiological factors closely associated with increased relative work rate and perception of effort can modulate the regulation of sweating and skin blood flow and potentially affect regulation of deep body temperature during dynamic exercise. The present study investigated whether a fatigue-induced increase in physical strain might also affect thermoregulation during exercise.
Methods: Euhydrated subjects cycled for 120 minutes at a constant absolute work rate (WR; 50% of the initial WRpeak) in a temperate climate (23 °C; 40% humidity). During the exercise, heart rate (HR), oxygen uptake (VO2), local sweating on the forehead and back, skin blood flow and rectal temperature were measured. The fatigue-induced increase in physical strain during prolonged exercise was evaluated from the changes in rating of whole-body perceived exertion (RPBwb). In addition, peak exercise capacity (VO2peak and WRpeak) was determined both prior to and immediately after the prolonged exercise trial.
Results: Median (range) RPEwb increased (P<0.01) from 3 (1-5) at the beginning to 5 (5-9) at the end of prolonged exercise. Accordingly, mean (SD) VO2peak and WRpeak attained immediately after prolonged exercise were 9 (5) % and 10 (5) % lower (P<0.01), respectively, than the corresponding initial values. Also, during the last 60 minutes of prolonged exercise trial, moderate upward drifts (P<0.01) in heart rate (deltaHR = 13 (5) bpm) and VO2 (deltaVO2 = 0.25 (0.11) L•min-1) were observed, most likely indicating a progressive deterioration of mechanical efficiency. Despite such progressive increase in physical strain, the regulation of heat-loss responses and core temperature after the initial exercise-induced perturbation remained constant throughout the steady-state exercise.
Conclusions: A fatigue-induced increase in physical strain does not affect the level of increase in core temperature or the regulation of heat-loss responses during prolonged steady-state exercise.
References
Eiken O and Mekjavic IB (2004) Ischaemia in working muscles potentiates the exercise-induced sweating response in man. Acta Physiol Scand 181: 305-311.
Kacin A, Golja P, Eiken O, Tipton MJ, Gorjanc J and Mekjavic IB (2005) Human temperature regulation during cycling with moderate leg ischaemia. Eur J Appl Physiol 95: 213-220.
Kacin A, Golja P, Eiken O, Tipton MJ and Mekjavic IB (2004) Exercise temperature regulation during intermittent altitude acclimatisation. In: 9th Annual Congress of the European College of Sport Science, Clermont-Ferrand, 3-6 July : proceedings.

EFFECTS ON THE THRESHOLD FORCE AND FREQUENCY OF HT- AND LT-MUS WITH INSTANTANEOUS COLD STIMULATION

Yona, M., Tadano, C., Seki, H., Naito, Y., Muro, M.

Tokyo University of Pharmacy and Life Science, Japan

(Introduction) Several investigators have demonstrated that subnormal muscle and skin temperature affects the recruitment and firing rate of motor units (MUs). We have demonstrated that the decrease in skin temperature to 25 degree with skin cold stimulation more markedly acted on high threshold MUs (HT-MUs) than on low threshold MUs (LT-MUs), resulting in a decrease in the threshold force of HT-MUs. However, this result indicated the effects on the MUs with decreased skin temperature over a fixed time. The purpose of this study was, therefore, to investigate the effects on the threshold force and frequency of HT- and LT-MUs with instantaneous cold stimulation. (Methods) The subjects who volunteered for this study were five healthy males. The electric signals were picked up by needle electrodes inserted on the belly of the right biceps brachii. The signals of MU were obtained in two places that changed depth below the skin (15 mm: shallow and 25 mm: depths). The force of the isometric contraction was established by a force transducer attached to the apparatus. The present experiment performed two conditions that consist of voluntary isometric ramp contraction (VIRC) (R) and sustain isometric contraction (S). The R consisted of three conditions (control; Rc, the skin temperature 25 degree; R25, cold spray; Rs) and the S consisted of four conditions (control; Sc, the skin temperature 25 degree; S25, cold spray; Ss, wind; Sw). Before each condition, 3 MVC for 2 sec were measured by the elbow flexion. The R was performed at a controlled 20%VIRC for 3 sec. The R25 was reduced gradually from Rc to 25 degree with cold air at -10 degree. In the case of S, the subjects were asked to modulate the torque during isometric contraction to identify motor units. The S was performed during a sustained isometric contraction for 10 sec. The Ss was instantaneously sprayed cold splay and the Sw was instantaneously sprayed wind on the skin of active muscle. (Results and Discussion) In the R, the threshold force of HT-MUs decreased, and that of LT-MUs did not change or increased with R25 and Rs. The result in R25 was the same as previous reports. However, the effect on the HT-MUs by spray stimulation did not have much to compare with Rs. On the other hand, the frequency of LT-MUs in S was influenced by spray stimulation. The frequency in S25 and Sw did not change. The frequency in Ss decreased just after stimulation with spray. Thereafter, the frequency returned to an original value. However, The average frequency before and after 0.5 sec of spray stimulation did not show any significant changes. Spray stimulation only affected 50% of MUs. The number of influenced MUs was different between shallow and depths. The influenced MUs in shallow were much more than that in depths. The instantaneous skin cold stimulation had an influence on the threshold force of HT-MUs and the frequency of LT-MUs for a short time. These results suggest that the influence on MUs is related to the dynamic response of cold receptors with cold spray stimulation.

THE EFFECT OF ACTIVE VERSUS PASSIVE RECOVERY IN HIGH-INTENSITY INTERMITTENT EXERCISE ON SALIVA FLOW RATE, SALIVARY SECRETORY IMMUNOGLOBULIN A AND AMYLASE RESPONSES

Naito, Y., Matsumoto, T., Yona, M., Muro, M.

Kokushikan University, Japan

High-intensity intermittent exercise is an important component of training for many athlete; few studies, however, have examined the effect of high-intensity repeated bouts of exercise on saliva parameters. Moreover, the positive effects of active versus passive recovery on high-intensity intermittent exercise training are controversial. The aim of the present study was to investigate the saliva flow rate, s-IgA concentration and alpha amylase activity in high-intensity intermittent exercise following passive and active recovery interventions. Nine active male volunteers (age 22.3(0.7)yrs, height 173.1(6.6)cm, body mass 67.3(6.1)kg, VO2max 57.3(6.2)ml/kg.min) executed two high-intensity intermittent cycling exercises. A load of 5% of body mass was applied. The exercise was composed of seven sets of maximal-effort 20-s sprint bouts with a 60-s recovery interval between sets. At the end of the first exercise bout participants were administered either active (low-intensity cycling at approximately 40% VO2peak) or passive recovery (sit quietly on the cycle ergometer). Unstimulated saliva and blood samples were collected before and after the exercise bouts and after the recovery interventions. Saliva parameters and metabolic measurements included: saliva flow rate, saliva protein, s-IgA, alpha-amylase activity, HR, and blood lactate. An ANOVA test was used to assess the difference between the conditions. There was a decrease in the mean anaerobic power and mean peak power among two tests, but there were no differences when comparing active with passive recovery. The performance of the two cycling exercise bouts affected the saliva flow rate, s-IgA concentration and alpha-amylase activity (compared with pre-exercise). However, no significant difference was found between active and passive recovery for the s-IgA concentration and secretion rate at any point. Saliva alpha-amylase activity and HR were lower in passive recovery than active recovery after the recovery interventions. At the same point, blood lactate concentration was significantly higher in passive than active recovery. The linear regressions revealed that the ratio of alpha-amylase activity between two bouts (exercise2/exercise1) was negatively correlated with the lactate concentration after the recovery intervention. Furthermore, correlation was seen between HR recovery and the change percent of the s-IgA secretion rate after recovery intervention. These results indicated that the magnitude of recovery/fatigue reflected the saliva alpha-amylase activity and do not support the benefit of active recovery when compared to passive recovery concerning s-IgA. However, the s-IgA secretion rate could be an indicator of short-term change in the activity of the cardiac autonomic nervous system.

EVALUATE THE CHANGE OF %SPO2 AND HEART RATE AT LACTATE THRESHOLD IN MALE ELITE ATHLETES DURING SPORT UNTIL EXHAUSTION

Tabatabaei, H.

Azad University, Iran

The purpose of this study was to evaluate the change of %SpO2 (saturation percent oxygen) and heart rate at lactate threshold in male elite athletes during sport until exhaustion. Also the relationship between %SpO2 and some physiologic factors such as blood lactate acid at the end of the test and the amount of oxygen used at lactate threshold was evaluated.

The sportsman in our study were national team athlete in Canoeing, Tae kwan do, Wrestling, and Middle distance running with the average age of 22.29 years, average height of 179.73 and average weight of 81.55. After explained about test, each case got on the treadmill. Once the treadmill started, each subject started walking on it. After a one-minute for warm-up with the speed of 4 km/h, they started running with the speed of 8 km/h. after each minute, the speed increased by 1 km/h up to the time until the exhaustion. During the test, %SpO2 and heart rate were recorded prior to increase in speed by the "pulse oxymeter". Meanwhile, with used gas analyzer (K4b2) some respiratory factors such as the Vo2 at lactate threshold and after the end of test blood lactate acid were evaluated.

The data were collected in forms and were analyzed using SPSS statistical software (Pearson correlation coefficient and regression).

The data revealed that there was no significant relationship between %SpO2 and heart rate at lactate threshold. Also, no relationship was detected between %SpO2 and either blood lactate acid at the end of test or Vo2 at lactate threshold.

Finally, the athletes were divided into two groups of aerobic and anaerobic sports. The statistical analysis was done again and no significant correlation was observed between the above factors.

Regarding the low regression line and reverse correlation between %SpO2 and heart rate at lactate threshold, a partial relationship or pattern may be presented like what suggested . However, presenting a more accurate table needs great subjects.

PRIOR HEAVY EXERCISE DOES NOT AFFECT PHASE II VO2 KINETICS BUT INCREASES MUSCLE OXYGENATION KINETICS DURING HEAVY EXERCISE

Marles, A., Perrey, S., Legrand, R., Blondel, N., Betbeder, D., Mucci, P., Prieur, F.

Laboratory of Multidisciplinary Analysis of Physical Activity, University of Artois, Lievin, France, France

The O2 demand in muscle at the onset of heavy exercise is more important than at the onset of moderate exercise. Therefore, the effect of prior heavy exercise on the balance between O2 delivery and O2 utilization should be different. To our knowledge, no study has investigated the relationship between kinetics of pulmonary VO2 and muscle oxygenation during a heavy exercise preceded by a prior heavy exercise. The effect of a prior exercise above the first ventilatory threshold (VT1) on the phase II VO2 kinetics and muscle oxygenation at the onset of a subsequent heavy exercise was therefore examined. We hypothesized that prior heavy-intensity exercise is sufficient to improve the O2 delivery at the onset of the second exercise. In these conditions, if VO2 kinetics is limited by O2 delivery during heavy exercise, then prior exercise would induce an acceleration of the phase II VO2 kinetics and a slowing of the muscle deoxygenation kinetics.

Ten young male adults (20 ± 2 years) performed twice the same test. This test was composed of a 6-min constant work rate exercise at a power output corresponding to 50% of the difference between VT1 and peak VO2 (Delta 50%) (CWRE 1), 6 min at 35 W and another 6-min of constant work rate exercise at Delta 50% (CWRE 2). VO2 was measured breath-by-breath, muscle oxygenation (Oxy) and blood volume (BV) were evaluated continuously by near-infrared spectroscopy. Phase II VO2 and Oxy kinetics were described with a mono-exponential model. The time delay (TD) from the exercise onset to a decrease in Oxy was also determined.

The parameters of the phase II VO2 kinetics (amplitude and tau1) were unaffected by prior heavy exercise, while the parameters of local muscle oxygenation kinetics were significantly faster (TauOxy: 10 ± 3 vs. 8 ± 2 s; $P < 0.05$, TDOxy: 7 ± 2 vs. 4 ± 2 s; $P < 0.001$). Blood lactate, heart rate (HR) and BV values were significantly higher before CWRE 2 than before CWRE 1.

These results suggest that the O2 availability was likely improved at the onset of second heavy-intensity exercise. It was however unsuccessful to accelerate the pulmonary VO2 kinetics. We have also observed that the muscle deoxygenation was faster at the onset of the second bout of exercise indicating an increase in the O2 extraction at the onset of CWRE 2 in comparison with CWRE 1. Taking together, these findings are in favour of a metabolic inertia limitation of the VO2 kinetics.

BIA-VECTOR AS A TOOL TO DETECT DEHYDRATION

Golja, P. 1, Blatnik, J. 1, Tomazo-Ravnik, T. 2

1 Nova Gorica Polytechnic, 2 University of Ljubljana, Biotechnical Faculty, Dept. of Biology., Slovenia

Background

BIA-vector (=RXc graph method), a new bioelectrical impedance method, was reported to detect changes in hydration status in renal patients and in high altitude climbers (Piccoli et al., 1994; 1996). BIA-vector derives from a classical bioelectrical impedance method, using resistance (R, Ohm) and reactance (Xc, Ohm) separately, to produce a vector in the RXc graph. The RXc graph depicts both, soft tissue hydration and cell mass, and it also presents reference values for these two parameters, thus the elliptical probability regions for a healthy population. The displacement of BIA-vector parallel to the major axis of the ellipse indicates changes in soft tissue hydration. The aim of the present study was to assess whether this method is sensitive enough to detect mild dehydration.

Methods

Sixteen young subjects (8 males, 8 females) were weighted and then rested supine for one hour in a 24°C room, to achieve equilibrium between intra- and extravascular liquid compartments. Following rest, bioelectrical impedance was determined with an alternating current of 800 microA and 50 kHz (BIA soft tissue analyzer, Akern Srl., Italy). The subjects then performed a 12.5 km walk (average speed = 5.5 km/h) outdoors in a temperate environment (ambient temperature = 20 (4)°C). During the walk, eight subjects drank water ad libitum (NH) and the other eight were not allowed to drink (DH). Following the walk, the bioelectrical impedance was determined in the same manner as prior to the walk.

Results

Body mass loss was 1.7 (0.7) kg in the DH and 0.6 (0.4) kg in the NH group, which equalled to 2.5 (1.0) % and 0.8 (0.4) % of pre-walk body mass in the DH and NH group, respectively. Despite mass loss, the classical bio-impedance showed an increase in total body water ($P<0.05$) and in extracellular water ($P<0.01$), and a decrease in body cell mass ($P<0.01$). Classical bioelectrical impedance thus did not detect dehydration in any of the groups. Similarly, vectors in the RXc graph did not lengthen following the walk in any group, as compared to pre-walk vectors, which would indicate dehydration. The BIA-vector (RXc graph method) was thus insensitive to mild dehydration.

Conclusions

Consistent with previous reports (O'Brien et al, 2002), classical bioelectrical impedance did not asses small changes in hydration status correctly. Although the BIA-vector (RXc graph method), a new bioelectrical impedance method, was reported to detect changes in hydration status of soft tissues in renal patients and in climbers at high altitude, it was not sensitive enough to detect mild (2.5 %) dehydration in healthy subjects.

References

O'Brien C et al. Int J Sports Med, 23 (5): 361-366; 2002.

Picolli A et al. Kidney International, 46: 534-539; 1994.

Piccoli A et al. Med Sci Sports Exerc, 28 (12): 1517-1522; 1996.

Acknowledgements

This project was financed, in part, by the Ministry of Higher Education, Science and Technology of the Republic of Slovenia, and by NATO.

SPIROERGOMETRY IN THE SWIM FLUME: STROKE RATE OF ENDURANCE AND SPRINT SWIMMERS AS A POSSIBLE INDICATOR FOR SWIMMING EFFICIENCY

Reer, R., Ramcke, C., Ziegler, M., Braumann, K.M.

University of Hamburg, Germany

Introduction: Stroke rate is considered to play an important role in swim performance. The goal of the present study was to assess if there is a difference in stroke rate between endurance and sprint swimmers.

Methods: 36 male swimmers (age: 26.64.9 years; years of practice: 13.95.2; training sessions / week: 2.30.6; training hours / week: 3.61.1), of which 18 were endurance swimmers (en) and 18 were sprint swimmers (sp), carried out a standardized stepwise spiroergometry in the swim flume (initial velocity: 0.90 m/s; increase of 0.05 m/s every 3 min; break of 1 min after each exercise step). Arm stroke rate was measured by means of a manual stop watch in the last 30 seconds of each exercise step using 3 complete arm cycles. Additionally, heart rate was measured continuously by means of a sports tester. Blood lactate was taken from the hyperemized ear lobe and respiratory parameters were measured by means of the rebreathing method, applying the exponential regression equation y=ae-bx during the 1-min break period.

Results: En showed a lower stroke rate in all exercise intensities compared to sp. If one relates stroke rate to body height, the differences increase. The ratio VO2/v, an indicator for efficiency mainly in aerobic exercise intensities, was lower for en in lower exercise intensities.

Discussion: It can be concluded that there is a characteristic difference in stroke rate between en and sp which is accentuated by relating stroke rate to body height. The lower stroke rate for endurance swimmers may be an indication for a more efficient propulsion.

References:

(1) Capelli et al. (1998). Eur J Appl Physiol 78:385-393

(2) Di Prampero (1986). Int J Sports Med 7:55-72

(3) Toussaint et al. (1994). Sports Med 18:384-405

Acknowledgments:

Supported by a grant from the German Federal Institute of Sport Science (BISP).

PHYSIOLOGICAL ASSESSMENT AT AND ABOVE CRITICAL POWER IN CHILDREN

Williams, C.A. 1, Berthoin, S. 3, Dekerle, J. 2, McGawley, K. 2, Carter, H. 2

1 University of Exeter, 2 University of Brighton, 3 University of Lille, United Kingdom

Critical power (CP) provides the upper boundary to the heavy intensity exercise domain but to date no studies have examined the physiological responses to exercise at CP in children. The purpose of the study was to examine the physiological responses to exercise at and 10 % above CP (CP+10) in children. Six male adolescent subjects mean (SD) age 12.8 (0.3) y, stature 154.8 (11.7) cm, body mass 43.7 (10.9) kg and VO2 max 2.31 (0.24) L.min-1 performed three constant load tests of between 2 and 20 min duration to derive CP. Subjects then exercised in random order, at CP and CP+10 with heart rate (HR), oxygen consumption (VO2), rating of perceived exertion (RPE) and blood lactate (Blac) concentration measured throughout until volitional exhaustion. The mean power output for CP was 123 (10.4) W and which represented 72 (2.2) % of VO2 max. The time to exhaustion (TTE) at CP [124 (11.4) W] was 1207.7 (288) s, was longer than that at CP+10 [136 (12.5) W] being 631.3 (173.6) s. (p value). Both blood lactate and VO2 were higher in the CP+10 trial 4.8 (1.1) mM, VO2 2.15 (1.83) L.min-1) than the trial at CP Blac 4.12 (0.9 mM), VO2 2.08 (1.64) L.min-1. End exercise heart rate and RPE were similar in both trials 188 (4.8) b·min-1 and 9 (1.0) compared to 187 (4.1) b·min-1 and 8 (1.0) respectively.Although the estimated % VO2 max at CP was ~72 %, the %VO2 max attained at the end of exercise for both CP (90 (0.7) %) and CP+10 (93 (0.8) %) trial, clearly demonstrate a non steady state. Indeed, attainment of VO2 max was observed in some children (one subject attained max at CP, and two in the CP+10). Similar to some adult studies, TTE at CP was found to be ~20 minutes. Although CP cannot be continued "indefinitely" in children, these results provide information about the boundaries of heavy and very heavy exercise intensities in children.

This study was supported by a grant from the Interreg IIIa grant, 'InterEx.'.

EXERCISE AS AN ANTIOXIDANT: IT UP-REGULATES IMPORTANT ENZYMES FOR CELL ADAPTATIONS TO EXERCISE

Gómez-Cabrera, M.C., Domenech, E., Ji, LL., Viña, J.

Catholic University of Valencia, University of Wisconsin-Madison, University of Valencia. Spain, Spain

Introduction

Over the past two decades it was shown that unaccustomed exercise can increase the generation of reactive oxygen species in biological tissues specially skeletal muscle and myocardium (1). However there is increasing evidence that reactive oxygen species (ROS) are not only toxic but rather play an important role in cell signalling and in the regulation of gene expression. We have tested this hypothesis by studying the effect of inhibition of ROS production by allopurinol (an inhibitor of xanthine oxidase, a free radical generating enzyme) on cell signalling pathways in marathon runners and in rats submitted to exhaustive exercise by running on a treadmill.

Material and methods

Animals

Twenty male Wistar rats were randomly divided into three groups: rest (n =5), exercised (n =5) and exercised but pre-treated with 32 mg kg−1 of allopurinol by intraperitoneal injection (n =5) (2). Rats were exercised until exhaustion following a modification of the protocol of Davies et al. (1). The time to exhaustion was recorded for each animal. Gastrocnemius muscle was obtained by quick removal.

Subjects

Volunteers were recruited from participants in the 23rd Marathon of Valencia. Runners (n= 25) were randomly divided into two groups: placebo (n=14) and allopurinol supplemented (300 mg administered orally, 2 h before the race; n=11)(3). Blood was drawn from an antecubital vein 1 day before and immediately after the marathon. Lymphocytes were isolated from fresh whole blood. The isolated suspension of lymphocytes was subjected to whole-cell protein extraction for the determination of NF-B p50 activation.

Results

Exercise caused an activation of NF-B in lymphocytes from marathon runners which was completely prevented by allopurinol. In the rat model exercise caused an activation of MAP kinases in gastrocnemius muscle. This in turn activated the NF-B pathway and consequently the expression of important enzymes associated with defence against ROS (superoxide dismutase) and adaptation to exercise (eNOS and iNOS). All these changes were abolished when ROS production was prevented by allopurinol.

Conclusions.

In our study we report evidence that ROS act as signals in exercise because decreasing their formation prevents activation of important signalling pathways which cause useful adaptations in cells. Because these signals result in an up-regulation of powerful antioxidant enzymes, exercise itself can be considered as an antioxidant. The practical implication is that decreasing ROS levels with antioxidants may hinder beneficial cell adaptations during exercise. Therefore the common practice of taking antioxidant supplements during training should be seriously questioned.

References

1. K.J. Davies et al,. Biochem. Biophys. Res. Commun. 107,1198(1982)

2. J. Viña et al. IUBMB Life 50, 271–277 (2000)

3. M.C.Gomez-Cabrera et al., JAMA 289,2503-2504(2003).

GENDER DIFFERENCES ON FAT OXIDATION RATES DURING EXERCISE IN POST PUBERTAL ADOLESCENTS

Zunquin, G., Theunynck, D., Arhan, P., Bougle, D.

Université du Littoral & CHU de Caen, France

Evidence exist that, compared to post pubertal males, post pubertal females utilize more fat and less carbohydrate during endurance exercise performed at similar relative intensities. Skeletal muscle has an increased content of triglyceride in obese population and induces skeletal muscle defects as well as fat oxidation rates during exercise are significantly decreased compared non obese people. Are gender differences found in fat oxidation in healthy people were also found in obese population?

PURPOSE: We investigate the effect of gender on fat oxidation rates using a graded exercise test to exhaustion in sedentary obese post pubertal adolescent. METHODS: Post Pubertal adolescent (14 males, age: 14.6±0.6 yrs BMI: 31.8±6.15; 12 females, age: 14.1±0.5 yrs BMI: 28.8±3.7) underwent an incremental cycle ergometry test (20 Watts increments, 3.5 min intervals) to exhaustion with measurements of breath by breath gas exchange and heart rate. Fat rates were determined from indirect calorimetry during the 30 seconds of each stage as described previously by Achten (2001) and expressed per kilogram of Fat Free Mass (FFM). Body composition was assessed by DEXA.

RESULT: Fat oxidation rates are significantly higher in the post pubertal males at 20, 30 and 40 % of peak VO2 ($p<0.001$). When the fat oxidation rates are reported to FFM, fat oxidation rates are significantly higher in females group at 50 % of peak VO2 ($p<0.001$). Maximal fat oxidation rates occurred later for females (47.7±0.8% vs 45±0.9% of peak VO2; $p<0.001$). CONCLUSIONS: Gender differences found in non obese population is also found in obese population. This study permits to target exercise intensity which elicits maximal fat oxidation rates in obese post pubertal people. Exercise training protocol achieved at these intensities could beneficial to reduce fat mass in this population.

PROXIMAL-DISTAL SKIN TEMPERATURE GRADIENT AS AN INDEX OF PERIPHERAL SKIN BLOOD FLOW DURING EXERCISE

Kounalakis, S.N. 1, Mekjavic, I.B. 2+3, Geladas, N.D. 1

1 University of Athens, 2 Josef Stefan Institute, Ljubljana, 3 University of Portsmouth, Greece

The skin temperature difference between the forearm and fingertip (Tproximal-distal) has been demonstrated to be an index of vasomotor tone during anesthesia, and exposure to hot and cold ambient conditions. Measurements of Tproximal-distal correlate well with finger plethysmography (PPG) and laser Doppler velocimetry. Tproximal-distal is a simple, inexpensive, and easy to use method, but has not yet been validated during exercise. The aim of the present study was to determine, whether Tproximal-distal can be used as an index of vasomotor tone during steady state exercise.

For this purpose, 10 healthy young male volunteers exercised on a cycle ergometer at 58-60% of their VO2max for 30 min on three separate occasions, with at least 2 days between trials. Tproximal-distal was measured with thermistors placed on the radial side of the forearm and on the tip of the 3rd finger of the left hand. Skin blood flow (SkBF) was determined with a laser probe placed on the forearm. Pulse transit time (PTT), considered an index of arterial compliance, was calculated from the simultaneous measurements of finger pulse pressure and ECG. All measurements were taken at rest and during the last 5 min of exercise.

Upon completion of the exercise, SkBF increased significantly ($p<0.01$) from mean (SD) resting values (arbitrary units) of 5.74 (0.74) to end-exercise levels of 37.51 (1.18). Concomitant with the increase in SkBF, we observed a significant decrease ($p<0.01$) in PTT from resting values of 0.42 (0.07) to end-exercise values of 0.32 (0.07) sec, and also a significant ($p<0.05$) decrease in Tproximal-distal from resting values of -0.4 (0.2) to end-exercise levels of -1.27(0.3) oC. Tproximal-distal correlated significantly with SkBF ($r=-0.67$, $p<0.01$) and PTT ($r=-0.50$, $p<0.05$).

Based on these results, it is concluded that Tsk-diff is a valid index of vasomotor tone during exercise.

The project was co-financed within Op. Education by the ESF (European Social Fund) and National Resources.

THE EFFECTS OF VARIOUS STRENGTH TRAINING PROGRAMS UPON STRUCTURAL AND FUNCTIONAL CHANGES OF KNEE EXTENSOR MUSCLES IN SINGLE- AND MULTI-JOINT MOVEMENTS

Vinogradova, O., Netreba, A., Popov, D., Lyubaeva, E., Bravy, Y.

SSC RF - Institute of Biomedical Problems RAS, Russia

Blood restriction in contracting muscles, associated with noticeable acidosis, is considered to induce hypertrophy of muscle fibers. Blood restriction during work may be achieved either by application of occlusive cuffs or by using special type of strength training without relaxation (TwR). The latter means that during rhythmic movements the muscles do not relax at the end points of movement. The training effect of this training program in comparison with classical training (CT) is achieved using considerably lower loads. Little is known about particular effects of training without relaxation upon leg muscles during single and multi-joint movements. The aim of the investigation was to compare the effects of 10 weeks classical strength training and of low intensity strength training without relaxation upon size, strength and resistance to fatigue of leg muscles in men. Two experiments with single- and multi-joint movements (S- and M-series) were performed. The duration of each training experiment was 10 weeks. The subjects were trained three times a week: once with high load volume and twice with lower loads. Training intensity in a CT group was about 85% of maximal voluntary contraction (MVC) and in a TwR group – no more than 50% of MVC. 10 weeks strength training led to an increase of size and of maximal voluntary contraction of trained muscles. The increment of strength was noticeably higher after CT than after TwR, on the other hand strength increment related to total work performed increased after TwR more than after CT. Two training programs influenced the size of the whole muscle and of muscle fibers (MF) differently: the volume of m. quadriceps femoris increased more after CT than after TwR. CT induced a significant increase of cross sectional area (CSA) of fast MF and TwR induced an increase of CSA of slow MF. Resistance to fatigue after TwR was higher than after CT. Thus strength increments related to the total work performed were remarkably higher after TwR than after CT. The effects of TwR turned out to be more pronounced in one-joint training than in multi-joint training.

ACUTE HYPOTHALAMIC-PITUITARY-ADRENAL AXIS RESPONSE TO THE STRESS IN SWIMMING AND RUNNING RATS

Contarteze, R.V., de Barros Manchado, F., Gobatto, C.A., Luciano, E., de Mello, M.A.

Sao Paulo State University - UNESP, Brazil

Many studies on metabolism and exercise are developed with animal models, especially with rats. Treadmill running and swimming are among the exercises most used in researches involving animals. However, doubts on which would be the most suitable exercise type to unchain to exercise responses associated to other stresses still remain. The activity of the hypothalamic-pituitary-adrenal axis, composed of adrenocorticotropic hormone (ACTH) and corticosterone hormones are important stress biomarkers. The aim of present study was compare blood ACTH and corticosterone concentrations, as stress biomarkers, during swimming and treadmill running exercises at the maximal lactate steady state (MLSS) intensity performed by rats.

For this, adult Wistar rats previously adapted to exercises in which MLSS was determined were used. For MLSS determination, the rats were submitted to 3 swimming tests with 25 minutes of duration (n=09) with loads of 5.0; 5.5 and 6.0% of their body weight (bw) or to 3 running sessions with 25 minutes (n=07) at velocities of 15; 20 and 25 m/min. Blood samples were collected from the tip tail of rats each 5 minutes of exercise for blood lactate determination. After MLSS attainment, the animals were sacrificed shortly after session of 25 minutes of exercise (swimming=09 or treadmill=07) at the MLSS intensity. For comparison purposes, a control group C (n=10) was sacrificed at rest. The Two-Way ANOVA was used in order to identify possible differences among groups ($P<0.05$).

The MLSS was obtained at 5.5% of the bw in swimming rats and at 20 m/min in running rats, at blood lactate concentrations of 5.2±0.3mmol/L and 3.8±0.1mmol/L, in swimming and running, respectively. Serum ACTH concentrations (pg/mL) were significantly

higher for the swimming group (963.3±420.4) when compared to the running (348.7±60.9) and control (179.3±46.3) groups, while the serum corticosterone concentrations (ng/mL) in swimming (2661.2±627.8) and running (1802.7±700.4) groups were significantly higher in relation to the control group (467.11±262.12). The swimming group presented higher concentrations for both hormones in relation to the running group. The swimming group presented higher concentrations of both hormones when compared to the running group.

These results allow us concluding that only acute swimming exercise induced endocrine/metabolic responses expected to stress: elevations on the serum ACTH and corticosterone concentrations.

Supported by FAPESP, CNPq (proc n°300270/2004-6) and Capes.

THE EFFECT OF LIGHT INTERMITTENT EXERCISE WHILST SEATED ON PEAK FEMORAL ARTERY BLOOD VELOCITY

Hunter, S., Spencer, S.

London South Bank University, United Kingdom

The aim of this study was to compare measurements of peak femoral artery blood velocity using Doppler ultrasound during a period of prolonged sitting with and without intermittent exercise. Six healthy male subjects underwent two test conditions. The first condition, (condition A) entailed sitting as still as possible for 1 hour. The second, (condition B) of the same duration, introduced three 5-minute bouts of light foot pumping exercise during sitting. The exercise involved alternate leg action exerting enough pressure to transfer 1-litre of air from one side of an inflatable cushion to the other. In both conditions A and B measurements of common femoral artery peak blood velocity were made for three 1-minute periods during the second 5-minutes of each 10-minute period using pulsed Doppler Ultrasound spectral imaging. In condition B this immediately followed the exercise bouts. Also in both conditions heart rate (HR) was continuously recorded using two electrodes attached to a standard ECG monitor and blood pressure (BP) was determined simultaneously with the blood velocity measurements using an automated, cuff integrated wrist-type monitor. Mean peak blood velocity and mean heart rates were recorded using Spike4 data acquisition software. Despite considerable intra and inter-subject variability in the data obtained the mean peak blood velocity showed a strong tendency to increase over time in condition B ($r = 0.77$, $p = 0.07$). No such tendency was evident in condition A. It was concluded from this that light intermittent exercise is strongly indicated in effecting blood flow responses whilst sitting for prolonged periods. The results for mean HR from condition B showed higher values and a steeper increase in the upward linear trend over time compared to condition A ($r = 0.66$, $p = 0.15$). This was not significant ($p = < 0.05$). The trend in condition A was for a smaller increase over time and this was significant ($r = 0.84$, $p = 0.04$). Mean systolic BP overall was higher in condition A but increases were seen following each exercise bout in condition B. These differences were not deemed significant ($p = 0.05$). Conclusions were that HR and BP may increase with light intermittent exercise but that the observed increase in BF may be due to peripheral rather than central systemic factors.

REGULATION OF SKELETAL MUSCLE MASS IN RESPONSE TO MYOSTATIN GENE ELECTROTRANSFER

Durieux, A.C., Amirouche, A., Banzet, S., Koulmann, N., Bonnefoy, R., Mouret, C., Bigard, X., Peinnequin, A., Freyssenet, D.

University of Saint Etienne, France

Background & Significance: The cellular mechanisms that mediate skeletal muscle atrophy and functional deficits due to muscular disuse are just beginning to be elucidated. Previous studies showed that myostatin was a master regulator of muscle mass (1) and notably by inhibiting satellite cell proliferation and differentiation during embryogenesis and early post-natal growth (2).

Hypothesis: We hypothesized that gene electrotransfer of myostatin in adult rat would directly act on mature/differentiated skeletal muscle fiber and in a satellite cell-independent fashion by regulating muscle specific protein expression.

Methods: Right Tibialis Anterior (TA) muscles of 3-mounth old rats were transfected with a plasmid encoding myostatin cDNA under the control of CMV promoter. Contralateral control TA muscles were injected with the corresponding empty vector (3). Muscles were harvested 7 and 14 days after gene electrotransfer and structural modifications were determined by histochemistry. Gene expression regulation was envisaged at mRNA and protein for selected molecules.

Results: Seven and 14 days after myostatin gene electrotransfer, TA muscle weights were decreased by about 10 and 20%, respectively, when compared to control TA muscles. This was accompanied by a corresponding decrease in fiber cross-sectional area. By contrast, muscle fiber number and total DNA content remained unchanged suggesting that the decrease in muscle mass was a consequence of a reduction in myonuclear domain. Our data show that myostatin gene electrotransfer does not sensibly affect ATP-dependent ubiquitin proteasome pathway, as illustrated by the unchanged chymotrypsin-like activity of 20S proteasome and the unchanged mRNA level of E3 ubiquitin ligases, MuRF-1 and MAFbx. However, we show that myostatin gene electrotransfer induced a marked down-regulation of muscle specific gene expression and to a lesser extent, a down-regulation of the Akt-mTOR biosynthetic pathway. Indeed, we have demonstrated a down-regulation of the troponin I and MyoD promoters transactivation in myostatin-transfected muscles, a decrease in desmin, Akt and mTOR protein levels.

Conclusion: These data indicate that myostatin can trigger important regulatory mechanisms inside mature muscle fiber in a satellite cell-independent fashion. It also identifies a major role for myostatin in the control muscle mass mainly by a down-regulation of muscle-specific gene expression.

References:

(1) McPherron A.C., Lawler A.M., Lee S.J. Nature 387:83-90, 1997.

(2) McCroskery S., Thomas M., Maxwell L., Sharma M., Kambadur R. J. Cell. Biol. 162:1135-47, 2003

(3) Durieux A.-C., Bonnefoy R., Busso T., Freyssenet D., J. Gene Med. 6:809-16, 2004.

BLOOD LACTATE CHANGES DURING INDOOR CYCLING

Clijsen, R., Taeymans, J., Pfister, R., Wüthrich, M., Duquet, W.

Internationale Akademie Physiotherapie , Switzerland

Introduction

Indoor Cycling (IC) booms in European fitness centres. It is said to be an aerobic training method. Cycling frequency is determined by heavy beat music. Mostly resistance is set subjectively by the athlete while heart rate controlled training is not that common yet. The aim of this study was to investigate changes of blood lactate concentration (Lact) during an IC session with resistance set subjectively and set at a percentage of maximal heart rate (HR) estimated by the common formula 220 minus age.

Methods

Subjects (M=4;F=3) aged between 31 and 43 yrs were recruited in a Swiss fitness centre. They were familiar with IC. Informed consent was given. On 3 consecutive Saturdays following tests were conducted: a bike ergometer-test to assess lactate threshold (day1), a first IC session with resistance set subjectively (day2) and a second IC session that was HR controlled (day3). IC sessions took place in a group and were guided by an instructor (60min.). Per subject and per session 8 fingertip blood samples were analysed:1 at rest and 7 after different blocks of higher and lower intensity bouts. The Lactate Pro™LT1710 was used for lactate analyses. HR was monitored using Polar devices. Exhaustion was assessed using the Borg scale (6-20). SPSS 12.0 was used for statistics (ANOVA for repeated measurements). Significance was set at 5%.

Results

Mean HR at lactate threshold (4.0 mmol/l) was 157.0±16.8 bpm. Baseline Lact was 2.5±0.8 mmol/l at the 1st and 2.9±2.0 mmol/l at the 2nd IC session. Under conditions of subjectively set resistance mean Lact was 4.9±3.0 mmol/l after warming-up and peaked at 8.6±4.4 mmol/l ($p<0.05$). At each measurement moments mean Lact was above 4 mmol/l ($p=0.008$). Under conditions of HR controlled set resistance mean Lact was 7.0±7.3 mmol/l after warming-up and peaked at 8.0±4.3 mmol/l. However, ANOVA showed no significant changes of Lact during the IC session under HR controlled conditions ($p=0.243$). Under both conditions Borg and HR increased ($p<0.05$).

Discussion

Lact increases above 4 mmol/l directly after warming-up and remains high during the entire session period, indicating that intensity levels are too high for adequate aerobic training. Subjectively set resistance may lead to a significant increase in Lact with individual values above 14 mmol/l. It may be argued that this is an appropriate training method for not highly trained persons. Our data suggest that the use of individual HR monitoring devices may lead to a better management of the individual set resistances.

Conclusions

During an IC session the anaerobic component is dominant. Following the Indoor Cycling concept warming-up already leads to Lact concentration above the threshold. The use of individual heart rate monitoring devices may lead to a better management of the individual set resistances which may avoid significant changes in blood lactate concentration. Further research with larger numbers of participants is needed to increase statistical power.

MENARCHEAL AGE, MENSTRUAL DISORDERS AND SOMATOTYPES OF SWISS ELITE JUNIOR AND SENIOR SYNCHRONIZED SWIMMERS

Taeymans, J., Clijsen, R., Kersting, M., Clarys, P., Duquet, W.

Internationale Akademie Physiotherapie , Switzerland

Introduction

The aim of this study was to investigate menarcheal age (MA), menstrual disorders (MD) and the somatotypes (S) of the junior (JR) and senior (SR) athletes from the Swiss National Synchronized Swimming Team.

Methods

Six JR (16.4±1.6yrs) and 9 SR (20.2±2.6yrs) participated in this study. MA and MD were assessed using questionnaires. Anthropometric measurements were carried out following the ISAK guidelines. S was calculated (Heath&Carter method). SPSS 12.0 was used for statistical analysis ($p<0.05$).

Results

In JR mean MA was 12.8±1.0yrs while in SR mean MA was 13.6±1.2yrs. Oral contraceptives (OC) were used by 5 out of 9 SR, and not by JR. MD were found in 66.7% of the JR and SR not using OC. Mean height of JR was 164.1±4.9cm and mean weight was 51.0±5.4kg (BMI=18.9±1.1kg/m2). Mean S were 2.9–3.3–3.9. Mean height of SR was 164.0±6.1cm and mean weight was 54.7±4.6kg (BMI=20.1±1.0kg/m2). Mean S of SR were 3.1–3.5–3.3. Mean S of the whole sample were 3.0–3.4– 3.5. The differences in age and in BMI between JR and SR were significant. The relatively low SD of the anthropometric data indicate small variance (distribution) in these athletes. No differences between the mean values of several anthropometric variables and of the S compounds in JR and SR were found ($p>0.05$). Mean %fat in JR and SR was 21.5±2.5% and 22.8±3.1% resp.

Discussion

Mean MA (13.4±1.1yrs) is on the P50 of the "Leuven Growth Study" (1) and comparable with MA (13.0±1.3 yrs) found in the "LEGS-Study" (2). In our sample sexual maturation was normal. The absence of differences for the mean epicondylar femur and humerus widths between JR and SR indicate that skeletal maturation is completed by the age of 16 yrs. The prevalence of MD is high, with 22.2% of the athletes that are amenorrheic probably due to severe training regiments and unconventional nutritional habits. Mean BMI (19.6±2.1kg/m2) is borderline with the lower cut-off for a healthy BMI. Mean age (18.7±2.9 yrs) is above this of Olympic female stroke swimmers (17.0 yrs) (3). Although there are no differences ($p<0.05$) between the mean S of JR and SR, JR are more ectomorphic and less endomorphic than SR. The same has been found in different selections of female Olympic stroke swimmers (3). S of synchronized swimmers tend to be central, with the 3 S compounds differing from one another by no more than 0.5 units. Such athletes have well balanced bodies, which is an advantage in esthetic based sports.

Conclusion

Synchronized swimmers show normal sexual maturation but also important MD. Seen the central S and the relatively low BMI, further analyses of the administered food questionnaires will be needed for a better understanding of these relationships.

Reference

(1) Growth, Maturation and Physical Activity (Malina&Bouchard&Bar-Or,2004)

(2) The Longitudinal Experimental Growth Study (Hebbelinck et al.,1990

(3) Somatotyping, development and applications (Carter&Heath,1990).

APOPTOSIS IN INDUCED SPUTUM CELLS IN LONG-DISTANCE RUNNERS: A LONGITUDINAL STUDY

Chimenti, L., Bonsignore, M.R., Paternò, A., Vultaggio, M., Bonanno, A., Bellia, V., Bonsignore, G., Morici, G.

University of Palermo, Italy

High intensity exercise induces inflammation and epithelial damage in airways. Whether, long periods of intensive training affects the response of airway cells to acute exercise in non-asthmatic athletes living in moderate climate has not been well assessed. We collected induced sputum samples for total and differential cell counts and apoptosis (TUNEL) in 9 long-distance runners (mean age±SD: 40±4 yr,

training volume: 85±26 km/week) at rest (3 days pre-race) and the morning after a race in November 2004 (Fall; 21 km, average temperature, T: 16±1°C, air humidity, H: 53±5%), February 2005 (Winter, 12.5 km, T: 7±2°C, H: 48±5%) and July 2005 (Summer; 10 km, T: 27.5±2°C, H: 48±5%). Air polutant concentrations were below attention threshold at all times. Induced sputum composition or cellularity did not vary according to season, despite large changes in outdoor T and a trend towards increased ozone concentration in Summer. Average neutrophil (PMN) counts in induced sputum of runners was 52.2% of total cells at baseline, and tended to increase after exercise (67.7%) independent of season. Total apoptosis was highest in Summer (45% of total cells) and lowest in Fall samples (11%, $p<0.05$) and apoptotic cells were mostly PMN (range 53-90% of total apoptotic cells) at all times. Bronchial epithelial cell (BEC) counts were low at all times (mean 4.3% at baseline, 3.5% post-exercise) but their contribution to apoptosis increased post-exercise (from 2% to 14% of total apoptotic cells, $p<0.05$) irrespective of season. Our data suggest that apoptosis of airway PMNs may be a mechanism to control airway inflammation in athletes living in moderate climate, whereas apoptosis of BECs may indicate epithelial damage induced by intense exercise, irrespective of season.

REMODELING AND INFLAMMATION OF SMALL AIRWAYS IN ENDURANCE TRAINED MICE

Chimenti, L., Morici, G., Paternò, A., Bonanno, A., Licciardi, A., Veca, M., Bonsignore, M.R.

University of Palermo, Italy

Studies on airways cells in well-trained endurance athletes at rest have found evidence of large airway inflammation, but the effects of endurance training on the small airways are poorly defined. We examined the integrity of bronchiolar epithelium and inflammatory cell infiltration in formalin-fixed, paraffin-embedded lung sections obtained in Swiss mice (body weight: 35 g, n=9/group) treadmill-trained (T) under standard laboratory conditions 5 days/wk for 2, 4 or 6 wks. Animals were sacrificed after 24 h rest. Sedentary controls (S) were examined at 0 and 6 wks. Daily running was progressively increased during T (fiber diameter of the tibialis anterior muscle at 6 wks: +26% in T vs. S mice, $p<0.05$). We assessed epithelial integrity of peripheral airways by counting ciliated cells/airway perimeter (range 400-1000 μm), mean epithelial thickness by measuring the area/perimeter (A/P) ratio and epithelial proliferation with an anti-PCNA antibody (Proliferating Cell Nuclear Antigen). We counted CD45+ and nuclear NF-κB+ cells (Santa Cruz) in bronchiolar walls. Ciliated cells decreased early during T (S: 0.117±0.02; 2-wkT: 0.03±0.00 cells/μm; $p<0.05$) and remained low after 6-wkT (0.03±0.01 cells/μm, $p<0.002$). The A/P ratio was 14.2±2.0μm in S mice, and increased after 4-wkT (19.4±1.1 μm, $p<0.03$) and 6-wkT (20.1±0.4 μm, $p<0.01$). Bronchiolar epithelium of trained animals showed evidence of increased proliferation respect to sedentary controls (0.060±0.040 vs 0.013±0.011 cells/μm, $p<0,001$). CD45+ cell counts in bronchiolar walls were 0.014±0.001 cells/μm after 6-wkT and 0.071±0.006 cells/μm in S mice ($p<0.001$). Finally, our results showed that endurance training decreased NF-kb nuclear activation in peripheral airways (nuclear NF-κB+cells•μm-1/ CD45+cells•μm-1: 0,730 S vs 0,303 T). Endurance training under standard laboratory conditions causes active repair processes in response to damage in the small airways, while attenuates airway inflammation. This may represent a physiological response to increased ventilation during exercise.

EFFECT OF RESISTANCE EXERCISE ON CHANGES IN MYONUCLEAR NUMBER AND FIBER SIZE IN RAT GASTROCNEMIUS MUSCLE FOLLOWING HINDLIMB-UNLOADING

Yamauchi, H., Miyano, S., Kimura, M., Shibasaki, T.

Jikei University School of Medicine, Japan

It has been documented that myonuclear number is associated with changes in cytoplasmic volume of skeletal myofibers due to hypertrophy and atrophy. The effect of myonuclear number on myofiber size is observed mainly in the slow-twitch soleus musucle, but controversy exists concerning its effect on fast-twitch muscles. Skeletal muscle atrophies in response to unloading, but mechanical stress to the muscle attenuates the atrophy. Hindlimb-unloading (HU) induces atrophy of both slow and fast muscles, and our previous study (Yamauchi et al. Jpn J Physiol 55: S222, 2005) showed that resistance exercise prevented the atrophy, especially in the fast skeletal muscles of rats. However, changes in myonuclear number in the study remained uncertain. This study investigated the effect of mechanical loading on changes in myonuclear number and fiber size of the gastrocnemius muscle. This study was conducted in accordance with the Japanese and American Physiological Society Guide for the care and use of Laboratory Animals, and approved by the Animal Use Committee at Jikei University. Adult F344 female rats were placed into either weight-bearing control (n=7) or HU group (n=14). Rats in the HU group had their hindlimbs suspended for 3 weeks. The HU group was subdivided to a group with (n=7) or without (n=7) an intermittent resistance exercise (IRE), in which the rats were put in a cylindrical wire mesh inclined 60 or 80 degree with a weight of 50-70% of body mass hung from the tail. The IRE was performed for 10 min, three times a day (total 30 min/day) throughout the HU. After the HU period, the medial gastrocnemius muscle was dissected out, weighed, and immediately frozen in melting isopentane cooled with liquid nitrogen. Frozen cross-sections of the mid-belly region were cut on a cryostat microtome, mounted on MAS-coated slide glasses, and stained. Myonuclear number inside the dystrophin-positive plasma membrane was counted, and fiber size of each fiber type identified by a myofibrillar ATPase staining was measured. The HU resulted in significant decreases in muscle mass (31%) and fiber size (30-39%) in all fiber types. The IRE attenuated the decreases of muscle mass by 49%, and fiber size by 33% to 86%. Especially, the attenuation effect of IRE on type IIa (86%) and type IIx (74%) fibers in the type I predominant region was strong. The HU resulted in significant decreases in myonuclear number (15-22%) and domain (ratio of fiber size to myonucleus) (17-25%) for all fiber types, but the decreases in myonuclear number (4-7%) and domain (0-19%) were significantly reduced by IRE. Muscle fiber size was significantly correlated with the myonuclear number ($r=0.74$) and domain ($r=0.94$). These results show that changes in myonuclear number occur in type II fibers as well as in type I fibers of the medial gastrocnemius muscle in response to mechanical stimulus, and the changes in the myonuclear number and domain are associated with changes in myofiber size.

THE EFFECTS OF 30 HOUR SLEEP DEPRIVATION ON VOLLEYBALL BASIC SKILL PERFORMANCE AND PHYSIOLOGICAL VARIABLES

Tarverdizadeh, B., Behpour, N., Safikhani, H.

Islamic Azad University,Branch of Bushehr, Iran

Introduction

The purpose of this study is to realize that sleep loss which may exit because long traveling or physical and mental factors has any effect on performance of volleyball basic skills and physical variables?

Materials and methods

To take into consideration 16 athletes of volleyball team in Kerman shah (14-17years)in tow groups of control and experimental have performed three volleyball basic skills(Windmill service .volley and Setting) and three physical variables (heart beat . blood pressure and vo2max) as pretest and posttest.

In this study the (AAHPER,1969) has used to evaluate basic skills of volleyball and physical variables.

In this study, after 8 hours of night sleep subject performed three volleyballs basic skill test and physical variables as pretest . 7days later, to determine the validity of tests and effect of learning on test results the athletes for the second time, performed the same three skills and three physical variables as posttest .in third stage, subjects sustained 30 hour sleep loss and independent variable and test performed again and the results recorded as experimental posttest and used for hypothesis testing .the obtained results compared in couple by T test and for compute used SPSS program and finally the following results gained:

Results

1)30 hours of sleep loss has a negative effect ($p<0.001$) on point of windmill service skill in volleyball.

2)30 hours of sleep loss has a negative effect ($p<0.001$) on point of volley skill in volleyball.

3)30 hours of sleep loss has a negative effect ($p<0.001$) on point of setting (volley set) skill in volleyball.

4)30 hours of sleep loss has a negative effect ($p<0.001$) on rest heart beat.

5)30 hours of sleep loss has a negative effect ($p<0.001$) on rest systolic blood pressure.

6)30 hours of sleep loss has a negative effect ($p<0.001$) on vo2max.

INFLUENCE OF THE POSITIONAL ROLE ON THE MORPHOLOGICAL AND FUNCTIONAL CHARACTERISTICS IN SOCCER PLAYERS

Olm, T., Thomson, K., Baskin, K., Herde, K.

Tallinn University, Estonia

An individuals' work rate profile during soccer competition is dependent upon the positional role of the player. The aim of this study was to determine the differences of the morphological and functional characteristics related to the positional role of soccer players.

The subjects were 46 male players of the best football clubs in Estonia. Three groups were formed from them. The first group (n=15) consisted of forwards, their average age was 22.2±2.08; the second group (n=15) consisted of defenders, their average age was 23.1±3.51; and the third group (n=16) were midfielders of age 23.8±4.05 years.

The test battery included anthropometric measurements, electro-, echo- and polycardiography, and incremental treadmill test to volitional exhaustion. Blood lactate concentration (Bla), maximum oxygen uptake (VO2max), and heart rate at anaerobic threshold were recorded. Anticipation speed and correctness, and ability to concentrate were assessed.

All mean values of the studied characteristics of the positional role groups were relatively similar, and only a small part of them differed significantly. The midfielders' height (177.1±5.33) and body mass (72.9±6,32) were significantly smaller than these of the two other groups. The tallest (184.0±6.68) and heaviest (79.0±7.92) were the defenders but their difference from the forwards was minimal. All three groups of soccer players had similar body mass indices and body fat percentages. No statistically significant differences occurred in any polycardiographic indices (E/Sm, T/St, grading points). The lowest working capacity was in the forwards' group. The mean values characterising aerobic metabolism were similar for all groups. However, their anaerobic thresholds, the ratios of the latter to the maximum heart rate, and maximum lactate indices (characterising anaerobic metabolism) were the highest in the forwards and the lowest in the midfielders' group. The ability to concentrate was also the best in the forwards, while the latter proved to be the most sensitive to fatigue: their anticipation correctness worsened twice after the treadmill test.

From the results we can conclude only a tendency to maintain the classical morphological and functional profile of the positional roles. The diminution of the differences between the characteristics of the different positional role groups might be due to the increased intensity of the soccer game over the recent years.

CHANGES IN LATENT TIME OF THE H WAVE AFTER ARM CRANK EXERCISE

Kazutoshi, S., Hidetaka, Y., Tomoyuki, I., Sho, O.

Kawasaki University of Medical Welfare , Japan

In humans, the monosynaptic H-reflex that is evoked by Ia afferents from muscle spindle to homonymous (MNs) is widely used as a tool for investigating the changes in excitability of the MN pool. There are few studies with an H reflex showing a recovery process after voluntary movement. The purpose of this study was to prove the effect of the change in latent time of the H wave during recovery examination after arm crank exercise.

Ten young males volunteered to participate in this study. After the H-reflex was elicited at time of rest, subjects performed 60％peakVO2 arm crank exercise for 10 minutes. After exercise, subjects were kept lying in the prone position, and H-reflex was measured after exercise (0, 7, 14, 21, 28, 35, 42 minutes). EMG was recorded at the medial head of MG of the right leg. H-reflex of MG was evoked by the electrical stimulation of the tibialis nerve in the popliteal fossa continuously for ten times in all of once per four second interval. Analysis of the H-reflex signal showed an average 4-6 times wave patterns, the amplitude of the M wave was maintained the same. We compared relatively evaluated latent time by the use of the value that deducted the latent time of positive peak of M wave to the latent time of positive peak of H wave because there was not a change for the latent time of positive peak of M wave each time.

The latent time of M wave did not change between pre and post exercise. But the latent time of H wave just after exercise shortened significantly as compared to the latent time of H wave of pre exercise. The latent time of H wave of post exercise was -0.43±0.21 ms and shortened significantly as compared to the latent time of H wave of pre exercise ($p<0.05$). We thought that just after arm crank exercise, the motor unit of fast muscle system was recruited remarkably, and the latent time of H wave shortened it. The latent time of H wave which shortened just after exercise with recovery time came back to the latent time of H wave at the time of rest (ANOVA: $p<0.05$). It is thought that the recruitment threshold of the motor unit changed as for the latent time of H wave returning to a previous value, and it is based on the size principle of the motor unit. This phenomenon was observed in the same experiment on different days. This study used arm crank exercise so that the position of a stimulation electrode on a tibial nerve did not change. It is clearly identified that an afference impulse from the upper limb has an influence on excitability of the motoneurons of the lower limbs. It was suggested that the lower-limb muscle group directly woke up muscle activity at the performance of exercise in the arm crank.

The latent time of H wave of post exercise shortened significantly as compared to the latent time of H wave of pre exercise. The latent time of H wave returned to a value for the latent time of H wave before exercise with time progress in recovery.

EFFECT OF TRAINING FREQUENCY ON CUTANEOUS MICROCIRCULATION IN RATS

Guerrero, F., Heylen, E., Saïag, B., Thioub, S., Mansourati, J.

Université de Bretagne Occidentale, France

Objective: Exercise training is known to improve endothelium-dependent relaxation in the coronary and skeletal muscle arteries. We previously showed that training-induced improvement of endothelium-dependent relaxation of rat aorta correlates with the frequency of training. However, the effects of exercise training on peripheral arteries, including cutaneous microcirculation, are still unclear. Therefore we investigated, in rats, whether the effects of chronic and regular aerobic exercise on cutaneous microvascular endothelial function matched those previously described on thoracic aorta.

Methods: We assessed the effect of physical training on skin microcirculation in 7 sedentary and 21 Wistar Kyoto rats submitted to a treadmill training protocol (15 m/min, 15% incline, 60 min/day, 8 weeks). Training rats were divided into three groups exercising 1 day/week (Ex1), 3 days/week (Ex3) or 5 days/week (Ex5). For all animals, cutaneous blood flow was recorded before the beginning of the training protocol, after 4 weeks and at the end of the training program. Hyperaemic responses (RH) were obtained 48h after the last exercising bout in anaesthetized animals using a Laser Doppler probe placed on middle of the calf. After baseline measurements, femoral artery was occluded for 1 min using an external circumferential garrotte. Artery occlusion was indicated by flow values reaching the occlusive zero. RH was the flow reaction obtained after sudden release of the garrotte. Caudal artery blood pressure was also monitored using non-invasive blood pressure equipment. For data analysis, cutaneous vascular conductance (CVC) was indexed as cutaneous blood flow (in arbitrary perfusion units) divided by mean arterial blood pressure (in mm Hg) and normalized to baseline values.

Results: At baseline, CVC was not different between all groups (sedentary or training) at three steps of experimental protocol. Considering RH, no significant difference was detected between all groups before the training protocol. In sedentary rats, as well as Ex1 and Ex5 animals, the maximal post-occlusive vascular conductance was not modified throughout all the protocol. Conversely, the hyperemic stimulus significantly increased normalized cutaneous vascular conductance only in group Ex3 after 4 weeks ($p<0.006$) and 8 weeks ($p<0.006$).

Conclusion: Since post-occlusive hyperaemia is known to reflect endothelium-dependent relaxation, these results indicate that exercise training exerts a generalized effect on the vasculature by increasing endothelial function in vessel beds different from central arteries. However, some differences exist since cutaneous microcirculation is modified by training at a frequency of 3 bouts weekly only.

OBSERVATION OF THE CORTICAL BMD AND URINARY PHOSPHATE EXCRETION IN THE RATS AFTER SIMULATED TAIL SUSPENSION

Kim, C., Park, G.D.

Gyeongju University, Korea, South

Introduction: Mechanical forces play a pivotal role in maintaining bone mass. Tail suspension is a ground-based model for the microgravity and cephalic fluid-shift aspects of spaceflight. This study was designed to clarify the difference of microgravity-induced bone loss between trabecular and cortical bone and changes of urinary mineral excretion.

Methods: Thirty 8-week-old female Spraque-Dawley (SD) rats randomly divided into five groups and completed tail suspension for two or four weeks: baseline control group (n=6, BC), 2 weeks vivarium control group (n=6, 2VC), 2 weeks tail suspension group (n=6, 2TS), 4 weeks vivarium control group (n=6, 4VC) and 4 weeks tail suspension group (n=6, 4TS). All rats were fed standard lab chow (CRF-1, Charles river, JAPAN) and to have same-volume-feeding for identical caloric intake. They were allowed access to distilled water ad libitum. After experimental period, rats were sacrificed and femurs were removed for analysis of bone mineral density (BMD) by dual energy X–ray absorptionmetry (DEXA, Lunar DPXL, USA) and peripheral quantitative computed tomography (pQCT, XC-960, Germany). The urine sample was collected in a glass flask with 10ml HCl during 24hrs at the end of experimental period.

Results: The femoral weights of 2TS and 4TS were decreased approximately 8% ($p<0.05$) and 9% ($p<0.05$) compared to the age matched both VC, respectively, but femoral length showed no difference among VC and TS. The femoral BMD measured by DEXA of 2VC and 4VC showed approximately 17% ($P<0.001$) and 24% ($P<0.001$) higher than that of BC, respectively. Those of the both TS, however, did not increased and approximately 12%($P<0.01$) and 14% ($P<0.001$) lower than those of VC, respectively. Also in the cortical BMD measured by pQCT, those of 2TS and 4TS showed approximately 4% ($p<0.01$) and 7 % ($p<0.001$) lower than those of VC, respectively. Similarly, the cortical cross-sectional area, bone thickness and stress-strain index (SSI), which reflect the mechanical strength, of cortical bone in both VC significantly increased, but those of TS were not ($p<0.01$ and $p<0.001$). However, trabecular BMD did not shown significant difference among any groups (NS). On the other hand, the serum calcium (Ca) concentration, urinary Ca and urinary deoxypyridinoline (Dpd) excretions of all intergroups showed similar levels (NS). The serum phosphate (P) concentrations of both TS, however, dynamically increased compared to the VC of 2-weeks ($p<0.001$) and 4-weeks ($p<0.05$), respectively, with approximately 40% decrease in urinary P excretion at both period ($p<0.05$, respectively).

Conclusion: These results suggest that the exposure to the microgravity environment induces spontaneous osteopenia in mainly cortical bone, and this osteopenia might be caused by disturbed P homeostasis.

LPS-INDUCED SICKNESS BEHAVIOR DOES NOT DEPEND ON KUPFFER CELL ACTIVATION IN MICE

Yano, H., Shiva, D., Matsumoto, T., Woods, J.A.

Department of Health and Sports Science, Japan

BACKGROUND: One characteristic of sickness behavior is demonstrated by a reduction in voluntary wheel- running activity during infection. Lipopolysaccharide (LPS), known as endotoxin, is a component of the cell wall of gram-negative bacteria that induces sickness behavior and increases proinflammatory cytokines. Additionally, it is well known that macrophages are the major cells that produce proinflammatory cytokines after LPS stimulation. Kupffer cells, which are resident macrophages in liver, constitute a large pool of macrophages. Although LPS binds to CD14/TLR4 of Kupffer cells directly, it is not clear whether Kupffer cells also are important in mediating LPS-induced sickness behavior.

PURPOSE: The purpose of this study was to determine the extent to which Kupffer cells contribute to LPS-induced reduction of running wheel behavior in mice. Our hypothesis was that LPS-induced sickness behavior is regulated by Kupffer cells via proinflammatory cytokine production.

METHODS: To clarify the effect of Kupffer cells on LPS-induced reduction of voluntary wheel-running activity, male C3H/HeN mice (n=8-9 in each group), were treated i.v. with either vehicle (PBS), GdCl3 (gadolinium chloride: inhibitors of Kupffer cells activity), or KDR (Kupffer cells

deletion reagent: provided by Prof. M. Inoue at Osaka City Univ.). We were measured changes in wheel-running activity and body weight before and after LPS (1mg/kg) or PBS injection.

RESULTS & DISCUSSION: Wheel-running activity in mice was greatly reduced after LPS injection (from 6,323+/-303 to 428+/-79 revolutions/day, 7%, p<0.01). Interestingly, wheel activity in GdCl3 injected mice was significantly lower than that in saline injected group (from 4,395+/-91 to 47+/-19 revolutions/day, 1%, p<0.01). However, in spite of non LPS stimulation, GdCl3 also induced reduction of wheel-running activity as a side effect (from 6,323+/-303 to 4,395+/-91, 70%, p<0.01). In contrast, KDR alone did not induce reduction of wheel-running activity. However, the wheel-running activity in KDR treated mice was still strongly decreased by LPS injection (from 8,609+/-1,954 to 233+/-110 revolutions/day, 3%, p<0.01). Thus, Kupffer cell activation might not regulate the response of LPS-induced reduction in wheel-running behavior.

CONCLUSION: Our results suggest that the transient reduction in physical activity after LPS injection is not mediated via Kupffer cells. Furthermore, we discuss the effect of inactivated Kupffer cells on plasma TNF-a concentration in mice after LPS injection.

THE EFFECT OF WATER IMMERSION ON ACTIVITIES OF ANTI-GRAVITY MUSCLES

Oyanagi, E., Seki, K., Lida, T., Miyakawa, T., Onodera, S.

Masters Program in Health and Sports Science, Japan

BACKGROUND: Holding the body's center of gravity steady represents the crucial variable for the stabilization of posture in the upright stance in man1). It is well known that the preservation of posture on land depends on contraction of anti-gravity muscles. However, it seems that the mechanism is different between on land and in water, because in the water condition we lose vertical force due to buoyancy. Although many previous studies showed that aqua exercise induces physiological exchanges, it is not clear whether neural muscular function affects the preservation of posture in the water. Especially, the effect of water buoyancy on response of muscular activities is still unclear.

PURPOSE: The purpose of this study was to determine the extent of the effects of activities of anti-gravity muscles. We hypothesized that water buoyancy regulates activation of anti-gravity by muscles for preserving posture.

METHODS: Six healthy adult males volunteered to participate in this experiment as subjects. Their characteristics were as follows: age; 22.0+/-1.0 years, height; 166.8+/-5.5 cm, weight; 66.0+/-5.3 kg, percentage of body fat; 21.2+/- 4.4%. All subjects were immersed up to the great trochanter-deep in the water. Furthermore, they were treated with different loads of body weight, by shouldering rucksacks. To evaluate muscle activities between on land and in water, all subjects were treated in the standing position and recorded surface EMGs (electromyograms) of TA (tibialis anterior), GAS (gstrochemious), SOL (soleus), RF (rectus femoris), BF (biceps femoris) and both left and right of MS (muscle of spine). IEMGs (integrated EMGs) were calculated by EMG signals from the 30th sec to the 60th sec after several load treatments. And then the values were expressed by percentage of IEMG in land condition.

RESULTS AND DISCUSSION: The relative IEMG of TA, GAS and SOL at great trochanter-deep in water immersion was significantly lower than that in land condition (98+/-86% vs. 165+/-136%; p<0.05, 82+/-87% vs.155+/-110%; p<0.01, and 79+/-45% vs. 110+/-26%; p<0.01, respectively). However, there was no significant difference in the relative IEMG of RF between the water immersion and the land conditions. More interestingly, although the relative IEMG of BF, left and right of MS were also not significantly changed, the relative IEMG of these muscles in the water immersion tended to be higher than that in land condition. Our results suggest that the activation of crural muscles might contribute to the preservation of posture in water immersion condition.

REFERENCES:

1) Horstmann, G.A. and Dietz, V.; A basic posture control mechanism: the stabilization of the centre of gravity. Electoroencephalogr. Clin. Nurophysiol., 1990, 76: 165-176.

EFFECT OF INTERNAL WORK ON MUSCULAR MECHANICAL EFFICIENCY DURING CYCLING EXERCISE

Tokui, M., Hirakoba, K.

Kyushu Women's Junior College, Japan

【Introduction】 Exercising muscle simultaneously performs external work (Wext) as well as internal work (Wint) due to movement in exercising muscle itself. Since the Wint level during cycling has been reported to be directly related to pedal frequency (Seabury et al., 1977), a ratio of Wint to Wext would vary depending on the changes in pedal frequency even at the same Wext level. This could lead to a change in oxygen consumption (aerobic energy) at the same Wext and/ a lower muscular mechanical efficiency. This study was carried out to determine the effect of Wint on muscular mechanical efficiency during cycling under the same Wext condition. 【Methods】 Nine healthy male subjects (age; 20.7±2.4 yr, height; 170.3±4.9 cm, mass; 62.6±4.7 kg, VO2max; 47.8±6.4 ml/kg/min) performed a constant-load exercise with three pedal frequencies (40, 80 and 120 rpm) on a friction cycle ergometer. The exercise test consisted of 3-min rest and unloaded cycling for 3-min followed by 4-min constant-load exercise, which was repeated three times separated by a resting period (~20 min). Breath-by-breath pulmonary gas exchange data were measured continuously throughout the exercise test using a metabolic analysis system. Blood lactate concentration was measured at rest and immediately after each exercise test. Work (ηwork) and true efficiencies (ηtrue) were calculated as a ratio of Wext to energy expenditure (E; aerobic and anaerobic energy) above E during unloaded cycling and a ratio of the sum of Wext and Wint (total work, Wtot) to E above rest, respectively. Wint was estimated from a method of Minetti et al.(2001) and anaerobic energy from blood lactate accumulation (di Prampero and Ferretti, 1999). 【Results and Discussion】 ηwork (27-29 %) was almost remained across the pedal frequencies used in this study. In contrast, ηtrue in 120 rpm (21 %) showed a tendency to be lower than in 40 rpm (24 %) and significantly lower than in 80 rpm (26 %). The differences between aerobic energy costs to Wext and Wtot were 31.8 (40 rpm), 34.6 (80 rpm) and 100.3 J/min/W (120 rpm). The differences between total energy costs (sum of aerobic and anaerobic energy) to Wext and Wtot were 31.1 (40 rpm), 29.4 (80 rpm), 65.2 J/min/W (120 rpm). It is inferred that the greater difference between energy costs to Wtot and Wext in 120 rpm would be due to the higher energy consumption used for Wint than Wext (approximately 10 ml/min/W). This was supported by a slope (15 ml/min/W) of Wint-VO2 rerationship calculated in this study, which led to the lower ηtrue in 120 rpm. The present results suggest that muscular mechanical efficiency could be affected by the ratio of Wint to Wext during cycling under different Wint conditions. Therefore, Wint level should be taken into considertion in assessing muscular mechanical efficiency.

【Reference】

Di Prampero and Ferretti (1999), Respir. Physiol. 118:103-115

Minetti et al (2001). Proc. R. Soc. Lond. B 268:1351-1360

Seabury et al (1977). Ergonomics 20:491-498.

CARDIOVASCULAR RESPONSES TO MAXIMAL DRY BREATH-HOLDING AT REST IN PROFESSIONAL DIVERS

Perini, R. 1, Tironi, A. 1, Butti, F. 1, Moia, C. 2, Ferretti, G.1+2

1 University of Brescia, Italy, 2 Centre Medical Universitaire, Geneve , Italy

The cardiovascular effects of prolonged breath holding were evaluated in 20 professional divers (16 males and 4 females; mean 33.4+6 yrs) during voluntary maximal dry breath-holds at rest. The subjects laid supine in a room at 25-26 °C for 5 minutes for control measurements; then they performed 3 successive apnoeas, the 3rd of which was requested to be maximal, at a lung volume close to the total lung capacity. ECG and blood pressure profile (PortaPress) were continuously recorded (Biopac). Arterial oxygen saturation (SaO2) was monitored every 5 s by infrared spectroscopy (Nellcor). Beat to beat values of heart rate (HR) and of the corresponding systolic and diastolic pressures (Ps and Pd) were obtained. Maximal breath-hold duration ranged from 92 s to 319 s (mean: 210±70 s). In all subjects HR decreased from 79±15 b·min-1 to 66±13 b·min-1 within the initial 30 s of apnoea (phase I), to attain a steady state that was maintained for 131±36 s (phase II). At the end of this phase, 9 subjects interrupted their apnoea (group A; mean time of apnoea: 141±35.5 s). The remaining 11 subjects maintained apnoea for additional 96±38 s (phase III; group B; mean time of apnoea: 267.3±37.4 s). During this phase, HR decreased to a minimum of 49.2±10.3 b·min-1. A comparison of group A and B showed no differences in times of phases I and II (respectively 29±10 s and 112±34 s in group A and 27±6 s and 145±31 s in group B) and in the corresponding HR decrements (14±8 b·min-1 and 14±9 b·min-1 respectively in group A and B). Ps did not change in phase I in both groups; in phase II Ps increased above control by 24±25 mmHg in group A but did not change in group B. In this group an increase in Ps occurred in the phase III (+23±20 mmHg; p>0.05 vs group A). A significant increment in Pd occurred in phase I similar in the two groups (+9±5 mmHg); an additional increment by about 10 mmHg was found in phase II in group A and in phase III in group B. SaO2% was 100 for the initial 97±47 s in group A and 143±48 s in group B (p>0.05), i.e. for the duration of phase I and 60% and 80% of phase II, respectively for group A and B. Then, SaO2% decreased and reached at the end of phase II a value of 95±5 % in both groups. In phase III a decrement occurred to 84±11 % in group B (p<0.05). During recovery, SaO2% further decreased to 92% in group A and 79 % (p=0.03) in group B, respectively at 15th s and 20th s. The rapid decrease in HR observed with breath holding corresponds to that described as diving reflex and was coupled with increased Pd, suggesting peripheral vasoconstriction. At the end of phase II, when a given SaO2% was reached, only those who were capable to resist a breathing stimulus entered phase III. We postulate that: 1) the end of phase II corresponds to the physiological breaking point; 2) chemoreceptor stimulation may contribute to the responses observed in phase III; 3) these responses should include stronger vasoconstriction and baroreflex induced bradycardia.

THE EFFECT OF LEG VIBRATION LOAD ON EXERCISE PERFORMANCE

Masaki, T., Takayuki, K.

Institute of Exercise physiology, Japan

Muscle vibration on the leg muscles may occur in the sports activities such as alpine ski, snowboarding, mountain bicycling, climbing, basketball, soccer etc. This vibration may depress the exercise performance. Recently, it has been confirmed that the muscle vibration occurs in the leg muscles during competitive alpine skiing (Mester, 2001). In curved turns of alpine skiing especially under icy conditions and high velocity, one major part of the frequencies can be seen in the rage of 15 -18 Hz (Mester 1997). However, if this vibration could be a lowering factor for the exercise performance were of a matter of concerned. In this study, we evaluated whether the vibration of 15 -18 Hz occurred in the leg muscles affects the exercise performance in the laboratory setting.

Fourteen men, aged 22.6±0.8 were participated in this study. All subjects were competitive athletes playing alpine ski, basketball, and soccer. Their sports career was 8 -11 years. Exercise performance test items were vertical jump, back strength, single leg balance with eyes closed, whole body reaction time, trunk flexion, and posture maintaining ability such as crouching were measured in both conditions of with 15 -18 Hz's vibration and without vibration. We defined the muscle endurance as the time to reach to the level of ratings perceived exertion (RPE)'s 17, i.e., fairly hard in which the subject had to maintain the crouching posture as long as possible to reach to this level. Moreover, to evaluate the muscle fatigue during crouching, electrromyographic (EMG) activities were measured on the 10 muscles including the buttocks, quadriceps and the gastrocnemius during crouching posture for 30 seconds and compared the mean power frequency (MPF) for every 5 seconds interval in the both conditions of with vibration and without vibration. Subjects were tested on the plate of vibration machine that was able to generate artificial vibration. The frequency of vibration was set at 15 -18 Hz and the direction of vibration was vertical. Measurements were conducted at first under the without vibration and, 1 day after, same performance tests were conducted with 15 -18 Hz vibration.

Vertical jump (52.7±6.6 vs. 54.4±6.0), single leg balance with eyes closed (23.2±22.2 vs. 83.3±5.1), and crouching (85.4±24.4 vs. 106.3±30.1) were significantly lower in the condition with vibration compared to without vibration. Particularly differences were remarkable in the equilibrium function and the muscle endurance. Significantly lower MPF was observed in 8 of 10 muscles. There were no significant differences in back strength, whole body reaction time, and trunk flexion. No beneficial effects of vibration on exercise performance were observed. From the results of this study, we conclude that 15-18 Hz's vibration load on the leg muscles could cause in the depression in exercise performance.

Reference

Mester J et al (2001). Science and Skiing II, 325-44.

MUSCLE AND CEREBRAL OXYGENATION CHANGES DURING ISOKINETIC LEG EXERCISE

Mookerjee, S., Weller, B., Welikonich, M., Matsuura, C., Bhambhani, Y.

Bloomsburg University, Bloomsburg, PA; Universidade Gama Filho, Rio de Janeiro, & University of Albe, United States

Muscle contraction is initiated in the cerebral motor cortex. This efferent signal traverses the spinal cord to recruit motor units in proportion to the intensity and velocity of contraction. Near infrared spectroscopy (NIRS) is a non-invasive optical technique that has been used to evaluate both cerebral activation and muscle performance during exercise. This study examined the relationship between isokinetic exercise at three velocities and cerebral as well muscle oxygenation/blood volume responses measured simultaneously using NIRS. Eleven healthy volunteers (mean age = 23.5 ± 3.3 yrs, height = 171.3 ±14.4 cm, mass = 68.5 ±12.3 kg, % fat= 15.9 ± 6.1 %) completed a 15-repetition leg extension/flexion protocol on an isokinetic dynamometer (Biodex System 3; Shirley, NY) after 2 min rest. Subjects exercised with the right leg at 150, 300 and 450 deg∙sec-1 in random order. NIRS measurements were recorded at rest and during the test from the left pre-frontal lobe and right vastus medialis muscle simultaneously using a dual wave spectrometer (MicroRunman, NIM Inc, PA). The difference in hemoglobin absorbency between the 850nm and 760 nm wavelengths was an index of oxygen extraction,

while the sum signal was an index of blood volume. Delta values of cerebral and muscle oxygenation/blood volume were calculated as the difference between the peak exercise and resting values prior to the initiation of contraction. Repeated measures analysis of variance indicated a significantly (p<.05) greater peak extension/flexion torque at 150 deg∙sec-1 compared to 300 and 450 deg∙sec-1. Cerebral oxygenation and blood volume exhibited a significant increase at all three velocities implying increased neuronal activation. These increases were significantly different (p<.10) between the contraction at 150 deg.sec-1 compared to the two faster velocities. Muscle oxygenation and blood volume decreased at all three velocities implying greater oxygen utilization despite a reduced blood volume. The decline in muscle oxygenation at 150 deg.sec-1 was significantly greater (p<.10) compared to the two faster velocities. Correlations between peak torque and delta values of cerebral oxygenation/blood volume were not significant with the exception of knee flexion torque and cerebral blood volume at 450 deg∙sec-1 (r2 = 0.68, p<0.04). However, statistically significant correlations were observed between peak extension torque and muscle oxygenation at 150 deg∙sec-1 (r2 = 0.63, p<0.04), and 300 deg∙sec-1 (r2 = .67, p<0.02). These NIRS findings support the well accepted torque-velocity principle and demonstrate the ability of NIRS in improving our understanding of the physiological factors that influence resistance exercise performance.

EFFECT OF ACUTE HYPOXIA ON FUNCTIONAL STATUS, RESOURCES AND PERFORMANCE OF MOUNTAINEERS

Kulnazarov, A., Ivanov, A., Sukhov, S.

National Research and Practical Center of Physical Culture, Almaty, Kazakhstan, Kazakhstan

Introduction

Mountain climbing involves the effect of a set of extreme natural factors; hypoxia being one of the main of them. Goal of the study is to assess the effect of acute hypoxia on the functional status, reserve resources and physical performance of mountaineers.

Methods

In the resting state and at submaximum and maximum aerobic load on the cycle ergometer, there were determined the indicators of respiration and gas exchange, lactate concentration and acid-base state of blood, registered ECG, and assessed performance. Ten males were tested twice, with interval of one day. During the first test the athletes breathed ambient air, while during the second one they inhaled hypoxic mixture with oxygen content 11.2% that corresponds to 5000m above the sea level.

Results

It was revealed that at breathing ambient air the respiratory minute volume (RMV) of in resting state was 7.20.61 l, while in the hypoxic conditions – 12.60.85 l. Heart rate prior to and after changing to hypoxic mixture was 72.13.5 and 84.42.7 beats a minute, respectively. Oxygen debt of in resting state was 247±8 ml/min, while in the hypoxic conditions – 278±14 ml/min. In hypoxia the maximum tolerable load decreased by 28.72.6%, and its total volume – by 39.23%. In hypoxic conditions, the PWC170 declined by 34.53.5%. At submaximum load in hypoxic conditions RMV increased by 427.9%, while at maximum load there was no difference in RMV. Oxygen debt at submaximum hypoxic load has decreased by 19.54,5%, and by 38.53.4% at maximum load. At the first and second examinations, the coefficient of correlation between the maximum oxygen consumption (VO2max) and PWC170 was 0.60. Submaximum load in hypoxia was accompanied with the growth of lactate concentration by 60.619.5%, in comparison with breathing ambient air. There was no difference in lactate concentration at maximum load. Physical load in the conditions of hypoxic mixture led to more expressed disbalance of blood acid-base status. Acidosis shift of pH at submaximum load in the hypoxic conditions was 0.160.01, and at breathing ambient air – 0.0710.02 conventional units. pH indices did not differ at the maximum load. Breathing the hypoxic mixture resulted in more expressed elimination of carbon dioxide from the blood. Thus, in breathing ambient air the рСО2 dropped to 37.53 1.31mm mercury at maximum load, while in hypoxic conditions – down to 31.190.99 mm mercury.

Conclusion

Use of such testing allows to assess the tolerance of athletes to locomotory and high-altitude hypoxia, and to forecast their performance in extreme high-altitude conditions.

THE STRESS OF CHESS PLAYERS. A MODEL TO STUDY THE EFFECTS OF PSYCHOLOGICAL STIMULUS ON BIOLOGICAL RESPONSES. AN EXAMPLE ON ENERGY EXPENDITURE IN MAN

Troubat, N., Gluck, M.-A., Dugue, B.

EA 3813 - University of Poitiers, France, France

Aim: We have studied the following stress model: the tension caused by playing chess.

Material and subjects: Eighteen subjectively healthy male chess players from the Limousin chess league participated in this study. Contests were arranged against players of similar levels (similar ELO chess rate). Heart rate (HR), O2 consumption (V.O2), CO2 production (V.CO2), breathing frequency (BF) were recording during the game using a portable metabolic cart (Metamax, Cortex, Germany) and a heart rate monitor (Polar Accurex, Finland). Indirect calorimetry was used to determine energy expenditure.

Results: The results were analysed between the 4th and the 20th minute of the game. Significant increase in HR (mean and [extreme values]: 86 [69-114] to 91,7 [68-124] bpm), V.O2 (4,5 [3,4-5,9] to 5,0 [3,8-7,8] ml.kg.min-1), BF (16,4 [9,6-24,9] to 17,1 [11,5-23,8] breath.min-1) and significant decrease in V.CO2 (4.2 [2.2-6.2] to 4.1 [2.9-7.0] ml.kg.min-1), and respiratory exchange ratio (RER) (0.9 [0.7-1.2] to 0.8 [0.7-0.9]) were observed. When calculating the oxidation rate, the lipid oxidation was found to significantly increase (from 0.6 to 1.7 g.min-1), whereas glucide oxidation significantly decreased (4.5 to 2.3 g.min-1). All together, total energy expenditure significantly increased during the game (22.9 to 24.8 Kcal.l-1).

Conclusion: We here describe an interesting real-life stressor that seems a useful stress model in that it has significant effects on the the metabolism. Considering the amount of energy used while sitting and playing cards for amusement, the extra energy due to a twenty min chess match is comparable to a 10 min walk at 5 km.h-1.

DIFFERENT ERGOMETRIC RESPONSE AFTER CAFFEINE INGESTION IN TRAINED AND UNTRAINED MEN

Olcina Camacho, G.J., Maynar, M., Caballero, M.J., Muñoz, D., Timón, R., Maynar, J.I.

Sport Science Faculty, Spain

Introduction: caffeine is an alkaloid, which may improve physical human performance due to different physiological mechanisms. Sport training generates physiological adaptations to itself, so, does caffeine act equally in trained men with adaptations as well as in non trained ones?.

Objectives: the aim of this study is to analyze the differences generated between trained and untrained men after caffeine ingestion in aerobic activities.

Material and Methods: A double blind randomized study with 5 mg/bw of caffeine was performed. Twenty non trained males and 15 trained cyclists had to cycle with two different protocols: progressive protocol until exhaustion and 30' steady state at 80% VO2 max under two conditions caffeine (CAF) and placebo (PLA). Ergospirometric response was measured with a Medical Graphics gas analyser and lactate values were analysed before and after all trials from vein blood using an YSI system. Statistical analysis was carried out using a statistical package for social sciences (SPSS 11.0 for windows). ANOVA was used for repeated measures to determine the significance of the differences, considering $p<0.05$ statistically significant.

Results: In incremental maximum tests, non trained subjects after caffeine ingestion showed an increase in total time of exercise (PLA: 11'35" ± 1'45 vs. CAF: 12'08" ± 1'59) $p<0.05$, VO2 max in ml kg/ min (PLA: 38.47 ± 4.99 vs. CAF: 41.59 ± 6.50) $p<0.05$, maximum heart rate (PLA: 184 ± 5 vs. CAF: 190 ± 6) $p<0.01$ and a decrease maximum RER values (PLA: 1.46 ± 0.14 vs. CAF: 1.40 ± 0.13) $p<0.05$, while, in trained cyclists there were only differences in maximum heart rate after caffeine ingestion (PLA: 182 ± 6 vs. CAF: 190 ± 5) $p<0.05$. With regard to the steady state trials, caffeine didn't change ergoespirometric parameters or lactate values in non trained subjects. In trained cyclists a better metabolic efficiency after caffeine ingestion with a decrease in VO2 and in RER values after 10 minutes of exercise was shown.

Discussion: caffeine ingestion improves maximal aerobic power in untrained men and it could enhance aerobic efficiency in trained men. Due to these different findings in trained and untrained men, caffeine would actuate by different ways depending on training level. In non trained men, changes in effort perception or nervous system stimulation could be the caffeine action mechanisms, while in trained men would be different, more related to metabolic aspects.

References:

Doherty, M. (1998). The effects of caffeine on the maximal accumulated oxygen deficit and short-term running performance. Int J Sport Nutr 8, 95-104.

Roy, B. D., Bosman, M. J. & Tarnopolsky, M. A. (2001). An acute oral dose of caffeine does not alter glucose kinetics during prolonged dynamic exercise in trained endurance athletes. Eur J Appl Physiol 85, 280-286.

MUSCLE OXYGENATION, BLOOD VOLUME, LACTATE AND HEART RATE RESPONSES DURING CONCENTRIC AND ECCENTRIC CONTRACTIONS

Moalla, W., Dupont, G., Ahmaidi, S.

Faculté des Sciences du Sport, Université de Picardie Jules Verne, Amiens, France

Introduction: Understanding muscular action mode is of importance to improve training programs for athletes and patients (Styf et al 1995). It has been reported that eccentric contraction (Ecc) produces less cardiovascular stress and was fatigue resistant than concentric contraction (Conc) (Durand et al 2003). This difference would be due in part to a better oxygenation which may reduce metabolic demand. The aim of this study was therefore to investigate the effects of Conc and Ecc contractions on peripheral muscle oxygenation (MO2), blood volume (BV), blood lactate concentration [Lac] and heart rate (HR) in comparable work.

Methods: Twelve men aged 21 to 26 years performed Conc and Ecc maximal voluntary contractions (MVC) and 100 s endurance tests of the knee on Cybex isokinetic dynamometer at a velocity of 60°.s-1 between 6° and 84° according to the protocol of Kay et al (2000). During endurance test, MO2 and BV were assessed continuously by near infrared spectroscopy NIRS (RUNMAN, USA) on the vastus lateralis muscle. An arterial occlusion was applied to determine changes in MO2. Then, we calculated the mean rate of decrease in MO2. To assess changes over time, we divided into 10 s epochs the endurance test. Likewise, maximal HR was recorded and [Lac] was determined 3-min after the endurance test (Dr Lange miniphotometer).

Results and Discussion: Compared to Ecc, Conc contraction showed a significantly lower MVC (201.8 ± 40.3 N.m vs. 268.4 ± 47.7 N.m; $p<0.01$), higher HR (132.7 ± 19.6 vs. 117.0 ± 14.9 beats.min-1; $p<0.05$), and higher [Lac] (6.92 ± 0.86 mmol.l-1 vs. 4.64 ± 0.83 mmol.l-1; $p<0.01$). These results confirms the hypothesis of reduce energy cost of Ecc contraction. MO2 kinetics showed a progressive deoxygenation in both Ecc and Conc contraction which is significantly pronounced in Conc ($p<0.001$) until 60 s. Surprisingly, we showed a better oxygenation during Conc from 70 s until the end of exercise. The mean rate of decrease in MO2 during the test was significantly faster in Conc compared to Ecc contraction (0.72 ± 0.03 %.s-1 vs. 0.67 ± 0.05 %.s-1, $p<0.01$). This better oxygenation could be due to the viscoelastic properties of the muscles fibres during Ecc contraction. Furthermore, no difference in BV was found between Ecc and Conc contraction at the beginning of exercise (from rest to 10 s), and from 50 s to the end of exercise. However, significant reduction in BV was observed in Conc than Ecc contraction at 20, 30 and 40 s ($p<0.001$) which could be explained by the lowest intramuscular pressure reported on Ecc contraction (Styf et al 1995).

Conclusion: Our results demonstrate that vastus lateralis muscle deoxygenate less during Ecc contraction compared to the Conc contraction. Moreover, Ecc generates a higher MVC, lower HR and [Lac] than Conc contraction.

References

- Styf et al. Scand J Med Sci Sports 5:291-296; 1995
- Durand et al. J Strenght Cond Res 17:541-548; 2003
- Kay et al. J Electromyog Kinesiol 10:425-431; 2000.

ACUTE INTERLEUKIN-6 ADMINISTRATION DOES NOT ALTER PLASMA SOLUBLE INTERLEUKIN-6 RECEPTOR CONCENTRATION FOLLOWING AN ACUTE BOUT OF EXERCISE

Robson-Ansley, P., De Milander, L., Collins, M., Noakes, T.

University of Portsmouth, Portsmouth PO1 2DT, UK, United Kingdom

Fatigue is a predictable consequence of physical activity; yet its biological cause remains ambiguous. During exercise, a polypeptide messenger molecule interleukin-6 (IL-6) is actively produced. We previously reported that administration of recombinant IL-6 (rhIL-6) to healthy trained runners prior to a 10 km time trial induced a heightened sensation of fatigue and a significant decrement in performance (Robson-Ansley 2004). Plasma soluble IL-6 (sIL-6R) receptors in association with IL-6 can render almost all cells sensitive to IL-6. In patients with elevated plasma IL-6 concentrations, administration of anti-IL-6 receptor antibodies reduced the symptoms of previously debilitating fatigue (Nishimoto et al., 2000). We hypothesise that the increased sensation of fatigue following exercise following rhIL-6 administration is due to a concomitant increase in sIL-6R concentration. The effects of exogenously provided rhIL-6 following an acute bout of exercise on plasma sIL-6R concentration in healthy trained male runners have yet to be reported. Thus, the purpose of this study was to determine if plasma soluble IL-6 receptor concentrations were increased following a low dose of rhIL-6 administered to trained male runners following a repeatable exercise challenge. Seven healthy, trained male runners completed an exercise challenge, which consisted of a 10 km time trial on a motorized treadmill on two occasions under two different treatment conditions i) a placebo (saline) ii) rhIL-6 subcutaneous injection at a dose of 0.05µg per kg body mass. Each trial was separated by one week and treatment was randomly assigned in a double-blinded manner. RhIL-6 administration had no significant effect on plasma soluble IL-6 receptor concentration post-exercise (P>0.05) despite (as previously reported) the fact rhIL-6 administration significantly impaired 10 km time trial running performance compared to the placebo 10 km time trial (P<0.01). In conclusion, rhIL-6 administration did not increase sIL-6R concentration post-exercise. Hence, we hypothesize that the rhIL-6 administration impaired exercise performance and increased sensations of generalized fatigue by altering CNS serotonergic activity.

Robson-Ansley P. J., Milander L, Collins M, Noakes T. D (2004) Acute interleukin-6 administration impairs athletic performance in healthy, trained male runners. Canadian Journal of Applied Physiology. 29 (4) 21-24

Nishimoto, N., Sasai, M., Shima, Y., Nakagawa, M., Matsumoto, T., Shirai, T., Kishimoto, T., and Yoshizaki, K. (2000). Improvement in Castleman's disease by humanized anti-interleukin-6 receptor antibody therapy. Blood .95: 56-61.

CHANGES OF URINE 8-OHDG LEVELS OF A SINGLE BOUT OF EXERCISE UNDER HEAT OR COLD ENVIRONMENT IN HUMANS

Saito, Y., Nagashima, K., Suda, K., Kanosue, K., Tanaka, H.

Waseda University, Japan

Purpose: 8-OHdG has been recognized as a biomarker of oxidative DNA damage by endogenously generated oxygen radicals. The urinary excretion of 8-OHdG is a reflection of the integrated rate of oxidative DNA damage and the whole body repair of DNA1). The aim of this study was to examine whether evaluation in 8-OHdG content after a single bout of exercise under different environment in humans is affected by heat or cold exposure. Methods: We have determined the urinary 8-OHdG levels of six healthy male volunteers (Age; 21.3±1.0 years, Height; 172.7±5.8cm, Weight; 72.0±13.4kg, BMI; 24.1±4.5kg/m2). They wore T-short and half pants during the period of the study. All subjects in each experiment gave their informed consent. The procedures for these studies conformed to the guidelines. So, we studied five condition tests; Change on urinary 8-OHdG levels 1)when they don't experiment (Baseline), 2)when HRmax 60-70% of a single bout of exercise for 60 min in a room maintained at 25℃ (neutral environment ; Neutral EX), 3)when HRmax 60-70% of a single bout of exercise for 60mins in a room maintained at 35℃(heat environment ; Heat EX), 4) when HRmax 60-70% of a single bout of exercise for 60 min in a room maintained at 0-5℃ (cold environment ; Cold EX), 5) when immersed leg at 43℃ water temperature for 60 min in a room maintained at 30℃ (Heat BATH). The urine 8-OHdG was used at selected time points; pre-, just post-experiment, 2 hr post-experiment and 6 hr post-experiment. Results: Urinary 8-OHdG excretion was increased all experiment compared to the each experimental control (p＜0.0１). But, only heat EX was not significant (pre-;11.36±4.09ng/h/kg, just post; 13.99±6.57ng/h/kg, 2 hr post; 15.42±5.53ng/h/kg, 6 hr post; 11.24±3.54ng/h/kg). Rectal temperature during the experimental load was rose Heat EX from 30 min point, and it was getting over 38℃ from 50 min point. Discussion: These results indicate that a single bout of exercise in a room maintained at heat environment, getting over 38℃ on thermoregulatory response in humans, was rose heat shock protein, so increased antioxidant enzyme, oxidative DNA damage was decreased, and oxidative DNA repair enzyme was activated. Our results suggest that the promotion of body tissue injury by the oxidative stress may cause the influence in rectal temperature. We conclude that urinary 8-OHdG content increases after short-term and a single bout of exercise.

1) Kasai H, Tanaka H and Nishimura S (1984) Formation of 8-hydroxyguanosine residues in DNA by X-irradiation. Gann 75 : 1037-1039

2) Loft S, Fischer-Nielsen A, Jeding I B, Vistisen K and Poulsen H E (1993) 8-hydroxy -deoxyguanosine as aurinary biomarker of oxidative damage. Journal ofToxicology and Environmental Health 40 : 391-404.

EFFECT OF TIME OF DAY ON VO2 KINETIC RESPONSES DURING SEVERE INTENSITY EXERCISE IN TRAINED CYCLISTS

Santana, M.G., Tufik, S., Passos, G.S., Santee, D.M., Denadai, B.S., Mello, M.T.

Federal University of São Paulo, Brazil

The kinetic analysis of the has been suggested to be an important parameter in the evaluation of aerobic capacity, as well as the capacity to tolerate exercise (Jones and Carter, 2000; Jones and Poole, 2005). As regards the tolerance to exercise and the diurnal variation, studies have shown that there is a longer exhaustion time at high intensity exercise in the afternoon and morning periods (Reilly and Baxter, 1983; Hill, 1996). The aim of this study was to evaluate a possible influence of the time of day on the parameters of oxygen uptake VO2 during severe intensity exercise. Nine trained cyclists, male (age 25 +/- 3.8 yrs., body mass 66.8 +/- 4.6 kg, height 174.4 +/- 6.7 cm and VO2max. 63.0 +/- 2.73 ml/kg/min), performed an incremental test to exhaustion (11:00 h) on a cycle ergometer and repeated bouts of exercise at constant loads (08:00, 13:00 and 18:00 h) on different days. These bouts of exercise were performed twice on each occasion, with an interval of 1 h between them. The intensity of the load used was 75%Delta (75% of the difference between the VO2 lactate threshold and the VO2max.). Prior to the bouts of constant-load exercise, the subjects rested in supine position for 20 min. Oral temperature was measured by a clinical digital thermometer inserted sublingually for 3 minutes after the period of rest. The oral temperature observed at 08:00 h (36.2 +/- 0.2ºC) was significantly lower than that at 13:00 h (36.5 +/- 0.2ºC) and at 18:00 h (36.6 +/- 0.2ºC) ($p < 0.05$). The values of the time constant of the VO2 primary component (19.3 +/- 2.5 s, 18.4 +/- 3.0 s and 19.7 +/- 3.9 s) and of the amplitude of

the VO2 slow component (735 +/- 81 ml/min, 764 +/- 99 ml/min and 680 +/- 121 ml/min) did not present significant differences at the different times (08:00, 13:00 and 18:00 h), neither did the other parameters of the VO2 kinetics. In summary, the data suggest that the VO2 kinetic responses of trained cyclists, exercising at severe intensity (75%Delta), were not influenced by the time of day exercise took place (either 08:00, 13:00 and 18:00 hours). This characteristic increases the time availability for the kinetic evaluation of the VO2 in cyclists.

EFFECTS OF SOME PHYSIOLOGICAL PARAMETERS ON SPECIFIED MOTOR SKILLS IN WATER POLO PLAYERS

Radovanovic, D. 1, Stamenovic, L. 2, Aleksandrovic, M. 1

1 Faculty of Physical Education Nis, 2 Faculty of Medicine Nis, Serbia and Montenegro

Introduction

Water polo requires a high level of physiological adaptation due to the game characteristics and aquatic envioronment. The aim of the present investigation was to determine the effects of some physiologic parameters on specified motor skills in young waterpolo players.

Methods

The investigation inlcluded 68 male subjects (age 11.8 yrs.±0.4, height 157.24cm±8.36, body weight 49.62kg±7.82). Subjects were junior water polo players of 4 Serbian water polo clubs with at least two years' training and competition experience in the league and tournament competitions. Functional abilities were determined according to absolute and relative VO2max values, forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1.0), and heart rate frequency at rest. The level of specified motor skills was determined by means of the following variables: 25 m front-crawl swimming (S25), 50m front-crawl swimming (S50), 100m front-crawl swimming (S100), 4x5m back-crawl swimming (S4X5), 3x5m leading the ball (S3X5), and throwing the water polo ball (TWB). The level of investigated dimensions in water polo players was determined by applying the basic statistical parameters. The establishment of the space structure of specified motor skills was performed using Hotelling's method for factor analysis of the main components. The effect of the tests for latent space functional ability of specified motor skills was determined by regression analysis.

Results

One main component was obtained–a general factor of situational motor skills (GFSM) using factorization of 6 tests for specified motor skills in the investigated water polo players. The projections of variables on the main component are bipolar. The connection of the whole predictor system of functional ability variables and GFSM is relatively high (R= .460), and common variability between them approximates 21% (R^2= .212). In particular, FEV1.0 has the highest statistically significant effect on GFSM (BETA= - .293).

Discussion/Conclusion

The presence of one main component (factor) of the specified motor skills in water polo players is a consequence of optimal selection and homogenous sample, as well as the adequate selection of a battery of tests. The applied battery of tests can be recommended for monitoring specified motor skills in water polo players at the age of 12 years. A significant effect of FEV1.0 on GFSM points to the interdependence of functional adaptation and specified motor skills even this early in a water polo player's sports career. Since 5 out of 6 test for situational motor skills lasted longer (S25, S50, S100, S4X5, S3X5), the effect of this parameter is expected.

CHARACTERIZATION OF A PERIPHERAL MARKER FOR THE IDENTIFICATION OF THE PREVAILING SKELETAL FIBER TYPE

Fontes Ribeiro, C.A., Tavares, P., Cabrita, S., Santos, A.C., Rosado, M.F., Fontes Ribeiro, G., Oliveira, A.

University of Coimbra, Portugal

The characterization of the skeletal fiber type can only be performed through a biopsy which is not available for routine use without personal and ethical concerns. Therefore, another method is needed.

The main objective of this work was to test if the aerobic training capacity might be assessed through the determination of the expression of nitric oxide synthase (NOS) isoforms in platelets. To verify this, Wistar rats were used for: a) Characterization of skeletal muscle fiber type in the following muscles: soleus, vastus lateralis and rectus femoris (both of the quadriceps muscles) and gastrocnemius; b) Determination of NOS isoform expression [constitutive (cNOS), which can be endothelial or neuronal, or inducible (iNOS)] through Western blotting in the same muscles; c) Determination of the expression of the same NOS isoforms in platelets; d) Determination after 28 days of aerobic training (treadmill of increasing velocity) of the expression of cNOS and iNOS in the same muscles and platelets.

Muscles were analysed histochemically for mATPase (with alkaline (pH 9.40) and acid (pH 4.35) pre-incubation) and succinic dehydrogenase (SDH) activities. NOS expression was determined by Western blotting, by using specific antibodies against the constitutive and inducible isoforms of the enzyme. Training was performed in a treadmill (LE8706 model, Panlab s.l., Barcelona, Spain) controlled by computer, starting with the velocity of 6 cm/sec and finishing at 54 cm/sec (after 6 weeks of continuous and progressive training).

The following results were obtained:

The principal type of muscle fiber in soleus is oxidative (slow-twitch oxidative fibers or type I fibers) whereas the other muscles are mixed (with type I, and type IIb and IIa fibers (fast-twitch glycolytic fibers and fast-twitch oxidative glycolytic fibers)). In the principal oxidative muscle – soleus - of sedentary rats there was no cNOS expression, the same occurring for cNOS and iNOS in the gastrocnemius muscle. However, after aerobic exercise there was a significant expression of these two enzymes in both muscles. In sedentary rats there was a high expression of cNOS and iNOS in the rectus femoris and principally in the vastus lateralis. After training there was an increase of 10-30% of the cNOS and iNOS expression.

In platelets, cNOS and iNOS are significantly expressed. After training there was a significant increase of both isoforms, of the same magnitude of the increase in muscles.

These results suggest that the skeletal muscle nitric oxide expression (cNOS and iNOS) may be obtained through the determination of the cNOS and iNOS expression in platelets. Moreover, aerobic training may increase the expression of both enzymes in muscles and platelets, in a parallel way. Thus, platelets may be used to determine the training effect on the nitric oxide system and may reflect the aerobic capacity of the subject.

Supported by PAFID, IDP, Portugal.

CASE STUDY OF SHORT-TERM HEART RATE VARIABILITY CHANGES WITH TRAINING LOAD IN A 16-YEAR-OLD MALE SWIMMER DURING PRE-COMPETITION AND COMPETITION

Matos, N., Winsley, R.

University of Exeter, United Kingdom

Introduction

To optimise training and preparation for competition athletes need to balance training and rest. Failure to provide adequate recovery may result in the athlete becoming overreached or eventually overtrained. The latter may be reflected by decreased performance, constant fatigue, altered mood states, depressed immune function, or changes in the autonomic nervous system activity (Halson et al., 2004).

Heart rate variability (HRV) analysis arguably provides an indication of autonomic sympathovagal balance. Acute changes in training load have been shown to influence HRV profile of trained athletes, with a reported increase in sympathetic drive (Hedelin et al., 2000), therefore HRV analysis may offer a non-invasive assessment of cumulative exertion and related fatigue (Earnest et al., 2004).

It has been suggested that competitions are physically and psychologically stress-inducing (Lehman et al., 1998), and whether changes in HRV profile are evident during a short-term (<1 week) competition period remains unclear. Hence, the purpose of this study was to examine the effects of quantifiable levels of exertion (TRIMPS) and resting HRV in a swimmer, assessed during pre-competition training and competition.

Methods

A 16 year-old national-level swimmer, 76.0kg body mass and stature 1.90m, who was currently in a 6-month training cycle, volunteered to participate. He was evaluated weekly during 3 weeks of mid-season pre-competition training and during a 3-day competitive gala (best score of 733 - International Points Score, IPS). A 5-minute resting HRV sample was measured at the end of each evaluation period. TRIMPS were calculated for each week of evaluation, assessed from both the duration of effort and its relative intensity. HRV data was analysed using frequency domain analyses.

Results

During week one, training load was high (74.8 TRIMPS) and this was accompanied by a LF/HF ratio of 4.8, indicating a predominance of sympathetic modulation. Interestingly, when training load reduced (week 2, 42.6 TRIMPS) LF/HF ratio declined to 0.4, with LFnu reducing by 64% and HFnu increasing by 300%, which suggests a rebound recovery of parasympathetic modulation during phases of lightest training. Return to higher training loads in week three again saw LF/HR ratio increase. Importantly during competition, although total TRIMPS were reduced, the swimmer gave close to his best performance (IPS=700), resulting in LFnu increasing by 8.7% (42.5) and HFnu decreasing by 5.6% (57.5), suggesting that stressors of competition may be reflected with a change in HRV profile towards increased sympathetic modulation.

Conclusion

HRV profile indicates an increased sympathetic modulation with increased training load and competition.

References

Earnest et al., 2004. Brit J Sports Med, 38: 568-575.

Halson et al., 2004. Sports Med, 34: 967-981.

Hedelin et al., 2000. Med Sci Sports Ex, 32: 1531-1533.

Lehmann et al., 1998. Med Sci Sports Ex, 30: 1140-1145.

PEAK OXYGEN UPTAKE, LACTATE, BODY MASS IN SWIMMERS AND NON-SWIMMERS

Colantonio, E., Barros, R.V., Peduti Dal´Molin Kiss, M.A.

University of São Paulo, Brazil

Maximal oxygen uptake (VO2max) is an important indicator of aerobic fitness so much for athletes as for non-athletes. Due to methodological aspects related for his determination, the peak oxygen uptake (VO2peak) is also used. In swimmers is common to find high values of this variable as for absolute as for relative values, in spite of the competitive swimming performance is associated, predominantly, to glycolytic anaerobic metabolism. Knowledge of metabolic and functional responses during exercise and sport still has some questions related to physical training in children and adolescents. The aim of the present study is to analyze the VO2peak behavior and lactate concentrations ([La]) in children and adolescents swimmers (Sw) and non-swimmers (Nsw). Seventy one male volunteers served as subjects in this study, ranging in age from 7 to 17 years (35Sw and 36Nsw). They were arrangement in age-groups from 7-10, 11-14 and 15-17 years, making six under groups, respectively: Sw1 (n=13), Sw2 (n=13), Sw3 (n=09), Nsw1 (n=12), Nsw2 (n=15), Nsw3 (n=09). Anthropometrical data: Stature, Body Mass (BM) and Sum of seven Skinfolds were realized. The VO2peak values were attained through the VO2000® gas analysis system and Inbrasport ATL® treadmill, using adapted Bruce (1973) protocol. Capillary blood samples were collected from ear lobe at the end of the test and they were analysed immediately using Accutrend® analyzer for blood [La]. The results of the [La] showed lactate absolute delta for Sw1 = 3.44 + 1.79, Sw2 = 5.44 + 2.28, Sw3 = 5.89 + 2.01 mM and Nsw1 = 1.79 + 0.96, Nsw2 = 3.85 + 1.96, Nsw3 = 4.23 + 2.52 mM. The mean values of the VO2peakabs (l.min-1) were: Sw1 = 1.60 sd 0.45; Sw2 = 2.59 sd 0.65; Sw3 = 3.86 sd 0.44; Nsw1 = 1.00 sd 0.16; Nsw2 = 1.98 sd 0.51; Nsw3 = 2.78 sd 0.39. The mean values of the VO2peakrel (ml.kg-1.min-1) were: Sw1 = 46.15 sd 6.66; Sw2 = 57.03 sd 6.75; Sw3 = 56.28 sd 6.28; Nsw1 = 36.50 sd 5.12; Nsw2 = 43.46 sd 6.35; Nsw3 = 44.44 sd 8.64. The mean values of the VO2peakrelcor (ml.kg-0.67.min-1) were: Sw1 = 147.66 sd 24.90; Sw2 = 200.23 sd 30.00; Sw3 = 226.61 sd 19.51; Nsw1 = 108.74 sd 14.77; Nsw2 = 152.24 sd 22.50; Nsw3 = 173.37 sd 28.68. Statistical differences in both VO2peak were observed among the age groups ($p<0.05$). These finds point that both VO2peak rise between age groups for Sw and Nsw, and still it suffers influence from the age group and total BM, in special the body fat. The absolute lactate delta depends of the age group and the state training. In all age groups both VO2peak was greater for Sw than Nsw.

Bruce et al (1973). Am Heart J 85:546-2.

DOES LOW INTENSITY ISOCAPNIC HYPERPNEA ENHANCE BLOOD LACTATE ELIMINATION AFTER EXHAUSTIVE ARM EXERCISE?

Perret, C., Mueller, G.

Swiss Paraplegic Research, Switzerland

Introduction: Increased lactate concentrations compromise exercise performance. Therefore to regain maximal exercise capacity a fast elimination of accumulated lactic acid is important, particularly if several high intensity exercise bouts have to be performed within a short period of time. In general, blood lactate elimination is enhanced by active recovery at moderate in-tensities using the previously loaded muscle groups. In doing so glycogen resynthesis in these muscles is compromised and might impair subsequent exercise performance. Respiratory mus-cles have the ability to metabolize lactate and may therefore be used for recovery purposes without affecting glycogen resynthesis in previously stressed limb muscles. The aim of this study was to investigate the impact of moderate isocapnic hyperpnea (IH) on blood lactate elimination after exhaustive arm exercise in comparison to passive and active recovery using the previously loaded muscles.

Methods: 18 healthy male subjects (age: 30±5yr; height: 178±7cm; weight: 72±9kg; VO2peak: 42±7ml•min-1•kg-1) performed three arm cranking tests to volitional exhaustion on 3 different days at least 48h apart. Arm exercise was randomly followed by 30min of passive re-covery (PR), ventilatory recovery (VR) by means of IH at 30% of 12s maximal voluntary venti-lation, or active arm cranking (AC) at a moderate intensity. Blood lactate concentrations were measured at rest, immediately after the exercise test and every 2min until the end of the re-covery period. Furthermore peak power, peak oxygen uptake and rate of perceived exertion were determined at the end of the arm cranking test. Heart rate was measured continuously throughout the test.

Results: No significant differences for blood lactate concentrations were found between inter-ventions PR, VR and AC during the whole measurement period (peak lactate concentrations: 11.09±1.98mmol•l-1 (PR), 11.25±1.93mmol•l-1 (VR), 11.13±1.44mmol•l-1 (AC); lactate concen-trations at the end of the recovery period: 4.35±1.56mmol•l-1 (PR), 4.09±1.35mmol•l-1 (VR), 3.77±1.60mmol•l-1 (AC). All other parameters measured were not significantly different be-tween interventions, with the exception of higher mean recovery heart rates during VR (111±7bpm) and AC (116±9bpm) compared to PR (93±11bpm).

Conclusion: Low intensity IH seems not to enhance blood lactate elimination after exhaustive arm exercise compared to passive or active recovery using the previously loaded muscle groups.

THE INFLUENCE OF FUNCTIONAL CLOTHING ON THE THERMOREGULATION OF AN ATHLETE

Jack, A., Thoma, S., Rossi, R., Niess, A., Schmidt, W.

Empa St. Gallen (CH)/ Universität Bayreuth Sportwissenschaft (D), Switzerland

Human beings are homoeothermic, which means that they have to maintain their core temperature within close limits around 37°C. During every activity, the body produces a certain amount of heat lying between 80 W while sleeping and over 1000 W during most strenuous activities. The surplus energy can be transferred to the environment via three channels: respiration and release of dry (radiation, convection and conduction) and evaporative heat through the skin. Evaporative cooling is a very efficient means of heat dissipation, as one litre evaporated sweat removes about 670 W/h from the body. The body evaporates from at least about 22 g/h so-called perspiration insensibilis, up to 4 l/h during short periods of time. In order to avoid heat stress, the heat loss to the environment should be as high as the heat production. In many sports activities, the heat production of the muscles is higher than the heat release and therefore the body will overheat. Marathon runners, for instance, show core temperature of 40°C or even higher at the end of the run. If the ambient temperature is high, the heat and moisture transport through the garment should be as high as possible to avoid heat stress. In order to develop sports clothing with optimal thermo physiological properties, all thermo physiological parameters have to be considered. In summertime, the thermal insulation should usually be low and the clothing should allow efficient water vapour transfer. During very strenuous activities, it is also very important that the liquid sweat produced can evaporate near the body. If the liquid sweat produced drops down, it will not contribute to cooling the body. Any liquid sweat that does not evaporate near the body will, on the contrary, correspond to an additional physiological load, as the body has to produce more sweat to compensate the run-off. For this reason we aim to develop new textiles, which help to improve human thermoregulation in order to achieve an enhancement of the physical performance. For this purpose we carried out a series of human subject tests on a treadmill. We chose environmental conditions similar to those we will find at the summer Olympic Games in Peking 08. The goal of our study was to look at the influence of running suits on the evaporation cooling process and the thermo physiological parameters of the human body, compared to a nude athlete. This investigation shows that the thermoregulation of the human body works best without clothes, as could be expected. Even if the garments can store additional sweat, they could not increase the evaporative cooling process in comparison to the nude body. However, the lower core temperature reached with one garment shows that a garment with fast wicking properties can efficiently help the thermoregulation of the body.

PERFORMANCE OF VOLUNTARY ISOMETRIC CONTRACTIONS AFTER DOWNHILL RUNNING IN FEMALES AND MALES

Willems, M.E., Northcott, S.R.

University of Chichester, United Kingdom

Downhill running results in injury of knee extensor muscles [i.e. force loss (Martin et al. 2004), disorganization of the myofibrillar ultrastructure (Féasson et al. 2002)] and alterations in motoneuron pool excitability (Bulbulian and Bowles 1992). Injured skeletal muscles that are part of a synergistic group may allow continued performance with different contributions from the individual muscles. PURPOSE: Gender differences for muscle performance and surface electromyograms (sEMG) of knee extensors 1hr after downhill running were examined. METHODS: Maximal voluntary isometric force (MVIF), steadiness and sEMG of vastus lateralis (VL) and vastus medialis (VM) muscles during 50%MVIF were measured in six males (22 ± 4 yr, mean ± SD) and six females (29 ± 9 yr) before and 1 hr after downhill running [(5x8 min, -12%, 60%Vmax (females: 7.5 ± 0.2 km/h; males: 10.5 ± 0.6 km/h)]. EMGworks software (Delsys, Boston, MA, USA) was used for bandpass filtering (20-500 Hz) of the raw EMG signals and calculation of the EMG parameters root mean square (RMS) and median frequency (MDF) for each muscle. RESULTS: Males had larger MVIF values (658.2 ± 58.9 N versus 460.4 ± 36.9 N, $P<0.05$) and longer endurance times during 50%MVIF than females (84.3 ± 25.3 s versus 54.4 ± 13.5 s, $P<0.05$) before downhill running. After downhill running, MVIF deficits were similar (males: 12.5 ± 3.3%, females: 9.1 ± 3.2%, $P=0.487$) with no changes in endurance times and steadiness during 50%MVIF. After the downhill run, females, but not males, increased the ratio for the root mean square (RMS) values of the VL and VM muscles during MVIF testing by 33% ($P<0.05$) and lowered the change in RMS for VM during 50%MVIF from 47.2 ± 35.6% to 29.6 ± 34.6% ($P<0.05$). In males and females, no changes were observed for the change in median frequency in VL and VM during 50%MVIF.

After downhill running, females, but not males, altered for knee extensor muscles the vastus medialis and vastus lateralis contributions to maximal isometric force production and the activity pattern of the vastus medialis during submaximal isometric fatigue. CONCLUSION: Downhill running causes acute neuromuscular adaptations to perform voluntary isometric contractions of knee extensor muscles in females, but not in males.

References

Bulbulian R, Bowles DK. Effect of downhill running on motoneuron pool excitability. J Appl Physiol 73:968-973, 1992.

Féasson L, Stockholm D, Freyssenet D, Richard I, Duguez S, Beckmann JS,

Denis C. Molecular adaptations of neuromuscular disease-associated proteins in response to eccentric exercise in human skeletal muscle. J Physiol 543:297-306, 2002.

Martin V, Millet GY, Martin A, Deley G, Lattier G. Assessment of low-frequency fatigue with two methods of electrical stimulation. J Appl Physiol 97:1923-1929, 2004.

THE EFFECT OF AN ACTIVE RECOVERY PROGRAM ON NEUROMUSCULAR AND BIOCHEMICAL MARKERS BETWEEN TWO ELITE FEMALE SOCCER MATCHES IN FOUR DAYS

Andersson, H., Raastad, T., Nilsson, J., Kadi, F.

Sport Sciences, Sweden

The aim of the study was to investigate the effect of an active recovery program on neuromuscular and biochemical markers during a simulated tournament match schedule for elite female soccer players (matches every 3rd day).

Methods: 20 elite female soccer players (23±4 years, 65±6 kg and 54±3 ml.kg-1.min-1) were randomly assigned to one of the following groups; active recovery group (n=10) and control group (n=10). The players in were evenly distributed into two teams that played two matches in four days. During the two days between the matches (22 and 46 hrs after match 1) the recovery training took place and consisted of 30 minutes of submaximal cycling (60% of HFpeak) and 30 minutes of low resistance training, while the control group was inactive. Before match 1, directly after, 5, 21, 27, 45, 51, and 69h after match 1, 20m sprint, countermovement jump, maximal isokinetic knee extension and flexion were measured. Creatine kinase (CK) was analysed from the blood plasma before match 1, directly after, 21, 45 and 69h after match 1. Total distance covered, distance covered in high intensity running and heart rate measures were recorded during the match. The food intake was standardised for all players during the 4 days and secured an optimal intake of macro nutrients for all players.

Results: No differences were found between the groups in recovery of performance, biochemical markers or match data. 20m sprint performance was reduced by 3.1±0.5 % after match 1 but was not significantly different from baseline level after 5hrs. Jump ability was decreased by 4.4±0.8% after match 1 and did not return to baseline levels before match 2. Peak torque in leg extension was reduced by 6.8±1.8% after match 1 and returned to baseline levels 27 hrs after match 1. Peak torque in leg flexion was reduced by 9.1±1.8% directly after match 1 and returned to baseline levels 45 hrs after match 1. CK levels were increased after match 1 with a peak concentration of 451±59 U/l 21 hrs after the match and returned to baseline levels 69 hrs after match 1. The total distance and, distance covered in high intensity running and mean heart rate was 9.4±0.3km, 1.1±0.2km and 81.7±0.7% of HRpeak respectively.

Conclusion: The active recovery program had no effect on recovery of physical performance or biological markers following a soccer match compared to complete rest. All physical and biological markers had recovered 45 hrs after match 1 except for jump ability that did not recover at all before match 2. The results indicate that 72 hrs is a sufficient recovery period between two elite soccer matches for neuromuscular and biochemical markers. Moreover, despite that the distance of high intensity running was in the normal range for elite female soccer matches, the total distance covered and mean HR were in the lower range, which may imply that a longer time for recovery is needed for matches with higher intensity, such as competitive international matches.

ELITE FOOTBALL ON ARTIFICIAL TURF VERSUS NATURAL GRASS: MOVEMENT PATTERN, TECHNICAL STANDARD AND PLAYER OPINION

Andersson, H., Ekblom, B., Krustrup, P.

Sport Sciences, Sweden

The purpose of the present study was to examine whether the movement pattern and ball skills of elite football players during competitive matches are different on artificial turf compared to natural grass. Another aim was to investigate the players' impression of the physical and technical performance in football matches on these surfaces. Six male and two female teams from the Swedish top league took part in the study. Technical analyses were performed for all out-field players during five male artificial turf games and five male natural grass matches against the same opponent. One male team that had artificial grass home ground were analysed in all 10 matches (5 home and 5 away matches). Three opposing teams, that had natural grass home ground, were analysed during 6 of those 10 matches (3 home and 3 away matches). In total, 8 team observations were performed for each surface. Ten players were video filmed during 1-4 games on each surface for computerized time-motion analyses. Questionnaires were filled out by 72 players with natural grass home ground and 21 players with artificial turf home ground. The players˝ match impression was registered via a "better(0)-equal(5)-worse(10)" visual analogue scale. The total distance covered and the amount of high-intensity running were not different during artificial turf compared to natural grass matches (10.190.19 and 1.860.10 km vs. 10.330.23 and 1.870.14 km, respectively). Moreover, no difference was observed between the surfaces in number of sprints (211 vs. 222), headers (81 vs. 81) and standing tackles performed per game (101 vs. 111), whereas the number of sliding tackles was lower (P<0.05) on artificial turf compared to natural grass (2.10.5 vs. 4.30.6). The number of short passes per game (218±14 vs. 167±12) and the number of midfield-to-midfield passes per game (148±11 vs. 107±8) was higher (P<0.05) on artificial turf than on natural grass. The number of long passes per game was not different between surfaces (87±5 vs. 82±6), but the proportion of unsuccessful long low passes was higher (P<0.05) on artificial turf than on natural grass (37±4 vs. 27±3%). The male players reported a negative overall impression of artificial turf (8.3±0.2) and stated that it was physically harder (7.0±0.2) and more difficult to control the ball (7.2±0.3) on artificial turf compared to natural grass. In contrast, the female players had a neutral overall opinion about artificial turf (5.4±0.5). In conclusion, the movement pattern of elite football players was observed to be similar on artificial turf and natural grass, except that fewer sliding tackles were performed on artificial turf. During games on artificial turf, much more short-passing was performed with no difference in the success rate of the short passes, but a lower success rate for long low passes. The female players reported a neutral impression of artificial turf, whereas the male player opinion was negative.

OBTAINING THE BASIC RESPONSE PATTERN OF PHYSIOLOGICAL TIME SERIES DATA USING FOURIER LOW-PASS FILTERING

Zakyntinaki, M., Stirling, J.

Universitat Autonoma de Barcelona, Spain

The derivation of a smooth curve describing the basic response pattern of physiological time series data is of great importance in the process of modeling the kinetics of such data, as well as in understanding the underlying dynamics of the physiological system under study. Currently simple noise reduction techniques, such as 3-rolling averaging, or averaging over repeated bouts of exercise are extensively used. In nonlinear systems such as the physiological systems under study, however, the characteristic high frequency oscillations do not only correspond to noise, but can also be inherent features of these systems. Therefore, the use

of such noise reduction techniques do not necessarily result in an enhancement of the basic response pattern; features not contained in the original data set might also be introduced, such as the time delayed transition to different phases in the 3-phase models of oxygen uptake and heart rate. The aim of the present work is to introduce Fourier low-pass filtering as an alternative curve smoothing technique, as well as an easy and very effective way for obtaining the basic response pattern from noisy physiological data. Fourier low-pass filtering is not only able to enhance the basic response pattern, by reducing the noise level of the data, but also to provide a smooth underlying curve about which any high frequency oscillations in the original time series of the data, including stochastic noise, are distributed. The application of such a filtering technique shows that the kinetics of such data can easily be described by a smooth curve (see for example Stirling et.al.), in contrast to the currently used 3-phase model which describes the kinetics of physiological variables in a non smooth manner. Fourier low-pass filtering can be successfully applied not only to physiological time series data corresponding to exercise of constant velocities, but also to any data obtained from varying exercise intensities providing a smooth curve that can be used further for modeling purposes. We will present the application of Fourier low-pass filtering to non-averaged, non-interpolated heart rate data sets of different exercise intensities. Averaging, as well as 3-rolling averaging is applied to the same data sets for a comparison. We believe that Fourier low-pass filtering can be successfully applied to data sets of any physiological variable (such as the V̇O2), not only to provide a smooth function describing the basic response pattern of the kinetics of these variables, but also to throw doubt onto the existence of different phases and time delays.

Reference: J. R. Stirling, M. S. Zakynthinaki, B. Saltin, A model of oxygen uptake kinetics in response to exercise: Including a means of calculating oxygen demand/ deficit/debt, Bulletin of Mathematical Biology, 67(5), p. 989-1015 (2005).

THE EFFECT OF PEDALING RATE ON CARDIAC OUTPUT AND STROKE VOLUME DECLINE IN PROLONGED EXERCISE

Kounalakis, S.N., Nassis, G., Koskolou, M.D., Geladas, N.D.

University of Athens, Faculty of Physical Education and Sport Science, Greece

Classical factors such as dehydration and hyperthermia do not fully explain the observed drop in cardiac output (CO) and stroke volume (SV) during prolonged steady state exercise, a phenomenon which has been named as cardiovascular drift and seems to be worse in cycling than in running. It has been speculated that a diverse active muscle mass and a more efficient muscle pump may partially explain the differences in cardiac output drop. PURPOSE: To explore the role of pedaling rate on CO and SV decline during steady state prolonged cycling. METHODS: Twelve subjects (24.3±3.8 yrs) cycled for 90 min at 126±15Watts (58-60% of VO2max), on two occasions: a) with a pedaling rate of 40 revolutions per minute (40rpm), and b) with 80 revolutions per minute (80rpm). Oxygen consumption (VO2), cardiac output (CO2 rebreathing method), heart rate (HR), rectal temperature (Tre), and mean skin temperature (Tsk) were recorded at various time points during exercise. Integrated EMG (iEMG) of vastus lateralis (VL) and skin blood flow (SBF; laser Doppler flowmetry) were also measured. Plasma and blood volume changes from rest (PV%, BV%) were calculated from hemoglobin and hematocrit values taken before exercise, at the 30th and 90th min of cycling. RESULTS: Despite the identical work rate performed, mean values of VO2, VLiEMG, HR, and CO were significantly higher during steady state exercise (20th min and onwards) with 80rpm than with 40rpm. Throughout the exercise protocol, the rate of decline in SV and the respective rate of rise in HR were significantly greater in the 80rpm than in the 40rpm condition. For instance, at the 85th min of exercise ΔSV was -16.21±0.85 ml/beat in the 40 rpm and -25±0.79 ml/beat in the 80rpm; similarly, ΔHR was +18.33±0.88 beats/min and +24.5±0.74 beats/min, in 40rpm and 80rpm, respectively ($p<0.01$). Overall, at the end of exercise CO decreased, from the steady state values, by 1±0.26 L/min in 80rpm ($p<0.01$), whereas no changes were observed in 40 rpm (ΔCO = -0.23±0.1 L/min, p=ns). Percent PV drop was greater during high than low frequency pedaling ($p<0.05$). Thermal variables (Tre, Tsk, SBF) were not significantly different between experimental conditions ($p>0.05$). CONCLUSION: During steady state prolonged cycling with high pedaling rate, cardiovascular drift is exaggerated compared to low pedaling rate, despite equal mechanical work being performed in both conditions. Thermal and hydration status of participating subjects cannot entirely explain the observed differences. It appears that muscle input may play a role on cardiovascular regulation during steady state exercise performed with different speed.

The project is co-financed within Op. Education by the ESF (European Social Fund) and National Resources.

EFFECTS OF INSPIRATORY MUSCLE FATIGUE AND BLOOD FLOW OCCLUSION ON EXERCISING MUSCLE

Lomax, M.E., McConnell, A.K.

Brunel University, United Kingdom

The existence of a inspiratory muscle metaboreflex has been demonstrated in the resting leg when inspiratory muscles are subjected to external loading sufficient to induce fatigue (Sheel et al., 2001), as well as during heavy exercise with inspiratory muscle loading (Harms et al., 2000). When evoked, this reflex induces sympathetically-mediated vasoconstriction that is capable of diverting blood away from locomotor muscles (Sheel et al., 2001; Harms et al., 2000). The influence of the inspiratory muscle metaboreflex upon limb muscle performance is unclear. We examined the effect of prior inspiratory muscle fatigue and manual occlusion of limb blood flow upon calf fatigue during sub-maximal plantar flexion exercise (PF).

Eight subjects performed 5 isometric voluntary PF trials: 1 control trial, 2 occlusion trials (cuff inflation of 50mmHg and 140mmHg), and 2 trials preceded by inspiratory muscle loading. The loading trials were identical, except that the first preceded 4 weeks of inspiratory muscle training (IMT; pre-IMT) and the second after IMT (post-IMT). Loading consisted of breathing against a flow resistive load equivalent to 60% of pre-IMT maximum inspiratory mouth pressures with a duty cycle of 0.7, breathing frequency of 15 per min (Sheel et al., 2001). PF was undertaken at 85% maximum voluntary contraction torque (MVC; 3-sec 'on', 2-sec 'off'). MVC was measured at 1-min intervals (5 sec

sustained contraction) with superimposed electrical stimulation. PF continued until subjects failed to generate 50% baseline MVC on 3 consecutive contractions (Tlim). Statistical comparisons were made using ANOVA.

The control trial produced the longest Tlim (mins) (9.67 ± 2.02). The 140mmHg trial produced the shortest Tlim (4.37 ± 1.74), followed by pre-IMT (6.12 ± 2.18), 50mmHg occlusion (7.52 ± 1.82), post-IMT (9.41 ± 1.82). The Tlim for the 140mmHg trial was significantly shorter than all trials (P<0.01) except the pre-IMT trial (p = 0.571). Similarly, pre-IMT Tlim was significantly shorter than all other trials (P<0.01) except the 50mmHg (p = 0.817). Inspiratory muscle training significantly increased inspiratory muscle strength (P<0.01).

When blood flow is restricted by manual occlusion, PF Tlim is significantly reduced. Furthermore, the greater the severity of the occlusion, the greater the decline in Tlim. Similarly, Tlim appears to be shortened by prior IMF. However, if the inspiratory muscles are strengthened by IMT this response is attenuated. Together, these findings are consistent with the notion that IMF elicits vasoconstriction in the working limb and that strengthening the inspiratory muscles attenuates this response.

References

Harms, C.A. et al. (2000). Effects of respiratory muscle work on exercise performance. Journal of Applied Physiology, 89, 131-138.

Sheel, W.A. et al. (2001). Fatiguing inspiratory muscle work causes reflex reduction in resting leg blood flow in humans. Journal of Physiology, 537, 277-289.

THE EFFECTS OF GRAVITY ACCELERATION ON THE CARDIOPULMONARY RESPONSE TO EXERCISE

Bonjour, J., Tam, E., Grazzina, F., Antonutto, G., Capelli, C., Montmerle, S., Linnarsson, D., Ferretti, G.

CMU, Genève, CH; Uni Udine, IT; Uni Brescia, IT; Karolinska Institute, Stockholm, SE, Switzerland

Models of internal work of cycling predict that the oxygen consumption (V'O2) at any given work rate should be higher the greater the gravity acceleration (ag). If so, assuming that the relationship between cardiac output (Q') and V'O2 be unchanged, then Q' also should be a function of ag. We tested these predictions by measuring, on 14 male subjects (age = 26 + 5 years, body mass 76 + 8 kg), V'O2, carbon dioxide output (V'CO2), pulmonary ventilation (V'E), heart rate (fH) and Q' at rest and at the steady state of submaximal exercise carried out at a pedalling frequency of 60 min-1 in the human centrifuge at 1 (centrifuge still), 1.5, 2 and 2.5 G (1 G = 9.81 m/s2). V'O2, V'CO2 and V'E increased linearly with the mechanical power. As ag was increased, these lines were displaced upward. The linear relationship between V'E and V'O2 was unchanged, indicating that the ventilatory equivalent was the same at all ag. At any investigated power, V'O2 was linearly related to ag. These results are coherent with the first tested hypothesis. They allow predictions of the oxygen cost of exercise on planets with different masses than the Earth. fH increased linearly with both power and V'O2. The relationship between fh and power was displaced upward when ag is increased, such that the relationship between fh and V'O2 was unaffected by ag. By contrast, because the increase in fh did not correct the decrease in stroke volume, the relationship between Q' and power was unaffected by ag, despite the increase in V'O2. As a consequence, the relationship between Q' and V'O2 was displaced downward by increasing ag, contrary to the tested hypothesis. The increase in V'O2 with ag was supported by greater oxygen extraction by the tissues. These results imply that the maximal aerobic power should be lower, the higher the ag, in spite of a potentially unchanged maximal oxygen consumption.

INVESTIGATION OF POSTURAL STABILITY, REACTION TIME AND BODY MEASURES IN BASKETBALL PLAYERS

Téczely, T. , Ángyán, L.

University of Pécs, Medical Faculty; University of Pécs, Faculty of Adult Education and Human Resou, Hungary

Objective The aim of this study was to determine if any relationship between balancing functions, reaction time and body measures. Subjects The subjects were 11 professional basketball players (complete team) aged 22.2±1.5 years. Methods The body height, weight, and fat (%) were measured; the body mass index (BMI) was determined. The postural sways were recorded during standing on two legs on the stabilometer for 30 seconds. Static balance was measured on one leg on a beam 50 cm long, 4 cm high, and 3 cm wide. The subject should keep balanced in this position for one minute. Each time the subject lost his equilibrium, a new attempt was started. The number of attempts needed to keep in balance was computed. The time elapsing between the onsets of either a light or a sound stimulus and pressing an electric push button was measured as reaction time. Descriptive statistics and regression analysis were used for data analysis. Results The average height was 193±2.6 cm, the body mass index 23±0.6, and the body fat (%) 11.5±1.37. The reaction time to the light and sound stimulus was 183.6±8.8 msec and 149.3±6 msec, respectively. The body sways to left side were significantly higher than to the right side (difference: 1.75◦, p<0.03). Moderately high correlations were found between body mass index and attempts to maintain equilibrium on one leg (r=0.599, p<0.003). Higher correlation was found between the body sways and the body mass index (r=0.685, p<0.01). A close correlation was shown between body sways and the force of back muscles (r=0.7, p<0.01). Moderately high correlation was found between the reaction time to light stimulus and the body sways to left side (r=0.54, p<0.05). Conclusions The higher body mass index the higher body sways appeared. No significant correlation was found between body measures and the reaction time. The moderately high correlation between body sways and reaction time indicates the responsiveness of the subject to kinaesthetic and to the light stimuli.

QUANTIFICATION OF TRAINING LOADS BY USING THE CRITERIONS OF EXERCISE PULSE COST

Savelev, I.A., Popov, O.I., Voitenko, Y.L.

Russian State University of Physical Education, Russia

Adaptation to influence of physical loads in sports training may be quantitatively described by relationship "dose-effect" . The value of trained function increase for the period of observation is assumed as a parameter of achievable effect. A dose of influence of physical load is defined as the product of intensity of exercise energy expenditure on the period of the physical load action. This period assumed to be the sum of exercise time, the rest pauses time, and part of the recovery time that is related with the fast component of the oxygen debt. The absolute values of a heart rate usually used in practice of sports for an estimation of a level of exercise energy expenditure, find out linear relationship with a level of aerobic energy production only in the limited area of the exercises, that are not exceeded critical power value where the maximum of oxygen consumption is achieved. For wide range of exercises will be more correctly to use overall pulse criteria, such as the pulse sum of work, the pulse debt, the pulse cost of exercise which are derived from the time course analysis of the heart rate kinetics during periods of the work and recovery.

26 well-trained male swimmers, middle-distance runners and skaters (age 18-24 years, height 162-186 cm, body mass 62-83 kg), ranging from club to international level, volunteered to take part in the study. All subjects performed 5 all-out tests – 10 s, 30 s, 60 s, 120 s and

360 s duration without preliminary warm-up. The gas volume, the O2 and CO2 fractions in the expired air were measured using a monitor system (Sensormedics V-max 29 C). O2-intake, O2-debt, O2-requirment, aerobic and anaerobic energy output were calculated with a special computer program. The blood lactate concentration is determined using an enzymatic method Dc Lange. Acid-alkaline balance parameters were determined using a pH and blood gases microanalyzer (Instrumentation Laboratory IL-213).
Changes of parameters total pulse cost in dependence with values of exercise limiting time close reproduce appropriate relationships for parameters oxygen requirement and energy cost of exercise. Thus, pulse cost indices may be used as objective criteria for quantification physical loads as well at the development of programs of optimization of training in various kinds of sports. As a criteria of achived training effect is used a increase of physical performance and as a criteria of physical load dose is used a product of relative power and total pulse cost of exercise.

INTENSITY OF INITIAL ECCENTIC EXERCISE AND THE MAGNITUDE OF REPEATED BOUT EFFECT

Nosaka, K., Chen, T., Sacco, P.

Edith Cowan University, Australia

The underlying mechanisms of the protective effect conferred by a bout of eccentric exercise, often referred to as the "repeated bout effect," are not fully understood. A shift in the angle-force curve toward longer muscle lengths after eccentric exercise, which is speculated to result from an increased number of sarcomeres in series, has been posited to play a role in the repeated bout effect (Proske and Morgan 2001). However, it is not known whether there is an identifiable relationship between alterations in the muscle length tension relationship and the level of protection associated with an initial exercise bout. This study investigated the effect of initial eccentric exercise intensity (40, 60, 80, and 100%) on the joint angle/strength relationship, and the extent of the protective effect conferred against maximal eccentric exercise (100%). Fifty-two male students (20.7 ± 1.9 yrs), who had not performed regular resistance training, gave informed consent in conformity with the Declaration of Helsinki. Based on the baseline maximal voluntary isometric strength (MVC) of the elbow flexors at the elbow joint 90°, subjects were placed into one of the four groups; 100%, 80%, 60%, or 40% group (13 subjects per group). Subjects performed the first eccentric exercise (ECC1) with the non-dominant arm using a dumbbell adjusted to 100%, 80%, 60%, and 40% of each individual's MVC. Subjects lowered the dumbbell from an elbow flexed (50°) to an elbow extended position (170°) in 4~5 s every 45 s for 30 reps. All subjects performed the second bout of eccentric exercise (ECC2) with the same arm using a dumbbell equivalent to 100% MVC 2-3 weeks after ECC1. The protocol for ECC2 was the identical to that of ECC1, except for the dumbbell weight for the 40%, 60%, and 80% groups. MVC at six elbow joint angles (50°, 70°, 90°, 110°, 140°, 160°), range of motion, upper arm circumference, serum creatine kinase activity, myoglobin concentration, and muscle soreness were measured before and for 5 days following ECC1 and ECC2. The higher the intensity of ECC1, the greater the subsequent change in the criterion measures. A rightward shift of optimum angle following ECC1 was significantly ($P<0.05$) greater for the 100% and 80% groups than the 60% and 40% groups. Changes in the criterion measures following ECC2 were significantly ($P<0.05$) greater for the 40% group compared with other groups. Although the magnitude of repeated bout following ECC2 was significantly ($P<0.05$) smaller for the 40% and 60% groups, all groups showed significantly ($P<0.05$) reduced changes in criterion measures following ECC2 in comparison to the 100% group. These results suggest that the magnitude of the repeated bout effect was dependent on the magnitude of muscle damage in the initial bout; however, a shift of optimum angle does not play a main role in the repeated bout effect.

INFLUENCE OF DIFFERENT TYPES OF STRENUOUS TRAINING ON INDUCED FATIGUE CHANGES OF CARDIORESPIRATORY RESPONSIVENESS IN ENDURANCE ATHLETES

Mishchenko, V., Tomiak, T.

Academy of Physical Education and Sport, Gdansk, Poland, Poland

Fatigue induced changes of CO2 sensitivity and primary cardiorespiratory (CR) kinetics may be an integral reflection of overall fatigue of athletes and were related to the stage of overall fatigue of high performance athletes [1]. There have been limited researches of CR responsiveness changes induced by fatiguing training of different types. The purpose of this study was to determine the effect of different types strenuous training sessions on response to CO2, hypoxia and the CR primary kinetics in endurance athletes.
Twelve male elite rowers (18-26 yrs old) were tested prior to, 13-15 hours and 37-39 hours after different type of strenuous training sessions (mainly intermittent or continuous bouts of exercises). Power output, blood lactate, primary kinetics of ventilation (VE), oxygen uptake (VO2), carbon dioxide production (VCO2) and heart rate (HR) in 6 min max rowing test and 5 min test (0.7 VO2 max, transition from 25 w) were measured breath by breath (T50, monoexponential function). In rebreathing tests ventilatory response sensitivity to CO2 (∆VE /∆ PACO2) and HR response sensitivity to normocapnic hypoxia (∆HR/∆SaO2) were also measured.
Results showed decrease lung ventilation response to CO2, increase HR response to hypoxia and decrease in CR primary kinetics 13-15 hours after the strenuous training session relative to baseline in both types of training. The results showed significant decrease in response to CO2 (1.33±0.11 vs. 1.53±0.13 l.min-1 per 1 mm Hg in baseline, $p<0.05$) after intermittent type of strenuous training session. There was also tendency to higher level in HR sensitivity to hypoxia (1.32±0.13 vs. 1.22±0.14 beat.min per 1%) and primary kinetics VO2 (29.7±1.4 vs. 27.3±1.3 s, $P<0.1$) 13-15 hours after intermittent in comparison with continuous type of training session. Data collected 37-39 hours after the intermittent type of training session only showed decrease in sensitivity to CO2 (-8.9±1.7%) and primary kinetics VE (-7.6±1.2%, $p<0.05$) relative to baseline. Blood lactate level in 6 min max test increased significantly more 13-15 hours after intermittent training in comparison with continuous type training (5.9±0.4 vs. 2.8±0.2%, $p<0.01$).
We concluded that temporary effects of fatiguing training session related to hypo-kinetic features of CR response in both type of training sessions (mainly intermittent or continuous exercises) of highly trained rowers; CR sensitivity to CO2 and primary kinetics were decreased at 15-13 hours after strenuous intermittent training session but showed relative better recovery by 37-39 hours in the continuous type of training lesson. Impaired performance and specific fatigue induced different types of sport specific training may be attributed not only to exhaustion in energy sources but to temporarily impaired CR responsiveness also.
1. Mishchenko V, Monogarov V (1995) Physiology of athlete. Barcelona.

EFFECTS OF PHYSICAL TRAINING ON THE GH/IGF-1 GROWTH AXIS IN DIABETIC RATS

Gomes, R.J., Caetano, F.H., Rogatto, G.P., Pauli, J.R., de Mello, M.A., Luciano, E.

State University of São Paulo, Brazil

The aim of the present study was to examine the influence of moderate physical training on the GH/IGF-1 growth axis in diabetic rats. Male Wistar rats were divided into 4 groups, sedentary control (SC), trained control (TC), sedentary diabetic (SD) and trained diabetic (TD). Diabetes was induced by Alloxan (35 mg/kg b.w.) The training program consisted by swimming 5 days/week, 1h/day, supporting a load of 5 % body weight for 6 weeks. At the end of the training period, the rats were sacrificed and the blood was collected for determinations of serum glucose, insulin, GH, and IGF-1. Samples of liver and skeletal muscle were used to evaluate glycogen content. Tibias were collected for determination of total area. Diabetes decreased serum GH, IGF-1, total tibia area and liver glycogen stores in SD group ($P<0.05$). Physical training promoted increases in serum IGF-1 (SC=82±18, TC=90±8, SD=59±11, TD=80±9 ng/ml) and in tibia area (SC=1.73±0.05, TC=1.74±0.14, SD=1.41±0.14, TD=1.67±0.14 cm^2) in trained groups ($P<0.05$). It was concluded that in diabetic rats, moderate physical training induces important metabolic and hormonal alterations that are associated with an improvement in glucose homeostasis and an increased activity of the GH/IGF-1 axis.

SURVEY THE EFFECT OF SLEEPLESSNESS ON AEROBIC AND NON-AEROBIC PERFORMANCE OF PHYSICAL EXERCISES AND SPORT SCIENCE MALE STUDENTS

Molanaei, N., Boroujerdi, S.S.

Kurdestan University, Iran

This research is a survey the effect of sleeplessness on aerobic and non–aerobic performance of physical exercises and sport science male students.

The statistical sample of this research is the male students of physical exercises and sport science in Open University of Medical Science of Kurdestan University. There were 54 students as a whole of which 21 students have been chosen as research samples.

This is a descriptive research in which physical power; heart endurance, speed and muscular power are studied by means of one-mile running (1609m), 5 Yard running and vertical jump Sarjent in two levels of pre-test and post–test. Analysis of the data of the research has been done according to descriptive static and ANOVA one way. And it has been considered at the level of p< %5.

The results of this research show:

1. There was a distinctive difference of the records of 1609m endurance running between the time they were sleepless and the second time which shows that sleeplessness has some effect on aerobic performance.
2. There was a distinctive difference between the medium of records of second normal time and other situations.
3. There was a distinctive difference between the medium of records of the second normal time and the sleeplessness one that shows the effect of sleeplessness on non-aerobic performance.
4. There was a distinctive difference between the records of the speed running of 45m in the first time and in other conditions.
5. There was a distinctive difference between records of vertical jump in the first normal time and the time of sleeplessness and it shows the sleeplessness affect the muscle power of feet.
6. There was a distinctive difference between the medium of the records of vertical jump in the second normal time and other conditions.

INFLUENCE OF PHYSICAL TRAINING ON BONE METABOLISM IN EXPERIMENTAL DIABETIC RATS

Luciano, E., Gomes, R.J., de Oliveira, C.A., Luciano, E.A., de Mello, M.A.

Sao Paulo State University, Brazil

Purpose: The purpose of this study was to verify the effects of physical training on protein and DNA levels in bone and the histology of epiphysis in diabetic rats. Methods: Male Wistar rats were distributed into sedentary control (SC), trained control (TC), sedentary diabetic (SD) and trained diabetic (TD) groups. Diabetes was induced by alloxan administration (30mg/kg b.w.). The training consisted of daily swimming with load of 2% b.w., 1 h/d, 5d/w, for 4 weeks. At the end of the experiment the rats were sacrificed and blood samples were collected for glucose, insulin and GH determinations. Fragments of epiphysis of the right tibia were excised for protein and DNA evaluation. The left tibias were fixed in formol (10%) and decalcified in TCA for histology. Results: One-way ANOVA indicated that glucose was elevated among the diabetics ($p<0.05$) and improved in the trained diabetics (SC=118„b20, TC=122„b19, SD=415„b35, TD=362„b24mg%). Physical training did not have influence on insulin and GH levels. Protein/DNA ratio were increased in diabetic rats and recovered in trained diabetic rats (SC= 2.9„b0.6, TC=2.5„b0.6, SD=4.5„b0.8, TD=3.2„b0.5). Conclusions: The histology reveled decalcification in epiphysis of tibia in sedentary diabetic and improvement in trained diabetic. Therefore, physical training is important for the maintenance of protein metabolism and recovery of the developmental pattern of bone tissue in diabetic organisms.

Supported by: FUNDUNESP , FAPESP and CNPq.

OXYGEN UPTAKE KINETICS AT THE ONSET OF MODERATE-INTENSITY EXERCISE IN TRAINED BOYS BETWEEN 12 AND 15 YEARS OLD

Millet, G., Solano, R., Borrani, F.

Aspire, Academy for Sport Excellence, Doha, Qatar

The VO2 response to the onset of exercise provides a useful assessment of the body's ability to match change in metabolic demand and is viewed as complementary to the traditional variables measured for assessing the aerobic fitness; i.e. VO2max, ventilatory threshold. Despite it has been generally shown that prepubertal children have a more rapid exponential rise in VO2 than adults, the effects of growth on VO2 kinetics are still unclear: it is unknown if the puberty period leads to change in VO2 kinetics in moderate-intensity exercise.

Four groups of 20 trained boys of calendar age respectively of 12 (height 147.6 ± 6.7 cm; weight 36.6 ± 5.4 kg), 13 (156.8 ± 10.0 cm; 44.4 ± 10.5 kg), 14 (165.2 ± 9.4 cm; 52.2 ± 9.6 kg) and 15 years (168.3 ± 9.9 cm; 55.2 ± 10.8 kg) performed an incremental test (1 km.h every min) to exhaustion on treadmill and a transition from rest to a 6-min constant-load exercise at moderate intensity, slightly below the ventilatory threshold. Gas exchange was measured using a breath-by-breath analyzer (Oxycon Pro, Jaeger, Hoechberg, Germany). The ventilatory threshold was determined by the method of the O2 equivalent. The VO2 kinetics of the rest-to-exercise transition was modelled by a single exponential function described by its amplitude, time constant and time delay. The first 15 s were removed from analysis. These

parameters were calculated by an iterative procedure by minimizing the sum of the mean squares of the differences between the modelled and the measured VO2. The inclusion of a second exponential was tested but did not improve the fitting. The variability (CV: coefficient of variation) of the modeling parameters was calculated by the means of the 'bootstrap method' (1).

VO2max was similar in the four groups (54.0 ± 5.1, 53.6 ± 3.9, 54.3 ± 5.6 and 54.9 ± 4.9 ml.kg.min for the 12, 13, 14 and 15 respectively; P = 0.85) whereas the velocity associated (vVO2max) was greater (P<0.05) in the 15 than in the 12 or 13 (14.3 ± 1.4, 15.1 ± 1.4, 15.4 ± 1.4 and 16.4 ± 1.5 km.h-1). The time constant of the exponential rise increased (F = 11.1, P < 0.001) from 12 to 15 [15.9 ± 3.9 (CV = 14.6 ± 6.2%); 19.8 ± 2.9 (11.8 ± 5.0%); 21.7 ± 4.5 (11.8 ± 4.8%) and 24.0 ± 6.9 s (11.3 ± 3.7%)] whereas its amplitude [31.3 ± 4.1 (1.3 ± 0.5%); 30.1 ± 2.3 (1.4 ± 1.1%); 28.6 ± 3.4 (1.2 ± 0.4%) and 29.7 ± 4.9 ml.kg.min (1.2 ± 0.5%)] was not significantly different (P = 0.16) between groups.

The present study confirms in moderate-intensity exercise the results of Fawkner and Armstrong (2) who reported that the time constant of the primary phase were increased over a 2-yr period in prepubertal children. Moreover, despite that theoretically the signal-to-noise ratio is low in children (3), the variability of the present parameters are lower than in previous adults studies (1).

1. Borrani et al. (2001) J Appl Physiol 90: 2212-20

2. Fawkner and Armstrong (2004a) J Appl Physiol 97: 460-6

3. Fawkner and Armstrong (2004b) Ergonomics 47: 1517-27.

THERMOREGULATION AND HORMONAL RESPONSES DURING COLD EXPOSURE IN WHEELCHAIR ATHLETES

Sugawara, M., Taimura, A., Nakagaichi, M.

Faculty of Education, Nagasaki University, Japan

The purpose of this study is to clarify the characteristics of thermoregulation and physiological responses during exercise in a cold environment in wheelchair athletes. The subjects were male wheelchair athletes with spinal cord injury and healthy male college students. The maximal oxygen uptake as a parameter of endurance exercise ability was higher in the wheelchair athletes than in the college students. Measurements were performed at an environmental temperature of 12 Åé with a mean relative humidity of 60% at a mean air stream of 0.5m/sec. After rest for 30 minutes, the subjects performed arm cranking exercise at 20 watts(50 rpm) for 60 minutes. The measurement items were tympanic temperature, mean skin temperature, heat production, catecholamine, and cold-induced vasodilation. During exercise under exposure to cold, the tympanic temperature, heat production, and catecholamine more markedly increased in the wheelchair athletes than in the college students. The resistance index as a value of cold-induced vasodilation were higher in the wheelchair athletes than college students during cold exposure. On the other hand, the decrease in the mean skin temperature was slighter in the wheelchair athletes than in the college students. The thermoregulation sensitivity and heat production responses to exercise in a cold environment were more markedly increased in the wheelchair athletes than in the college students.

PREVENTION OF UNLOADING–INDUCED ATROPHY BY VITAMIN E SUPPLEMENTATION : LINKS BETWEEN OXIDATIVE STRESS AND SOLEUS MUSCLE PROTEOLYSIS?

Desplanches, D., Letexier, D., Servais, S., Pequignot, J., Duchamp, C.

UMR 5123 CNRS, Université Lyon I, France

Exposure to reduced activity induces skeletal muscle atrophy (1, 2). Oxidative stress might contribute to muscle wasting via regulation of proteolysis (3). This study was designed to test two hypotheses in rats. Firstly, long-term supplementation of the lipid-soluble antioxydant vitamin E, prior and during the phase of unloading, would partly counteract unloading-induced soleus muscle atrophy. Secondly, prevention of oxidative stress would decrease the rate of muscle proteolysis by reducing expression of different protease systems : calpains, caspase-3, -9, -12 and E3 ubiquitin ligases (MuRF1 and MAFbx). Soleus muscle atrophy (- 50%) induced by fourteen days of hindlimb unloading was reduced to only 32 % under vitamin E. Vitamin E partly prevented the decrease of type I (- 59 % vs – 38 %) and IIa (- 42 % vs – 32 %) fibre size. Supplementation suppressed the rise in muscle level of thiobarbituric acid-reactive substance caused by suspension but failed to modify the lower ratio of reduced vs. oxidized glutathione and the higher antioxydant enzyme (superoxide dismutase, catalase, glutathione peroxidase) activities observed after unloading. Vitamin E treatment abolished the upregulation of calpain 1 (+ 30 %), caspase- 3,- 9 and - 12 transcripts (+ 110, + 35 and + 50 % respectively) in unloaded muscle and decreased the large upregulation of both genes encoding ubiquitin ligases. In conclusion, vitamin E supplementation partly prevents muscle atrophy via redox control of proteolysis.

References

1) Desplanches D, Mayet MH, Sempore B, Flandrois R. J. Appl. Physiol. 63: 558-563, 1987.

2) Wittwer M, Flück, M, Hoppeler H, Müller S, Desplanches D, Billeter R. .Faseb J, 16 : 884-886, 2002.

3) Powers SK, Kavazis AN, DeRuisseau KC. Am J Physiol. 288 : R 337-R344, 2005.

IMPACT OF AN INCREMENTAL EXERCISE ON THE PAIN

Grancharska, K., Pencheva, N., Nikolova, E., Kotcev, C.

South-West University , Bulgaria

Introduction

Exercise of sufficient intensity and duration has been shown to activate endogenous opioid and adrenergic systems and modulates the pain perception (Pencheva, Bojkova 2004). The object of this study was to investigate the effect of an incremental cycle ergometric test to exhaustion on pain threshold (PT) and pain tolerance using tourniquet ischemic pain technique. The total activity of creatine kinase (CK) as a marker protein for skeletal muscle injury, was also determined.

Methods

Two groups of healthy men (mean age 23, range 21-24) were studied. The first group of six untrained persons (UTr) had no limitations to exercise and were not involved in any specific training. The second group comprised six trained persons (Tr) - short-distance runners with middle level of training. The Tr and Utr males were evaluated before and 10-15 min after maximal incremental cycle test to exhaustion (30 W/1.5 min; W0=60 W) on ischemic pain test for both: (i) PT (mm Hg) for absence of pain (APT), poor pain (PPT), powerful tolerable pain (PTPT) and powerful intolerable pain (PIPT); the thresholds were determined cumulatively after inflation of the tourniquet to the level (mm Hg), corresponding to the verbal estimation of the subject; and (ii) pain tolerance by verbal rating scale (VRS) after 3 min ischemia with a constant pressure (BPd+50 mm Hg), comprising: intolerable pain, powerful pain, moderate pain, soft pain and absence of pain. The

blood samples were obtained from all participants about 15 min before and 30-40 min after the exercise test. CK activity (U/L) was analysed by measuring the rate in NADH, using commercial kits.

Results

The Wmax for Tr and Utr males was 300+/-12 W and 190+/-14 W respectively. All kinds of PT after exercise were significantly higher ($p<0.05$) as compared with pre-exercise values, for both Tr and Utr participants. The APT was increased with 16.5+/-3.2 % in both groups, but PPT increase was 22.4+/-3.2 % for Utr and 13.7+/-2.6 % for Tr. The post-exercise increase (%) of PTPT and PIPT in Tr males was 30.0+/-1.8 and >30, respectively, while for Utr was 15.9+/-1.8 and 15.5+/-1.9. Thus, the more pronounced increase in Tr concerns the powerful pain stimuli. Pain ratings according to VRS were decreased with 2-3 degree after exercise for all subjects (Tr and Utr). The plasma CK activity in Utr males was increased 4 times as compared with the pre-exercise value, but in Tr subjects was not significantly changed.

Discussion/Conclusion

These findings allow to conclude that the incremental exercise to exhaustion produces a pronounced hypoalgesic effect, which increases the pain tolerance. The changes, probably mediated by endogenous opiate release (Sgherza et al.2002), concern the total pain perception during and immediately after exercise.

References

Pencheva N, Bojkova L (2004) Sport & Science (bulg) 2; 101-112

Sgherza et al. (2002) J Appl Physiol 93: 2023-2028.

Poster presentation (PP)

PP3-02 Training and Testing 1-7 - "Exhibition Hall"

ISOKINETIC STRENGTH AND JOINT MOBILITY ASYMMETRIES IN STROKE AND BOW SIDE OARSMEN

Riganas, C.S., Vrabas, I.S., Papadopoulou, Z., Vamvakoudis, E., Mandroukas, K.

Aristotle University of Thessaloniki , Greece

Competitive rowing is a strenuous sport which requires high levels of dedication. There are two types of rowing: Sculling where the sculler uses two oars, and sweep oar where the oarsman uses one. Sweep rowing is an asymmetric activity which involves loading the back in a rotated and flexed position. Therefore imbalances can occur between the agonist and antagonist muscles, as well as, bilateral asymmetry. The purpose of this study was to investigate oarside and non-oarside lower extremity asymmetries in isokinetic strength and joint mobility of oarsmen.

Peak torque of the right and left quadriceps (Q) and hamstrings (H) in 12 bow side (Mean ± SEM) (BS; age 18.6 ± 0.5 yrs, height 181.6 ± 1.4 cm, weight 77.6 ± 2.5 kg, training age 5.5 ± 0.5 yrs) and 14 stroke side (SS; age 20.6 ± 1.3 yrs, height 182.2 ± 1.8 cm, weight 78.8 ± 1.6 kg, training age 6.1 ± 0.9 yrs) Greek national level male rowers were measured on a Cybex II isokinetic dynamometer at 60 and 180°s-1. Three repetitions were carried out at each angular velocity and the best torque value was used. A 30 sec rest period was taken between each trial and a 60 sec rest period between each velocity measurement. Mobility of the hip, knee and ankle joints was measured using the Myrin flexometer, a modification of the Leighton flexometer. All measurements were made on an adjustable bench and were evaluated passively without causing pain, at the same time of the day and at uniform environmental conditions.

Considerable left/right and agonist /antagonist asymmetries, as well as, differences between oarside and non-oarside in both isokinetic strength and joint mobility were observed. Peak torque of the right Q was significantly lower in BS compared to SS at both speeds (216.7±15.8 vs. 286.2±8.8 and 144.9±7.6 vs.182.5±8.1 N∙m, $p<0.01$). Peak torque of the left Q was significantly higher in BS compared to SS at both speeds (271.0±14.0 vs. 233.5±10.9 and 182.1±8.0 vs. 158.1±5.6 N∙m, $p<0.05$).

Peak torque of the right H was significantly lower in BS compared to SS at both speeds (113.1±6.4 vs. 131.5±6.1 and 71.3±5.3 vs. 93.21±4.2 N∙m, $p<0.01$). No differences were observed in Peak torque of the left H between groups. Mobility of the right hip and ankle was significantly less in BS compared to SS (79.6±2.3 vs. 86.0±1.1 and 32.2±1.4 vs. 35.5±1.0 degrees, $p<0.01$) where mobility of the left hip and ankle was significantly larger in BS compared to SS (87.4±1.9 vs. 78.0±1.5 and 36.2±1.6 vs. 27.9±1.2 degrees, $p<0.01$). No differences were observed in right and left knee joint mobility between groups.

These results indicated a significant effect of sweep side on isokinetic strength and joint mobility of oarsmen.

LIGHTWEIGHT AND OPEN CLASS ROWERS: DIFFERENCES IN PHYSICAL PERFORMANCE AND ANTHROPOMETRIC CHARACTERISTICS

Riganas, C.S., Vrabas, I.S., Papadopoulou, Z., Vamvakoudis, E., Mandroukas, K.

Aristotle University of Thessaloniki , Greece

Competitive rowing is a strenuous sport which requires high levels of dedication. The anthropometric profile of rowers has been reported to be closely related to the level of sports performance (Jürimäe et al., 2000). The purpose of this study was to compare the possible differences in anthropometric, metabolic and performance variables between lightweight and open class rowers. Eighteen lightweight (LW; training age 6.8 ± 0.7 yrs) and 16 open class (OC; training age 7.4 ± 1.4 yrs) Greek national level male rowers were subjected to two exercise sessions on a rowing ergometer (Concept IIc, Nottingham, UK). An incremental exercise test to determine the anaerobic threshold (AT) and maximal oxygen uptake (VO2max), and a 2000 metre "all-out" test to evaluate performance indices. In addition underwater weighting (Vacu·Med, Ventura, CA, USA) was performed for body fat percentage calculation (Brozek: 100x[(4.570/BD)-4.142]).

Results revealed significant differences between groups. Anthropometric characteristics was significantly different between LW and OC rowers (Mean ± SEM) (Height 179.81 ± 1.07 vs. 184.78 ± 1.07 cm; Weight 72.44 ± 0.90 vs. 88.22 ± 2.2 kg; BSA 1.91 ± 0.11 vs. 2.11 ± 0.16 m2; BMI 22.50 ± 0.39 vs. 25.87 ± 0.46 kg•m-2; Body fat 10.71 ± 0.32 vs. 14.6 ± 0.53 %; Lean Body Mass 64.64 ± 0.96 vs. 75.29 ±1.78 kg; Fat Weight 7.79 ± 0.20 vs. 12.93 ± 0.68 kg; $p<0.001$). Physical performance characteristics was also significantly different between LW and OC rowers (VO2max 4705.09 ± 60.01 vs. 5237 ± 231.68 ml•min-1; VO2max 65.03 ± 1.03 vs. 59.37 ± 2.07 ml•kg-1min-1; VEmax 145.45 ± 5.29 vs. 165.42 ± 9.28 l•min-1; T2000 410.96 ± 1.70 vs. 393.05 ± 4.52 sec; P2000 323.72 ± 3.75 vs. 378.85 ± 2.79 Watt; SPM 29.90 ± 0.34 vs. 28.85 ± 0.14 strokes• min-1; LAmax 10.35 ± 0.39 vs. 11.81 ± 0.43; $p<0.01$). No differences were observed between groups in HRmax (200.45 ± 1.29 vs. 198 ± 2.04 beats•min-1), Dyspnea Index (0.87 ± 0.26 vs. 0.92 ± 0.31), BFmax (56.81 ± 2.05 vs. 57.28 ± 4.23

Breaths•min-1), RERmax (1.15 ± 0.12 vs. 1.19 ± 0.11), EqO2 (30.56 ± 0.70 vs. 31.38 ± 1.54), AT (178.27 ± 1.81 vs. 176.42 ± 2.49 beats•min-1), LA2000max (14.68 ± 0.62 vs. 13.64 ± 0.68 mmol• lt-1)

In conclusion the antropometric, metabolic and performance characteristics of lightweight rowers differ from those of open class rowers.

PHYSIOLOGICAL DEMANDS OF 4 V 4 AND 8 V 8 GAMES IN ELITE YOUNG SOCCER PLAYERS

Drust, B., Jones, S.

Liverpool John Moores University, United Kingdom

Small-sided games are time efficient as training activities since they present an opportunity for technical, tactical and physical development of players. Changes in the structure of training sessions may have consequences for the physical and technical demands placed on individuals. The impact of these changes has not been systematically investigated especially with young children. The aim of the current investigation was to evaluate the physiological and technical demands associated with 4 v 4 and 8 v 8 games in elite young soccer players.

Eight elite male soccer players from a Premier League Soccer Academy (Mean ± S.D. age 7 ± 1 years, height 1.3 ± 0.2 m, body mass 25.3 ± 3.8 kg, playing experience 2 ± 1 years) completed three 4 v 4 and three 8 v 8 games. Match duration was restricted to 10 min. The physiological responses to match-play were determined for each player by recording the heart rates during all games (Polar Electro, Kempele, Finland). Each player was also filmed using a video camera (Sony CCDTRV218, Japan) for the determination of individual work-rate profiles. These tapes were analysed using a hand notation system for both locomotor actions and ball contacts.

Mean ± S.D. heart rate responses to 4 v 4 and 8 v 8 matches were not significantly different (4 v 4, 175 ± 10 beats.min-1; 8 v 8, 168 ± 6 beats.min-1). Total distance covered, estimated by calculating stride length at the various velocities, during games were also similar (4 v 4, 778 ± 160 m; 8 v 8, 693 ± 103; $P>0.05$). The total distance covered walking, jogging and sprinting did not significantly differ with the number of players included in the game. Significant differences were noted for utility (backward and sideways) movements ($P<0.05$) with greater distances covered in 4 v 4 (140 ± 68 m) than 8 v 8 (107 ± 51 m) games. When expressed as a percent of the total distance covered the overall activity profile of players was similar in both forms of game. Walking, jogging, sprinting and utility movements accounted for 24 %, 44%, 19% and 13 % in 4 v 4 games and 27%, 48%, 10% and 15 % in 8 v 8 matches. The technical requirements of the game, as illustrated by the mean ± S.D. number of ball contacts, was dependent on the number of players involved. Reductions in the number of players significantly ($P<0.05$) increased the number of individual ball contacts per game from 13 ± 7 in 8 v 8 to 36 ± 12 in 4 v 4.

The data from this investigation suggest that small-sided games impose substantial physical demands on young players. The number of players involved in these activities does not seem to be a crucial determinant in these demands at this age. This observation is in contrast to more technically related actions that are significantly influenced by player number. This would suggest that activities that include smaller numbers of players can deliver a more effective multi-component training stimulus whilst maintaining the same cardiovascular stresses as large group activity.

TRAINING PREPARATION FOR AND PHYSICAL RESPONSES TO AN ULTRA LONG TERM HANDBIKE RACE

Abel, T., Lindschulten, R., Schneider, S., Strüder, H.K.

German Sport University Cologne, Germany

Introduction: Handbike as a wheelchair sport has gained increased popularity in Germany. It is a very attractive sport and important for the prevention of cardiovascular diseases. During the last 5 years race performance has increased enormously. Aim of this study is to measure the physical responses during a race from Trondheim to Oslo (540 km). The race will take part from 24.6 – 25.6.2006. Results will be really new.

Method: One spinal cord injured subject (lesion level Th4 ASIA B, gold medal winner in Paralympics and European Champion in handbiking) is going to perform the race in between a time window of 45 hours. Before, during and after the race blood samples will be taken to determine hormonal and immune system parameters as well as the metabolic situation (catecholamines, cortisol, leukocytes, lymphocytes, granulocytes, monocytes, CD3+ T-cells, CD19+ B-cells, CD4+ T-cells, CD8+ T-cells, CD56+ NK-cells, lactate). The handbike of the athlete will be equipped with a SRM system to register work load, speed, cadence and heart rate continuously. Body temperature will be measured by skin electrodes. Daily energy intake will be determined as well as distribution of carbohydrates, fat and protein. Water consumption and intake of vitamines and minerals will be documented.

Results: The athlete is in preparation for the race since October 2005. First training camp started on the 6th of December and was terminated on the 29th of January. Work load at metabolic threshold (4 mmol/l lactate) was inclined by 44 % from 90.0 watts to 128.8 watts by cycling 2.852 km. Maximum oxygen uptake per kilogram body weight increased by 14.6 % from 36.9 ml/kg to 42.28 ml/kg. The training was registered using as well the SRM system (average speed 18.1 km/h, average heart rate 132.1 bpm, average cadence 57.1 rpm). The training intensities were dedicated to metabolic situations of a laboratory staged test: 56.5 % with an intensity lower than 2.6 mmol/l lactate (> 60 watts), 10.2 % in between 2.6-3.4 mmol/l lactate (60 - 80 watts), 15.1 % in between 3.4 – 5.2 mmol/l lactate (80 – 105 watts), 8.5 % in between 5.2 – 6 mmol/l lactate (105 – 125 watts); 9.7 % > 6 mmol/l lactate (> 125 watts). A second training camp will start on the 26th of March ending 22nd of May. Planned are again approx. 3.000 km. The race will be accompanied by mobile medical laboratory equipment. All relevant parameters will be analysed in the first week after the race.

Conclusion: The influence of a systematic training period of nine months on an ultra long term race in handbiking will be shown. The profile of such an extended load and the physical reactions will be shown. The hypothesis is that moderate intensities during the training with great volumes will increase the performance capacity best.

EXPLOSIVE LEG STRENGTH AND LEG STIFFNESS AS PREDICTORS OF 100M SPRINT PERFORMANCE IN ELITE CROATIAN SPRINTERS

Vueti, V., Babic, V., Markovic, G.

Faculty of Kinesiology, University of Zagreb, Croatia

Introduction

It has been demonstrated that sprint performance is dependent on several qualities of the muscular system, explosive leg strength in particular1,5. In addition, it has been suggested that the stiffness of the legs also represents an important factor responsible for successful sprinting performance, particularly in the maximum velocity sprint phase1,2. Leg stiffness is one of the elastic components of the muscle-

tendon complex behavior that influences the mechanics and kinematics of body's interaction with the ground3. Both explosive leg strength and stiffness can be successfully determined by means of various jump tests1,3. The purpose of this study was to relate, in national level track sprinters, explosive leg strength and leg stiffness to the 100m sprint performance.

Methods

Eleven regional to national level male sprinters (100m sprint performance: 10.9 ± 0.4s (mean ± SD); range: 10.3-11.5s) participated in the study. Best 100m sprint performance (R100) during an official competition in the present season for each sprinter was considered as a criterion. Explosive leg strength was assessed from the height of the squat jump (SJ), countermovement jump performed with both legs (CMJ), as well as CMJ performed with each leg separately (CMJR and CMJL, respectively)4. All vertical jumps were performed on a force plate. Leg stiffness was assessed from maximal hopping in place test, as previously suggested2. Each subject performed ten maximal hops in place on a force plate. Mean jumping height (HOP) and leg stiffness (K; half-period method4) were calculated. Stepwise regression analysis (backward model; SRA) was used to calculate the relationship between jumping variables and R100.

Results

Performance in SJ, CMJ, and HOP correlated significantly to R100 (r = -0.76 to -0.83; p<0.02). No significant relationship between K and R100 was found (r = 0.14; p = 0.72). SRA revealed a simple solution with only CMJ as a significant predictor variable, which explained 69% of R100. For comparison, full regression model (i.e. all five jumping variables included) explained only 5% more variance in R100.

Discussion and conclusions

Although jump heights in both concentric and stretch-shortening cycle (SSC) movements were significantly related to R100, the best predictor of R100 in trained sprinters is CMJ. These data suggest that CMJ explains both concentric and SSC muscle function relevant to sprint performance. In contrast to previous data1, we found no relation between K and R100. Future studies should examine specific influence of jumping performance on each particular sprint phase. We conclude that CMJ represents the best jumping indicator of R100 I trained sprinters.

References

1. Bret C. et al. (2002) J Sports Med Phys Fitness 42:274-81
2. Chelly SM, Denis C. (2001) Med Sci Sports Exerc 33:326-33
3. Farley CT., Morgenroth DC. (1999) J Biomech 32:267-73
4. McMahon TA, Chen GC. (1990) J Biomech 23, Suppl 1: 65-78
5. Mero A, et al. (1981) Scan J Sports Sci 13:16-22.

ENERGETIC COST AND D-TE RELATIONSHIP IN SWIMMING

Dekerle, J., Zamparo, P., Capelli, C., di Prampero, P.E.

University of Brighton, United Kingdom

Introduction. The concept of critical velocity (CV) has been criticized on different grounds (e. g. di Prampero 1999) especially for such sport activities, as is the case for swimming, in which the energy cost (C) is not constant but increases with increasing velocity (v). In sports for which C does not change as a function of v (e. g. running), the relationship between distance (d) and minimal time taken to cover it (te) is linear and CV can be calculated as the slope of this relationship, the y-intercept being associated to the anaerobic work capacity (AWC): d = AWC + CV te. Even if the slope and the intercept of this relationship do not represent CV and AWC in swimming, these two parameters can be calculated also for swimmers as described below.

Methods. During maximal exercise, the total energy expenditure (Etot) is given by the sum of the anaerobic (An) plus the aerobic (Aer) capacity. The latter can be calculated as the product of maximal oxygen uptake (O2max) and the time of exhaustion (te, s): Etot = An +  O2max . te (where Etot and An are expressed in kJ and  is the energy equivalent for O2). Etot can also be expressed as the product: Etot = C . d (where C is expressed in kJ m-1 and d is the distance covered, in m). By taking into account that, in swimming, C = a . vn (e. g. Capelli et al. 1998) and dividing all terms by C, one obtains: d = (An / a . vn) + ( O2max / a . vn) . te. In this equation the first term (An / a . vn) represents the distance that can be covered by exploiting the anaerobic energy sources (AWC) whereas the second term ( O2max / a . vn) represent the critical velocity (CV).

Results and discussion. Based on data published by Capelli (1998), AWC and CV were calculated for three elite male front crawl swimmers whose O2max was known (4.09 ± 0.54 l . min-1) and for which the C vs. v relationship was experimentally determined (C = 0.607 . v1.614). The values of AWC and CV were then compared to the intercept and the slope of the d vs. te relationship as obtained over 4 distances (46, 91, 183 and 366 m). CV (e. g. the ratio  O2max / a . vn) turned out to be 1.33 ± 0.07 m . s -1, e. g. 0.11 m s -1 smaller that that obtained from the d vs. te relationship (d = 1.44 . te + 16.8, R2 = 0.999, n = 12). AWC (e. g. An / a . vn) was found range from 18 (over the shorter distance) to 42 m (over the longest distance). These data show that the slope of the d vs. te relationship is not a measure of CV in swimming and that to calculate this parameter the subject's O2max and his/her C vs. v relationship should be known. Moreover, these data show that the intercept of the d vs. te relationship is not a measure of AWC which, in turn, is not a constant but increases as a function of the distance covered.

References

Capelli C, Termin B, Pendergast DR (1998 a) Energetics of swimming at maximal speed in humans. Eur J Appl Physiol 78: 385-393
di Prampero PE (1999) The concept of critical velocity, a brief analysis. Eur J Appl Physiol 80: 162-164.

PHOSPHATE INGESTION LOWER BLOOD LACTATE CONCENTRATION AFTER A MAXIMAL OXYGEN CONSUMPTION TEST

Frøyd, C.

Sogn og Fjordane University College, Norway

Ingestion of phosphate for athletes in sports is not advised by nutritionists due to lack of effect on performance. Athletes using the sports drink FOZ, containing sodium dihydrogenphosphate report that they like the beverage and believe the phosphate increase performance and recovery in endurance sports.

PURPOSE: Compare the effect of a sports drink containing phosphate and the same sports drink without phosphate. The effect on performance was measured during a VO2max-test (VO2max, time to exhaustion and lactate concentration) and recovery (10 minutes) after the VO2max-test for athletes. METHODS: 29 athletes (men n=23, women n=6, age 20-27 years, VO2max 61.2±7.8 ml O2 kg-1 min-1) ran two test sessions on a treadmill with four hours rest period between the test sessions. Each test session contained of 15 min warm up

running, a VO2max-test (4-8 min), 2 min rest and 10 min recovery running. Heart rate (HR) (Polar, Finland) were measured during the whole test, VO2 (MetaMax I, Cortex, Germany) were measured during the VO2max-test, and lactate concentration in blood (cLa) (YSI, USA) were measured 1 minute (cLa0) after the VO2max-test, and after 3 (cLa3), 5 (cLa5) and 10 min (cLa10) recovery running. Between the two test sessions, all subjects ate the same light meal, drank water and 1 liter of sports drink. Half of the subjects (n=14, VO2max 61.5±7.4 ml O2 kg-1 min-1) drank a sports drink containing sodium dihydrogenphosphate (PHOS) and the other half (n=15, VO2max 60.9±8.3 ml O2 kg-1 min-1) drank the same sports drink without sodium dihydrogenphosphate (PLACEBO). All results are reported as mean ± SD. RESULTS: Time to exhaustion or VO2max were not significantly different between test 1 and 2 for PHOS or PLACEBO. cLa were significant lower for PHOS for all cLa-measurements between test 1 and 2: cLa0: 8.8±1.8 mmol l-1 (test 1) – 7.4±1.8 mmol l-1 (test 2) p<0,001, cLa3: 8.4±1.9 mmol l-1 (test 1) – 7.3±1.4 mmol l-1 (test 2) p<0.01, cLa5: 6.9±2.2 mmol l-1 (test 1) – 6.0±1.5 mmol l-1 (test 2) p<0.05, cLa10: 4.5±1.9 mmol l-1 (test 1) – 3.3±1.3 mmol l-1 (test 2) p<0.05. For PLACEBO, only cLa10 were significant different between test 1 and 2: cLa10: 4.5±1.5 mmol l-1 (test 1) – 3.6±1.1 mmol l-1 (test 2) p<0.05. CONCLUSION: Ingestion of sodium dihydrogenphosphate in a sports drink with sodium and D-glucose result in lower lactate concentration in blood 1 minute after VO2max-test and after 3 and 5 min recovery running after the VO2max-test. However ingestion of sodium dihydrogenphosphate did not alter time to exhaustion or VO2max during a VO2max-test. This is surprising since it is usually assumed that a reduction in cLa would be associated with increased performance. The mechanism which lowers cLa is unclear.

ACCURACY OF SUB MAXIMAL CYCLO-ERGOMETRY IN SENIOR ROWERS AND RUNNERS - WHAT CAN WE CONCLUDE BASED ON THE STATISTICS?

Ruzic, L., Mikulic, P., Sporis, G.

University of Zagreb, Croatia

Astrand cycle ergometry test is probably the most famous and most frequently used sub maximal test aimed at evaluation of the aerobic capacity. In this research the accuracy of test was evaluated based on results comparison with the results obtained during maximal ergometry test, the test which is considered to be an objective indicator of functional status of the individual. The sample consisted of 46 rowers and 22 runners. All the examinees are males in their middle age (35-65 yrs), who are at least twice per week active in rowing or running recreational training sessions. The maximal ergometry test was conducted using the rowing ergometer for the sample of rowers, and treadmill for the sample of runners. Basic statistical parameters were calculated followed by Pearson correlation coefficient. Simple regression analysis was performed and Student T-test and Fisher F-test were used to verify the obtained results. The results pointed out statistically significant, but low to moderate relationship between Astrand test results and maximal ergometry results (r=0.68 for rowers and r=0.56 for runners). Simple regression analysis pointed out statistically significant prediction of true VO2max based on the Astrand test results, but the shared variance turned out to be relatively low (R2=0.46 for rowers, R2=0.31 for runners). T-test results pointed out no statistically significant difference between Astrand and maximal ergometry results in both of the observed groups (p=.42 for rowers and p=.27 for runners), while stronger F-test proved otherwise (p=.00 rowers; p=.01 runners). Acquired results confirmed that Astrand test can not be considered an accurate test for evaluation of the aerobic capacity in recreational rowers and runners. For further research, it remains to be investigated can these results be translated to a broader population of the physically active men in their middle age.

FROM INTENTION TO ACTION: TOWARD PROFESSIONALISM IN TENNIS

Leitão, M.T., Bergamo, V.R., Loschi, L., Lemos, E., Campos, K.

ESEFJ/PUCC, Brazil

The practice of tennis is considerably increasing in Brazil, and many juvenile players have expressed intent to become pros. With the evolution of sports, other aspects have been exhaustively studied, and nevertheless the coaches seem not to be following that evolution, since factors like biomechanics, nutrition, injury prevention, or sports psychology are not receiving due attention. Research show that the number of juvenile players who give up sports during this complex transition phase is high, and they mention pressure with travel, training, ranking, injuries, and sponsors as reasons for giving up. It is true that players who aspire to this higher level need more training - at the risk of premature specialization as pointed out in some studies - but not all of those who engage in broader training as suggested become a professional. Other players do not train so much and do not reach a professional level. In order to investigate the type of training being offered at tennis clubs and academies, and if the players are also being prepared out of court, a questionnaire with 20 questions was submitted to 28 juvenile players of both sexes between 12 and 16 years of age, from Jundiai, Sao Paulo. Of the 28 subjects, 14 want to become pros, and the average training is two hours a day three times a week. None of them has psychological counseling with a specialist, 10 do not have nutritional counseling, 09 have a physical trainer, and none of the teachers use audiovisual aids in their training. They play an average of 03 tournaments per month, mostly at local and state level. When questioned about their weak and strong points in tennis, most of the answers were about technical aspects and 03 mentioned tactical and mental skills as weak points. Many of them said that they watch friends, opponents and professional players in order to improve. The results show that few of these juvenile players are having adequate out of court support to achieve their goals. Players 10 to 12 years of age should train with less intensity and frequency, and also play fewer tournaments; after 14 training may be adapted to the characteristics of this age group and to the demands of competitive sports. Besides the stress inherent to the game and the weariness resulting from playing more than once a day or during several hours, they need focus, motivation and emotional control, as well as good nutrition. While some players overtrain and give up before achieving their goals, others want to achieve them without training enough. We believe that training should be reconsidered and restructured, and new studies should be carried out so even if many of them do not become professionals, they continue to have adequate training and continue to play quality tennis during a long term, which helps them lead active and health lives.

THE DEVELOPMENT OF WOMEN'S BASKETBALL AFTER BALL SIZE REDUCTION: A STATISTICAL ANALYSIS OF PARTICIPATING PLAYERS OF 2003 AND 2005 EUROPEAN CHAMPIONSHIP AND CONSEQUENCES FOR THE TRAINING PROCEDURES

Ohanian, J., Michna, H.

Faculty of Sport Science Technical University Munich , Germany

Introduction:Changes of rules in sports were introduced to vitalize the game for spectators. Due to reduction in possession time in offence (Schmidt et. al., 2003) basketball already gained speed. 2004 a further change took place in european women's basketball, as the ball size was reduced to enhance game speed and create more offences.

The aim of this study is to determine whether the change of ball size had an effect on shooting quotas and overall offences (game speed) and to consider consequences for the training procedure.Methods:The detailed shooting quotas of 41 female players who participated in the 2003 and 2005 final round of the European Championship in Basketball were analysed using t-test for paired groups in order to discover significant changes in the shooting performance. The data were retrieved from FIBA. The detailed shooting performances (made shots, attempted shots and shooting percentage) of 2 point field goals (FG), 3 point shots (3 PtS) and free throws (FT) of 2003 were compared to those of 2005. In addition, ball handling skills such as assists, turnovers and steals were analysed. Results:
In 2005 the 2 point FG attempts as well as the number of assists, steals, turnovers and minutes played were significantly higher. The individual over all points and the point averages were higher in 2005. Although there are more attempts and made shots, the 2 point FG and 3 point quota went down in 2005. However, the FT quota increased in 2005.Conclusions:
Following up some interpretations on 2005's shooting quotas: The number of attempted shots is an indicator for overall offences. Hence, this significant increase in attempted shots in 2005 may be a consequence of the ball size reduction. A rise in shot attempts should lead to the detected increase in overall points and points on average. However the rise of playing time of these players along with their progression from 2003 to 2005 should also be considered. The fact that there are more made and attempted 2 and 3 point shots but a lower quota can be explained by the not yet fully adapted shot to the ball. Nevertheless, the increasing intensity on defence should also be discussed. The improved free throw quota in 2005 can be interpreted as a faster adaptation to the smaller ball of undisturbed shots than shots in motion and against opponents.The significant higher number of assists can be the result of adaptation to the ball since passing is easier with a smaller and lighter ball. However, dribbling and ball handling is more difficult. Thus both, turnovers and steals, have increased since these two parameter correlate. Consequences for training are as follows: the increased game speed can be enhanced by emphasizing fast break and offence transition. In order to adapt to the increase in defence intensity all shots should be performed in full speed and against opponents to create game like situations. References:
Schmidt GJ et al.(2003). Leistungssport 01: 41-48
www.fiba.com.

STUDY OF THE EFFECTS OF BRIEF AND LONG TERM OF STIMULATION METHOD IN THE KICK BOXING

Villani, R. 1,2+3, Tomasso, A. 1+3, Fratarcangeli, M. 1, Distaso, M. 1+3
1 TMA.Combat Sport, M.Sc.Faculty, Univ.Cassino, 2 IUSM Rome, 3 CSRSC Combat Sport Research, Italy

Introduction: In the kick boxing the speed of kick is a fundamental quality, but hard to train. The most interesting method of rapidity training is the stimulation one (Verchoshanskij) where a rapidity exercise is replaced by an "intense loading of strength".
We want to verify the methods effects in a brief and long term in a month of training.
Methods
The method of stimulation is based on the connection of two exercises: one general (squat 85%; 3 set X 4 reps; rec. 3 min) and one specific, the medium round kick executed with a backward leg position (3 set X 4 kicks, right and 4 left; rec. 1 min.) performed against the punching bag with the maximum explosive force (rec. squat-kicks: 4 m.)
This experiment was practised with twenty-two kick boxing trainees (age 17/30; w.60/88kg; h.168/185cm; practise: 2/7years) of different competitive levels (provincial and national).
All the athletes had to do a modified version of the SOK TEST (Villani et al.,2004) in which the time of execution of the kick (4 right, 4 left) was evaluated in both conditions of before and after the definite squat loading. The reliability of the testing was verified repeating the exercises in two following sessions (test-retest correlation).
Two uniform groups have been formed with athletes with a comparable quality both physical and technical:
11 athletes (experimental team), trained four weeks with the stimulation method;
11 athletes (control team) trained four weeks with a standard training: the squat session was executed an hour after the specific training with the punching bag.
After the training, the test was repeated to evaluate the effects of both training methods. We compared the pre-load and post-load test to study the short term method; we compared the SOK TEST results in both teams to study the long term method effects .
Results
The test reliability pointed out values of the r between 0,79 and 0,89 ($p<0,01$) for the round kick, in conditions of pre and post-load.
In the experimental team, the SOK TEST results improved in the evaluation of pre-training, while the control team decreased the improvement and not always was significant (20-28% vs. 10-14%). In the comparison of the SOK TEST results, before and after the squat, both teams had a higher speed of the execution of kicks after the overloading stimulation, but after the month of training, the experimental athletes team had a higher difference between the pre-squat and the post-squat test (from 11-15% to 19-21%); the control team didn't have such significant variations.
Discussion
The stimulation method applied to the kick boxing techniques can be considered an efficient system of training of speed and specific explosive force. The results indicate an increasing efficiency of the method proceeding with the training. Our future studies will evaluate these aspects on higher competitive level athletes
References
Verchoshanskij J.V. (1996). SdS, 36: 23-33
Villani R., Angiari P., Tomasso A. (2004), 9th ECSS Congress, 295, Clermont-Ferrand.

90S ALL-OUT TEST AND AEROBIC FITNESS IN CHILDREN

Dekerle, J., Williams, C.A., McGawley, K., Berthoin, S., Carter, H.
Unversity of Brighton, United Kingdom

The purpose of this study was to establish the validity of an all-out test for the estimation of the power associated with peak VO2 during a ramp test (P-VO2peak), and sub-maximal aerobic ability as represented by critical power (CP). Based on the 2-parameter CP concept, it was hypothesized that the power output at the end of the 90s test (EP) would correspond to CP due to a complete depletion of the anaerobic capacity. Seven active children (mean ± SD: 12.8 ± 0.3 years; 43.7 ± 10.9 kg) carried out a series of physiological performance trials: (i) an incremental ramp test to determine P-VO2peak; (ii) three tests to exhaustion to determine CP and (iii) a 90-s all-out isokinetic test to measure EP and end VO2. The VO2 at the end of the 90-s trial (2266 ± 485 mL.min-1) reached 92 to 106% of VO2peak (mean ± SD:

99 ± 5%). Mean ± 95% limits of agreement was equal to 40 ± 233 mL.min-1 giving limits of agreement of -194 to 273 mL.min-1. EP in the last 10-s (168 ± 44 W) was related to (r=0.91; SEE = 22 W; P=0.05) but was not significantly different from P-VO2peak (173 ± 42 W; P =0.75). Mean ± 95% limits of agreement was equal to 3 ± 38 W giving limits of agreement of -35 to 40W. These two variables were not statistically significantly different from CP (123 ± 24 W; P =0.05). CP was significantly correlated with EP (r=0.96; SEE = 16 W; P=0.01) and P-VO2peak (r=0.94; SEE = 16 W; P=0.02). In conclusion, VO2peak determined from a ramp test can be assessed from the performance of a 90s all-out test in children. While the end power of an all-out test is not different from and highly correlated with P-VO2peak, the level of agreement between the two variables is too high to use these variables interchangeably. Based on the 2-parameter CP concept, it could be concluded that 90s is not of sufficient duration to totally exhaust the anaerobic capacity in children. Further investigations are required to corroborate these findings, as the 90s all-out test seems a useful tool to assess aerobic and anaerobic potentials in children.

INFLUENCE OF EXERCISE DURATION ON RESTING HEART RATE VARIABILITY FOLLOWING EXERCISE IN ACTIVE WOMEN

James, D.V., Reynolds, L.J.

University of Gloucestershire, United Kingdom

INFLUENCE OF EXERCISE DURATION ON RESTING HEART RATE VARIABILITY FOLLOWING EXERCISE IN ACTIVE WOMEN

JAMES, D.V.B. AND REYNOLDS, L.J.

FACULTY OF SPORT, HEALTH & SOCIAL CARE, UNIVERSITY OF GLOUCESTERSHIRE, OXSTALLS CAMPUS, OXSTALLS LANE, GLOUCESTER, UK

Few studies have investigated the resting heart rate variability (HRV) response following a single exercise bout (James et al., 2002; Pober et al., 2004). The aim of the present study was to examine the influence of exercise duration on the 24 h post-exercise HRV response in active women.

Twelve active healthy women were recruited who undertook two conditions in a randomised order: a 20 min bout of walking (W20) and a 60 min bout of walking (W60). Walking was performed on a level motorised treadmill at 6.5 km.h-1. Participants visited the laboratory once prior to (-1 h) and twice following (+1 h; +24 h) the walking exercise interventions to allow determination of resting HRV. Participants also visited the laboratory prior to any testing for a familiarisation session. Resting determination of HRV involved participants sitting for 20 min whilst breathing at a controlled rate of 0.2 Hz. Successive R-R intervals were measured in the final 5 min using a heart rate monitor (Polar 810i) and transmitted telemetrically to a PC for storage. Time domain variables included average R-R interval (AVRR) and standard deviation of the R-R interval (SDRR) and frequency domain variables included total power (TP), low frequency (LF) power (0.04 – 0.16 Hz), high frequency (HF) power (0.16 – 0.24 Hz) and LF/HF ratio.

A significant (p = 0.05) interaction (condition x time) for AVRR was observed. AVRR was significantly higher (p = 0.017) at +1 h in W20 (889ms) compared with the W60 (832ms). A main effect for time (p = 0.056) was observed for SDRR in W60, with post-hoc tests revealing a significant increase between –1 h (51 ms) and + 1 h (65 ms). However, by +24 h, SDRR was not significantly elevated from the –1 h value. Similarly, a main effect for time (p = 0.047) was observed for LF power in W60, with post-hoc tests revealing a significant increase between –1 h (847 ms2) and + 1 h (1316 ms2). However, by +24 h, LF power was not significantly elevated from the –1 h value.

The main finding is that AVRR responded quicker (i.e., after 1 h) in W20. Coupled with the finding that LF power was not significantly increased after 1 h in W20, this suggests that in the short-term (+1 h) W20 confers a positive change in extending the R-R interval, without any change in LF power. Although W60 was able to induce an increase in SDRR after only 1 h, this change was associated with an increase in LF power.

James, D.V.B., Barnes, A.J., Lopes, P., Wood, D.M. (2002) Heart rate variability: response following a single bout of interval training. Int J Sports Med 23 247-251

Pober, D.M., Braun, B., Freedson, P.S. (2004) Effects of a single bout of exercise on resting heart rate variability. Med Sci Sports Exerc 36 (7): 1140-1148.

GOAL SCORING PATTERNS OF THE GREEK NATIONAL SOCCER LEAGUE

Katis, A., Kati, F., Kellis, E.

Aristotle University of Thessaloniki, Greece

Introduction

The low frequency of goals scored during a soccer game compared to other team sports gives greater importance and value to each goal. Goal scoring pattern is defined as the time at which the goals are scored during a game (Abt et al., 2002). The purpose of the present study was to examine the goal scoring patterns of the Greek national soccer league.

Methods: Five seasons (2000-01 to 2004-05) of the Greek soccer league were totally analyzed. For each game, the time at which the goals were scored and the goal scoring technique which was used were recorded. A 90min game was divided into two 45min, six 15min and eighteen 5min time periods. Goals scored at the extra time of each half, goals scored per month and goals scored per place of playing were also analyzed. The kick, the heading, the free kick, the penalty and the owngoal were the goal scoring techniques which were further examined.

Results: In total, 2318 goals from 1804 games (1.28 per game) were totally analyzed. Chi-square analysis indicated a significant ($P < 0.01$) increase of goals scored at the second half. An upward trend was revealed across the 5 and 15min time periods. Significantly ($P < 0.01$) more goals were scored on May and at the home conducted games. The kick was the most effective goal scoring technique (67.08%), followed by heading (18.55%), penalties (8.33%), free kicks (4.06%) and owngoals (1.98%).

Discussion/Conclusion: The present results suggest that more goals were scored at the end of each half, at the home conducted games and at the last months of the league, while a significant number of goals were scored after the implementation of the regular time of each half. Similar results were reported for the Australian and the Scottish soccer league (Abt et al., 2002; Ekblom, 1994) and for the 14th World Soccer Cup (Jinshan et al., 1993).

ELABORATION OF A SPECIFIC TEST FOR THE EVALUATION OF PUNCHES FREQUENCY SPEED OF BOXING

Villani, R. 1,2+3, Tomasso, A. 1+3, Tucciarone, G. 1, Distaso, M. 1+3

1 TMA.Combat Sport, M.Sc.Faculty, Univ.Cassino, 2 IUSM Rome, 3 CSRSC Combat Sport Research, Italy

Introduction

The rapid execution of punches is a determining factor in order to excel in the sport of boxing and above all in amateur boxing,
A few authors studied the speed of action and the speed of frequency of the attack's combinations (Alonso & Lopez, 1983).
In order to observe the development of the frequency speed, we invented a new kind of specific test called FSP (Fre-quency Speed of Punch), a valid and economic test that allows us to study the speed of a simple combination (jab-cross) and the number of punches hitting the sack in defined unities of time.
Methods
To carry out the FSP test, we used a footboard with piezoelectric cells connected to a computer (ergotester Globus) and put around a boxing sack. The test had 3 procedures: jab-cross (speed of the single punch), number of punches in 5" (speed of frequency) and number of punches in 15" (resistance to the speed of frequency). The experimentation was tried on a group of 20 boxing athletes, sorted out from the age of 16 till the age of 33: 10 amateurs (non agonists) (weight 74±14, h 176±8) and 10 agonists (weight 65±9, h 175±9).
For the FSP jab-cross mode each athlete had to repeat the test for 3 times (and we considered just the best one), while for the other two modes (number of punches in 5" and in 15") we repeated the test just once. In FSP 15" we considered and observed the frequency of punches and the heart frequency (post-test recovery). In order to check the validity of the test itself, it has been repeated after 2 days (test-retest correlation).
To study the test validity and to verify the capacity of distinction among athletes of different level, we made a transverse comparison between the group of agonists and the group of amateurs.
Results
The results of the reliability of the test (test-retest) for the 3 modes in both groups, put in evidence values of r between 0,84 and 0,95 ($p<0,01$). The transverse comparison (validity study) put in evidence a greater speed of frequency in the group of agonists than in the amateurs. In fact the agonists had a 20% best result in the 5" and a 12% best result in 15" ($p<0,01$). In the jab-cross mode the difference was only of 5% ($p=0,47$ n.s.). Analyzing the rhythm of punches in FSP 15" we noticed a greater regularity in the agonists if compared to the amateurs. The agonists also resulted as the best in the post-test recovery of the heart frequency.
Conclusions
The FSP test resulted as a reliable test (test-retest correlation) and as a valid one (transverse comparison). As a conclu-sion, this test can be considered a valid means in order to obtain a precise and economical valuation of the frequency's speed of punches in the sport of boxing and in fighting sports in general. But, to obtain final conclusions is important to analyse with the FSP test also top level athletes. It will be the subject of our next study.
References
Alonso J., Lopez E.G. (1983). Boletin cientifico-tecnico INDER-Cuba (Havana) 18: 5-12.

RELIABILITY AND VALIDITY OF AN ACCELEROMETER-BASED FOOT SENSOR IN RUNNING

Niessen, M., Hartmann, U., Laukkanen, R., Kinnunen, H.
Technical University Munich - Faculty of Sport Science, Germany

Novel innovative technologies provide tools to monitor continuous running velocity (vrun). For outdoor running purposes e.g. global-positioning systems (Witte & Wilson 2004, Terrier & Schutz 2005) have been developed. Accelerometer-based technology provides tools measuring acceleration or deceleration in both indoor and profiled outdoor terrain. Attached on top of one shoe, the sensor (FS) can determine distance and vrun based on frequency, length and height of strides. Aim of the study was to verify the reliability and validity of FS-technology under standardised laboratory conditions.
A group of 27 male (31±6 yrs, 181±6 cm, 78±7 kg) & 23 female (28±6 yrs, 167±5 cm, 59±5 kg), divided into low (VO2max: 49-53 ml/kg/min) and high fit (VO2max: 57-65 ml/kg/min) competitive endurance runners, completed pre & post training phase standardised maximal graded load tests (GLT 1 & 2) on a treadmill. Starting speed was 2 or 2.5 m/s, step duration 5 min, increase 0.5 m/s, rest 30 s and incline 1%. Before tests FS was calibrated running on a track for minimum 400 m with individual extensive vrun-intensity. Sensor data were memorised by running computer S625x (Polar Electro) with 12Hz. Maximum of 3 min data within each 5 min step were extracted. Descriptive and group-specific parametric statistics were applied.
Mean vrun results of 373 steps (n=12340 data points) showed a strong linearity (r=0.983, p≤0.001) between predicted and derived FS-vrun (2-5.5 m/s) for both GLTs. Underestimation in vrun as well as increased negative deviances of FS- compared to treadmill-vrun were found with risen speed (Δ: -0.1 m/s (2%) at 2 m/s; -0.3 m/s (5%) at 5 m/s). There was no significant difference between more or less fit endurance runners or genders. Individually slightest deviations were -0.2% to 0.6%. Paired t-tests pointed out high sig. diff. (p≤0.001) between GLT 1&2 vrun. In contrast to sig. (p≤0.01) deviations of predicted and derived vrun in GLT 1 for all steps, GLT 2 showed only low sig. diff. (p≤0.05) for two steps.
Familiarisation to FS, calibration modus as well as better running economy due to regular training leaded to more precisely vrun and definite lower intraindividual variances (-1.7 %) in GLT 2. Despite slight variations between runners and/or shoes there was a good reproducibility (<1% error) of vrun per step. Prospective including a categorisation of moderate, medium and high vrun zones into product software to better adjust a correcting factor for FS values would be needed. In summary accelerometer-based FS gave reliable instant vrun results under standardised conditions. Further field tests and real speed / distance comparisons on various in- & outdoor surfaces are necessary to verify suitability & accuracy of this technology in varying running terrains.
Terrier P & Schutz Y (2005). J Neuroengineering Rehabil 2 (2): 28
Witte TH & Wilson AM (2004). J Biomech 37 (12): 1891-1898
Acknowledgements
This study was partly supported by a grant of Polar Electro, Finland.

RELATIONSHIP BETWEEN MOTOR PERFORMANCE ABILITY AND PERCEIVED PHYSICAL STATES IN YOUNG ELITE SOCCER PLAYERS

Kornmayer, A., Steinbacher, A., Spitzenpfeil, P., Kleinert, J., Hartmann, U.
Technical University of Munich, Faculty of Sport Science, Germany

Introduction: The motor performance in soccer depends on different variables. Beside technical-tactical, coordinative to physical condition abilities as well as constitutional qualities, the mental parameters, like motivation, mood states also perceived physical states (PPS) play a determining role.

Within the project soccer interdisciplinary performance-diagnostics are carried out regularly for injury prophylaxis with young elite soccer players. Beside the motor performance ability and the physical comfort are collected in this study. Purpose of the study is to find out coherences between the PPS and objectively measured data of motor performance.

Methods

81 young elite soccer players (U17) of the highest German league were tested. After measuring the PPS (activity, fitness, flexibility and health) by the questionnaire Perceived Physical State (PEPS; Kleinert 2004), twelve physical performance variables were tested via the talent diagnostic system (TDS; Werthner 2000). By means of factor analysis four categories were built: speed (sprints of 0-10m, 10-20m and 0-20m), agility (shuttle run, steeplechase and slalom run), reaction (match, flash jump, rhythm run and drop jump) and jump strength (squat jump and counter movement jump). Nonparametric bivariate correlations (according to Spearman) have been used to determine the behaviour between the perceived physical state and the motor performance factors.

Results and Discussion

Over all analysis did not show significant results in all parameters for all players of all teams. However, a significant correlation of single factors appeared within single teams. The perceived activity showed a correlation with the factor speed (r = 0,54, p ? 0,05). This means the more actively the players have subjectively felt, the faster they were. Furthermore the factor agility correlates with the area perceived fitness (r = 0,60, p ? 0,05) which indicates that the sense of fitness resulted in better values of the shuttle run, steeplechase and slalom run.

Those first results show a possible assessment of physical performance abilities by psychological data. Are there any further variables which have an influence on the relation between the motor and the mental performance?

References

Kleinert, J. (2004). Die Methode des kognitiven Dilemmas als Messparadigma in der Befindlichkeits- und Beanspruchungsdiagnostik.

Gruber, M, Gollhofer, A. (2004). Impact of sensorimotor training on the rate of force development and neural activation. Eur J Appl Physiol; (92): 98-105.

Werthner, R. (2000). Aspekte der Talentdiagnostik. In: Bewegungserziehung , 3, 6-10.

Acknowledgements

This study was supported by the Federal Institute of Sports Science of Germany (VF 08/01/04/2004-2005).

THE RELATIONSHIP BETWEEN EXERCISE INTENSITY AND TIME TO EXHAUSTION DURING SHORT INTERMITTENT RUNS: IMPACT OF EXERCISE BOUTS DURATION, CARDIORESPIRATORY FITNESS, EXPLOSIVE STRENGTH OF LOWER LIMBS

Buchheit, M., Pactat, F.

Laboratoire de Recherche Adaptations Réadaptations (APS et conduites motrices), France

The relationship between exercise intensity and time to exhaustion during short intermittent runs: impact of exercise bouts duration, cardiorespiratory fitness, explosive strength of lower limbs and anaerobic capacity.

Purpose: The purpose of this study was to use, during short intermittent runs, the slope of the time to exhaustion (TE) vs running intensity relationship as an index of intermittent endurance (IE), and to observe its association with exercise bouts duration, cardiorespiratory fitness, explosive strength of lower limbs and anaerobic capacity. Methods: 12 athletes (24.5 ± 4.1 yrs) took part in six maximal shuttle intermittent runs (100%-95%-90% of V30-15IFT [1] during 15 or 30sec, intersected with 15 (Int15) or 30sec (Int30) of passive recovery, respectively) on a synthetic track (40 m). Cardiorespiratory fitness was estimated by the V30-15IFT (VO2est). Explosive strength of lower limbs was evaluated in all subjects through counter movement jump (CMJ), drop jump (DJ), and 10m sprint time (10m). Anaerobic capacity was estimated by the MART test [2] that is aimed to provide maximal lactate production ([la]max). TE data was log-transformed and all calculations were adjusted on age and body mass index. Results: TE vs. running intensity relationship obtained with the three exercise sets for each subjects was linear for all (r = 0.98 ± 0.2 and r = 0.98 ± 0.2 for Int15 and Int30 respectively). Although TE was significantly higher during Int15 than during Int30 for all intensities, IE indexes did not differ between the two exercise conditions (6.7 ± 1.2 vs 7.1 ± 1.7 for Int15 and Int30). In Int15, IE was not related to VO2est or [la]max, but was negatively correlated with CMJ and DJ ($P<0.05$) and positively with 10m ($P<0.05$). Concerning Int30, IE was not related to VO2est, 10m or [la]max, but was positively associated with CMJ and DJ ($P<0.05$). Conclusions: cardiorespiratory fitness and anaerobic capacity may not constitute relevant predictors of IE during short intermittent runs. Explosive strength may have distinct incidences on IE, depending on exercise bouts duration. Although a high explosive strength level, often synonym of a limited peripheral oxidative background, may not be beneficial for a high IE during Int15, it could be hypothesized than during the Int30 with its longer runs, a higher explosive muscular fitness could help decreasing the energy cost of running and thus maintaining IE.

References

1. Buchheit, M. The 30-15 intermittent fitness test: relevance for interval training of intermittent sport players. in ECSS proceedings. 2005. Belgrade.

2. Nummela, A., M. Alberts, R.P. Rijntjes, P. Luhtanen, and H. Rusko, Reliability and validity of the maximal anaerobic running test. Int J Sports Med 1996; 17: S97-102.

EFFECTS OF 6-WEEK RESISTANCE TRAINING PROGRAM USING "RESISTOGYM" ELASTICATED TUBING ON PHYSIOLOGICAL PERFORMANCE INDICES IN AMATEUR MALE SOCCER PLAYERS

Donne, B., McGowan, M.

Trinity College Dublin, Ireland

Resistance training (RT) plays a role in improving athletic performance by increasing muscular strength, power and speed, inducing hypertrophy, and improving local muscle endurance. Recently studies have investigated the effect of short-term RT using elasticated tubing in the elderly (Mikesky et al., 1994; Damush and Damush, 1999) and in collegiate tennis players (Treiber et al., 1998). Elasticated RT stresses single or multiple joints making exercises more functional, and facilitating training in a more effective weight bearing functional position. The aim of this study was to investigate if the addition of a simple six-week RT intervention using elasticated tubing (Resistogym Ltd.) at low/medium load and high repetitions would affect physiological indices relative to control.

Amateur male soccer players in mid-season training, resistance group (R: n=10, mass 83±11 kg, height 184±6 cm, body fat 19±4 %) and control group (C: n=7, mass 80±9 kg, height 182±8 cm, body fat 17±5 %) participated. C performed only standard soccer training and competitive matches; R supplemented their standard training and matches with a graded RT program 3 day.week-1 using low/medium

load and high repetitions. Each RT session consisted of repeated sets (2-3 sets of 15-20 reps) of 10 discrete lower limb exercises and was completed in approximately 45min. Aerobic, anaerobic and specific strength indices were assessed pre- and post-intervention. Data was analysed using a two factor ANOVA with time as the repeated measure, values of $P<0.05$ were considered statistically significant.

No significant intra-group differences in assessed variables were observed pre-training and no significant inter-group differences were observed in C following standard soccer training. However, significant improvements in maximum voluntary isometric force (682±49 vs. 797±47 N, $P<0.01$) and isometric endurance capacity (41.3±3.9 vs. 62.0±8.3 kN.s, $P<0.05$), vertical jump height (49.5±2.2 vs. 55.6±1.4 cm, $P<0.01$), standing broad jump (232±5 vs. 242±4 cm, $P<0.05$), 10 x 5m sprint agility data (14.8±3 vs. 14.3±3 s, $P<0.05$) and 20 MST performance (99±6 vs. 108±7 shuttles, $P<0.05$) were recorded following RT. In addition, RT had no significant negative effects on aerobic performance indices assessed during either an incremental treadmill test to volitional exhaustion (VO2 max, vVO2 and velocity at Dmax) or 12 min Cooper Run and no significant improvement in 30 or 50 m sprint velocities were observed.

In conclusion, a six-week RT program using low-cost elasticated tubing supplementing regular soccer training resulted in significant improvements in many of the performance indices assessed which could potentially benefit on-field soccer performance without the need for complex and expensive gym-based RT regimes.

References

Damush, T. and Damush, J. (1999) Gerontologist, 39, 705-710.

Mikesky, A. et al. (1994). Eur J Appl Physiol Occup Physiol, 69, 316-320.

Treiber, F. et al. (1998). Am J Sports Med, 26, 510-515.

EFFECT OF INITIAL PACING STRATEGY UPON 10-KM RUNNING PERFORMANCE

Edwards, B.J., Currell, K., Waterhouse, J., Atkinson, G.

Research Institute for Sport and Exercise Sciences, Liverpool John Moores University, United Kingdom

Pacing strategies have been found to influence athletic performance in a number of events. However, few researchers have investigated the effects on overall time taken of manipulating pace, especially during the first part of the event. Purpose: We examined the effect upon overall performance of three enforced pacing strategies during the first 3 km of a 10-km run. Methods: Eight male participants completed two initial trials at a self-selected pace. The mean running speed was then used to calculate the enforced pacing strategy for the first 3 km. The pacing strategies were "fast" (velocity 5% above the mean), "slow" (5% below the mean) and "even" (equal to the mean); the last 7 km were run as quickly as possible. Ratings of perceived exertion (RPE), split times and heart rate were recorded every km, and stride length and frequency were measured at 2, 5 and 8 km. Haemoglobin, haematocrit and blood lactate were measured before and after the runs, as was time taken to complete them. Results: A significant effect was found for times to completion (fast trial 2747 ± 598 vs even trial 2796 ± 629 vs slow trial 2851 ± 601 s respectively; $P<0.05$), with the "fast" trial being faster than the "slow" ($P<0.05$) but no difference between slow and even trial ($P>0.05$). Split times and RPE showed significant effects of the pacing intervention ($P<0.01$) and significant interactions between pacing intervention and distance ($P<0.01$). No significant effects of pacing intervention were observed for the other variables. A 5% increase in running velocity during the first 3-km of a 10-km running time-trial led to an improved overall performance, with ~90% of this improvement explained by the first 3-km. Conclusion: It was concluded that a sustained aggressive approach in the early stages of a 10-km run would be of overall benefit to performance.

THE INFLUENCE OF STRENGTH TRAINING IN ISOKINETIC STRENGTH AND IN THE PERFORMANCE OF SOCCER PLAYERS IN JUMP, SPRINT AND AGILITY TESTS

Alves, J., Rebelo, A.

Faculdade de Desporto - Universidade do Porto, Portugal

The purpose of this study was to analyse the effect of a strength training program in isokinetic strength and in the performance in physical actions involved in soccer: jump (Squat Jump), sprint (5 and 15 meters velocity) and agility ("505" test).

Twenty three young elite Portuguese soccer players (average age: 17, 36±0, 57 years) were divided in three groups: two experimental groups (G1, n=9, e G2, n=8) and a control group (G3, n=6). G1 and G2 have done the strength training program. The average weekly training sessions were one session for G1 and two sessions for G2. Besides the strength training program, G1 and G2 have performed their regular soccer training program. G3 has kept their regular soccer training program.

After the strength training program the following results were mostly observed: i) an increase in the average of peak torque (PT) and in the average power (AP) of G2 on knee extension at 90°.s-1 and 360°.s-1 ($p<0,05$); ii) a reduction of the sprint times over 5 and 15 meters for G1 and G2 (9,17% and 6,19% for G1 and 7,03% and 3,11%, for G2; $p<0,05$); iii) an increase on Squat Jump for both groups (12,6% for G1 and 9,63% for G2; $p<0,05$).

The training program was effective to increase the PT and AP only in group G2, which was submitted to a frequency of training sessions of two sessions per week. The increasing perfomance observed on jump and sprint tests after the strength training program didn't reveal being statistically influenced by the number of weekly training sessions used (one or two sessions/week).

20-HZ WHOLE BODY VIBRATION TRAINING FAILS TO COUNTERACT THE DECREASE IN LEG MUSCLE VOLUME INDUCED BY 14 DAYS OF 6° HEAD DOWN TILT BED REST

Zange, J., Liphardt, A.M., Müller, K., Mester, J.

DLR, German Aerospace Center, Germany

Atrophy of leg muscles caused by long term unloading is still a major health problem in the scope of human space flight. Training countermeasures currently performed in space can only partially conserve muscle volume and strength. A common model to study the effects of space flight conditions on leg muscle is a permanent 6° head down tilt (HDT) bed rest.

Vibration training (VT) has been shown to improve muscle performance in training studies with little time effort per day. Thus, it was hypothesized that VT could be a potential measure to counteract the negative responses of human body to bed rest. This abstract focuses on leg muscle volume. In a cross-over design 8 healthy male subjects (78.1 ± 9.5 kg; 179 ± 9.6 cm, 26 ± 5 years) took part in two study phases in the metabolic ward of the DLR-Institute of Aerospace Medicine. Study phases were divided into a 4-days adaptation period, a 14-days intervention period in 6°- HDT bed rest, and a 5-days recovery period. During bed rest each subject performed either VT or the control intervention. VT was performed twice daily on a Galileo 900 vibration plate (20 Hz / 2-4 mm). Subjects walked a defined

distance to the plate and performed 5 intervals of 1 min vibration in an upright standing position with 30° knee angle and 15% body weight extra load interrupted by 1 min sitting. The control intervention included exactly the same procedure except the vibration plate was not turned on. Subjects were mobile in the adaptation period and the recovery period. Both study phases were identical with respect to environmental conditions, study protocol and diet. At day 4 of the adaptation phase and at day 1 after bed rest muscle volumes in upper and lower legs were determined using magnetic resonance images recorded at 1.5 Tesla. Axial images showed a pixel resolution of 0.78 mm x 0.78 mm. Two sets of stacked slices without inter slice distance were recorded from the upper and the lower leg each over a distance of 20 to 25 cm. Before measurements subjects laid for minimum 20 min in horizontal position to allow a sufficient equilibrium of blood volume. The feet were kept at an angle of 90°. Bed rest combined with control intervention caused a significant ($P<0.05$) decrease in muscle volume in all examined muscle groups. The relative changes for the sum of muscles in both legs was -5.6 ± 1.9% in m. quadriceps, -4.3 ± 2.0 % for the hamstrings (m. biceps femoris + m. semimembranosus + m. semitendinosus), -6.5 ± 2.0 % for the m. triceps surae, and -3.6 ± 2.9 % for the m. tibialis anterior. Vibration training failed to cause a significant reduction in the volume loss of any examined muscle. Instead the volume reduction was significantly amplified by VT in the hamstrings (-6.2 ± 1.2 %, $P<0.05$). Whole body vibration at 20 Hz combined with an isometric loading at body weight + 15% failed to counteract leg muscle atrophy induced by 14 days 6°-HDT bed rest.

STUDY ON THE IMPROVEMENT OF TAKE OFF HEIGHT IN 13-14 YEARS OLD GIRLS AND 14-15 YEARS OLD BOYS

Gloria, R., Bogdan, R., Marinela, R., Gheorghe, B.

Universyti of Bacau, Romania

Starting from the hypothesis that going through a training program of localized physical exercise, which would use certain muscular groups, improves the vertical leap (the height of vertical take off) over the level of normal development, we have initiated an experiment. The experiment was organized on two groups: an experiment group and a witness group, and each group was formed of 12 girls (6 of 13 years old and 6 of 14 years old) and 12 boys (6 of 14 years old and 6 of 15 years old). The work methodology relied on performing a training system for 10 weeks. During the first and the last week control tests were held: drap jump (jump/100 in depth from 40 cm followed by a quick take off), countermovement jump (vertical jump preceded by quick flexion), squat jumps (vertical jumps from a semiflexed position) and 15 consecutive jumps. During the 8 weeks, they followed a training program made of exercises localized at ankle, knee and hip level and global training exercises. The means were used in an approach from easy to difficult, in a structure of three training sessions a week. The results analysis pointed out the value evolution for: unitary strength, take off height, repetition speed, the duration of ground time, the duration of air time, and take off power. Comparing the increases of the three jump types, we can notice that the best progress was achieved in drap jump of 3.9 cm and the lowest in countermovement jump of 3 cm. The conclusions point out significant increases for the experiment group, over the normal limits that were registered for the witness group. We also underline that the progress made is due to the specific work, localized with simple plyometric-type means, with light loads; to the usage of pendular balance which led to the increase of the bi-articular muscle strength; and to the improvement of performing manner to the nervous command at the level of the motor unit. The differences among the four jump types are bigger from the dynamic movement to the static.

STROKE QUALITY WITH YOUTHFUL CADRE PLAYERS OF THE INTERNATIONAL TOP CLASS IN TENNIS

Pieper, S., Denke, I., Weber, K.

Institute of Movement Science for Games in Sport , Germany

Introduction: The modern elite tennis has developed in last decades to a faster play. Thus, for instance, advancements of the stroke technique, the athletics and the racquet material cause a clear increase of the stroke velocity. The following contribution shows the diagnostics of stroke velocity and precision of cadre tennis players of the youth world rankings. Ones, the stroke quality were measured by service, forehand and backhand winner. To the other the influence from this was examined on the ranking list position.

Method: To the analysis of the quality of winners and service a total of 33 participants are at the age of 13 to 14 years (height 172±7.3 cms; BMI 20±1.8 kg/m²) diagnoses of the international Tennis Youngsters Cup in Cologne by means of a test battery to the stroke velocity. The test protocol exists of a service, forehand and backhand winner test. The passing with the winner test occurs through a ball throw machine. This was placed on the T-line. For the test realization all balls should be hit at high velocity on target fields.

Results: The service speed of the youngsters lies between 140 and 190 km/h (156±11 km/h). The players reach a strokes rate for the respective service field from 28%. In the forehand winner test the cadre players show a maximum stroke velocity from 113 to 151 km/h (135±9 km/h). On this occasion, they place possibly every third stroke in the field and everybody fourth on the target field. Besides, the stroke hardness of the backhand from 115 to 142 km/h (128±6 km/h) is slightly lower; indeed, the precision rises in comparison to forehand by 15%. The maximum service speeds (S) show in the ranking list comparison (R) no test-statistical differences ($p=.064$) (SR12-62 168±13 km/h; SR81-197 157±9 km/h; SR206-627 162±9 km/h). With the forehand winner (FH) merely significant differences appear in the stroke precision (target) between FHR12-62 35±15 and FHR206-627 19±10. With regard to the height (H) the maximum service speed differs high significantly (SH≥1.75 171±12 km/h; SH 1.70-1.74 160±8 km/h; SH≤1.69 156±9 km/h). Nevertheless, the forehand ($p=.708$) and backhand ($p=.137$) remain uninfluenced by the height.

Conclusion: The study shows that the stamping degree of the stroke quality takes in particular the stroke velocity already with youthful cadre athletes in the international top tennis a high meaning. As already in early works (Ferrauti and Weber 2000) shown, the service speed of the present study also shows a bigger connection to the ranking on than the forehand velocity. Hence, the stroke velocity should be coached in the training intensively in combination with an improvement of the stroke technique (intra-and intramuscular coordination) as well as the behaviour (e.g. Return) by fast or hard strokes forced.

EFFECTS OF DIFFERENT BODY POSITIONS ON BIOELECTRICAL IMPEDANCE ANALYSIS

Knuth, S., Yue, Z., Mester, J.

Institute of Training Science and Sport Informatics, Germany

Introduction

Bioelectrical impedance analysis (BIA) is a widely used method to assess body composition. Recently, there are several automatic devices available which can be simply used for daily measurements. To get accurate and reproducible assessments, it is necessary to standardize the measurements of BIA. Several factors, such as fluid balance of the body, physical exercise and the stage of menstrual cycle, have

been proved to affect the measurements of BIA. The goal of the present study was to analyze the possible influences of different positions of the arms or the legs on the measured values of the whole body and segmental composition.

Methods

Eight healthy subjects (age: 30.0 ± 5.5 years, height: 173.4 ± 7.2 cm, body weight: 69.2 ± 12.5 kg) participated in this study. The subjects carried out three trials with four different body positions on a BIA single-frequency scale (TANITA BC 418 MA, TANITA Europe GmbH, Sindelfingen, Germany), which had eight pressure-contact electrodes. Four stainless steel foot pad electrodes were fixed on the weighing platform to connect to the toes and heels respectively. Another four electrodes were fixed on the two handles to connect to the finger tips and the palms respectively. Thus, different connections of the voltmeter would allow the measurements of impedance of either the whole body or of a body segment (left or right leg, left or right arm). The four different body positions were: normal upright position (N), position 1 (P1) with arms stretched horizontally from the trunk, position 2 (P2) with arms in a 90° angle und position 3 (P3) with arms stretched parallel to the trunk and bended knees.

Results

The results of the whole-body impedance showed significant differences between position N and positions 2/3 as well as among positions 1 to 3. However, there was no significant difference between position N and P1. The body segment impedances showed significant differences in the arms and legs depending on body position. Generally speaking, the impedance tended to be overestimated by P1 and underestimated by P2 and P3, compared to position N.

Conclusions

Significantly different values of impedance for different body positions were obtained in the present study, suggesting that it is necessary to standardize the body position in order to get reliable results. The normal position is the standing position with arms stretched alongside the trunk. Changes from that position can, besides other variables such as ingestion of food or exhaustive exercise, lead to over- or underestimated values of impedance.

References

Deurenberg, P., Weststrate, J.A., Paymans, I. & van der Kooy, K. (1988). Factors affecting bioelectrical impedance measurements in humans. Eur. J. Clin. Nutr., 42, 1017-1022

Gallagher, M.R., Walker, K.Z. & O´Dea K. (1998). The influence of a breakfast meal on the assessment of body composition using bioelectrical impedance. Eur. J. Clin. Nutr., 52,092-97.

BIOELECTRICAL IMPEDANCE ANALYSES: RELIABILITY OF THREE DIFFERENT SCALES

Knuth, S., Yue, Z., Mester, J.

Institute of Training Science and Sport Informatics, Germany

Introduction

To measure the body composition is of vital importance in elite sport and for health purposes. The body weight is used particularly e.g. for the determination of the relative performance or the relative maximal oxygen uptake. Even minor changes in body composition may affect performance. Thus the accuracy of a measurement is important. There is a set of methods to determine the body composition (dual-energy x-ray absorptiometry (DEXA), underwater weighting (UWW), skinfold measure). Besides intricate lab techniques bioelectrical impedance analyses (BIA) are used widely although these methods are often criticized with respect to accuracy.

Three different BIA scales are used in the study. The purpose of the study was to investigate the reliability of the three scales.

Methods

Nineteen subjects (age: 28.3 ± 8.9yrs, height: 172.3 ± 5.5cm, body weight: 64.1 ± 6.6kg) participated in this study. They carried out five trials in the morning and in the evening on three different scales (scale 1: BC 418MA, scale 2: BF 576 (both: TANITA Europe GmbH, Germany), scale 3: CS-25, CURAmed GmbH, Germany). The devices using BIA and are equipped with eight (scale 1) respectively four (scale 2/3) electrodes. Four stainless steel foot pad electrodes, two for toe and heel each, and two handles with additional four electrodes for the hands (scale 1 only) are integrated to measure impedance. Measured parameters were body weight and body fat.

Results

The correlations of the five trials showed very high reliability coefficients for all three scales. For body weight the reliability coefficient of the five trials was 1.0 each on all three scales. The mean correlation coefficient of body fat was 0.996 for scale 1, 1.0 for scale 2 and 0.998 for scale 3. On scale 1 the correlation coefficient of impedance reached 0.994. The comparison of the five trials for the body weight, body fat and impedance (scale 1 only) with repeated measures ANOVA showed no significant differences.

Conclusions

The measurements of three scales point out high correlation coefficients for body weight and body fat. Non-significant mean differences between the five trials underline these results. This leads to the assumption that the scales appear to be reliable. The results align with several investigations, where test-retest-reliabilities for body fat between 0.957 and 0.999 were found. Also surveys for validity of BIA with DEXA (r=0.91-0.94) or UWW (r=0.71-0.81) as reference show similarly strong results. Due to the high reliability of BIA these method seems to be suited notably for intra-individual measurements.

References

Demura, S., Sato, S. & Kitabayashi, T. (2004). Percentage of total body fat as estimated by three automatic bioelectrical impedance analyzers. J. Physiol. Anthropol. Appl Human Sci., 23 (3), 93-99

Jackson, A.S., Pollock, M.L., Graves, J.E. & Mahar, M.T. (1988). Reliability and validity of bioelectrical impedance in determining body composition. J. Appl. Physio.

VARIATION IN BODY STRUCTURE, AEROBIC/ANAEROBIC FITNESS AND MATURATIONAL STATUS OF FEMALE PORTUGUESE SWIMMERS 12-13 YEARS

Figueiredo, A., Coelho e Silva, M., Ribeiro, L., Rama, L., Peña Reyes, M., Malina, R.M.

University of Coimbra, Portugal

The present study considers the growth and maturity status and performance profile of Portuguese female swimmers 12-13 years of age. The total sample (T) included 25 swimmers classified as local (n=17, L) and elite (n=8, E) level competitors. Somatic characteristics included the dimensions needed to estimate somatotype (Carter & Heath, 1990) and the androgyny index (Tanner et al., 1951). Aerobic and anaerobic performances were assessed with the 30-minute freestyle swim test (Olbrecht et al, 1985) and the 6x50-meter swim test (Cazorla,

1989), respectively. The latter provides the fastest and slowest trials and a mean time. Since the intermittent test was not performed on the same style, time-scores were converted to FINA short course point scores. Hand-wrist radiographs were taken and skeletal age (SA) was assessed with the FELS method (Roche et al., 1988). Chronological age (CA) was subtracted from SA to provide an indication of maturity status (Malina et al., 2004). In addition to descriptive statistics, comparisons between local and elite swimmers were made with the significance level set at 0.05. Mean CA was 13.0±0.5 years and mean SA was 13.5±1.2 years, and there were no differences between the two groups of swimmers. There also was no difference in maturity categories: local, 1 late (delayed), 11 on time, and 5 early (advanced); elite, 1 late, 5 on time, 2 early. There was no difference between groups for weight; the mean (T: 48.6 kg) was between the 50th and 75th percentiles of US reference data. However, elite swimmers were taller (E: 161.7 cm, circa 75th percentile; L: 156.4 cm, just below the 50th percentile). Elite swimmers were leaner with a lower sum of skinfolds (E: 39 mm; L: 58 mm), but there was no difference between the groups in the androgyny index (T: 76.7). Mean somatotypes were 4.7-3.3-3.2 (balanced endomorph) for local competitors and 3.1-3.9-3.4 (central) for elite swimmers. Elite swimmers attained better performances in the aerobic (E: 2092 m; L: 1636 m) and anaerobic (E: 374 points, L: 244 points – best sprint; E: 347 points, L: 210 points – mean of 6 trials) protocols. In conclusion, elite and local level female swimmers do not differ in skeletal maturation and body weight, but the former are taller and leaner, and attain better aerobic and anaerobic performances.

Carter J, Heath B (1990). Somatotyping – Development and Applications

Cazorla (1989). Tests spécifiques d'evaluation du nageur. Federation Française the Natation

Malina RM et al. (2004). Growth, Maturation and Physical Activity

Olbrecht et al. (1985). Intern J Sports Med. 6: 74-77

Roche AF et al (1988). Assessing the skeletal maturity of the hand wrist – FELS method

Tanner J et al. (1951). The Lancet. 1: 574-579.

TWO-YEAR STABILITY AND IN-FIELD RELIABILITY OF FUNCTIONAL CAPACITIES AND SOCCER SKILLS AMONG YOUTH SOCCER PLAYERS

Figueiredo, A., Coelho e Silva, M., Malina, R.M.

University of Coimbra, Portugal

The purpose of the study was to examine the stability and reliability of tests of functional capacities and soccer skills among young soccer players over a two year period. The sample consisted of 44 male soccer players who were measured and tested on three occasions at 11.6±0.3 (M1), 12.6±0.3 (M2) and 13.6±0.3 (M3) years, respectively. Tests of functional capacities included the 10x5-meter agility shuttle run, vertical jump (squat and counter-movement protocols using an ergo jump), 7x34-meter sprint shuttle run (anaerobic, Bangsbo, 1994), YO-YO intermittent endurance shuttle run - level 1 (Bangsbo, 1994). Tests of soccer-related manipulative skills were ball control with the body, dribbling speed and shooting accuracy (Portuguese Soccer Federation, 1986) and passing accuracy (Kirkendall et al., 1987). Inter-year correlations (M1-M2; M2-M3, M1-M3, respectively) for the functional indicators were moderate to moderately high for the yo-yo test: (0.75, 0.87, 0.64), mean sprint (0.69, 0.68, 0.74) and squat jump (0.64, 0.59, 0.54); moderate to low for the fastest sprint (0.42, 0.52, 0.58) and counter-movement jump (0.45, 0.32, 0.46), low for the fatigue index based on the 7x34-meter sprint (0.31, 0.14, 0.13, and variable for the agility test (0.37, 0.70, 0.15). Corresponding inter-year correlations for soccer skills were, respectively, moderate to moderately high for ball control with the body (0.81, 0.71, 0.58), dribbling speed (0.81, 0.69, 0.84), and passing accuracy (0.64, 0.63, 0.55); and moderate to low for shooting accuracy (0.58, 0.36, 0.17). Inter-age correlations were generally lowest across the two year interval (M1-M3), although the trend varied among tests. Coefficients of reliability (%) in M1, M2 and M3 were moderately high: yo-yo (83, 88, 86), fastest sprint (83, 81, 83), mean sprint (82, 88, 89), fatigue index (81, 82, 79), squat jump (77, 83, 71), counter-movement jump (85, 87, 82), agility shuttle run (80, 84, 83), ball control with the body (82, 77, 80), dribbling speed (76, 74, 89), passing accuracy (73, 83, 73) and shooting accuracy (70, 71, 71). With few exceptions, the indicators of functional capacity and soccer skill were generally stable and quite reliable over the two year interval.

Bangsbo J (1994). Journal of Sports Science. 12: 48-52

Kirkendall et al. (1987). Measurement and Evaluation for Physical Educators.

REGULARITIES OF THE ATTACK DEPENDING ON RECEPTION AND SETTING ZONE:

Mesquita, I., Afonso, J.

Faculty of Sport -University of Porto, Portugal

The purpose of this study was to establish associations between attack patterns and reception and setting zones, and it used a sample of four national volleyball teams integrating an intercontinental pole in the 2001 World League – Portugal, Japan, Cuba, and Yugoslavia. Two matches per team were analyzed, totalizing eight games, 25 sets and 549 game sequences. The variables were the zones of reception, setting and attack. Descriptive and inferential statistics were used, namely the Chi-Square, in order to test the association between variables. For all the variables, the agreements percentage was above 80%.

The present study has shown that the most common reception zones were 1, 5 and 6, being zone 2-3 the most common setting zone for side-out, and out of zone 2-3 the most common in transition. The most solicited zone in attack was zone 4, especially with the setting zone being out of 2-3. The middle attack had reduced expression with sets performed out of zone 2-3. Receptions from zones 1 and 3 make the construction of the attack difficult by zone 3, and the receptions from zone 2 drastically reduce the number of attacks by zones 1 and 2, revealing the attack construction by the central and left zone of the net.

PERFORMANCE PREDICTING FACTORS DURING PROLONGED NON-STEADY STATE CYCLING

Laaksonen, M.S., Björklund, G.B., Pettersson, S., Schagatay, E.

National Winter Sport Center, Mid Sweden University, Sweden

The work intensity during road cycling competitions involves periods of extremely high but also relatively low work intensities (e.g. Fernandez et al. 2000). However, only few studies have evaluated the physiology behind a non-steady state exercise pattern (e.g. Ekelund & Holmgren 1964; Bot & Hollander 2000). Although there are several possible tests that could predict performance in endurance sports, few of these tests takes into account the variability of workload.

Therefore, the purpose of the present study was to examine to prognostic value of blood lactate (La), respiratory exchange ratio (RER) and heart rate (HR) during non-steady state prolonged exercise (NSS). Eight male cyclist (age 26 (4) yrs; VO2max 4.7 (0.5) L min-1; BMI 22.5 (1.8) kg m-2) performed first maximal ramp test to establish the maximal aerobic power (VO2max) and power output (Wmax). After 24-48 hrs the subjects performed NSS-test which consisted of six high intense (HI) workloads at 90% of VO2max for 3-min each, interspersed by five middle intense (MI) workloads at 70% of VO2max for 6-min each. During the NSS test blood lactate (La) concentration, respiratory exchange ratio (RER), oxygen uptake (VO2) and heart rate (HR) were measured.

VO2 during MI and HI workloads were 3.4 (0.4) L min-1 and 4.2 (0.4) L min-1, respectively, and were kept stable with no difference between workloads ($p>0.05$). RER and HR increased when exercise load switched form MI to HI. However, only RER decreased when exercise mode shifted from MI to HI ($p<0.05$). La concentration increased also for each transition from MI to HI ($p<0.05$). During the first HI La was 2.8 (1.3) mmol L-1 and increased by 110%, 140% and 170% during the consecutive three HI workloads. During the first MI La was 3.3 (1.6) mmol L-1 but large individual differences were observed. HR, RER or VO2 responses were not associated with the time to exhaustion during NSS test. However, the changes in La concentration from the first HI to the first MI workload correlated inversely with the time to exhaustion during NSS test ($r = -0.714$; $p = 0.047$).

These results indicate that the magnitude of decrease in La concentration between the first high intensity workload and the consecutive middle intense workload could be a predictor for performance during prolonged non-steady state exercise.

Bot & Hollander (2000) Ergonomics 43: 1578-1592
Ekelund & Holmgren (1964) Acta Physiol Scand 62:240-255
Fernandez-Garcia et al. (2000) Med Sci Sports Exerc 32:1002-1006.

THE EFFICACY OF A GENERAL PHYSICAL CONDITIONING PROGRAMME ON GREEK CADETS' PERFORMANCE CAPACITY

Havenetidis, K., Paxinos, T., Kardaris, D.

Hellenic Army Academy, Greece

Introduction

The Hellenic Army Academy, as other Military academies across the world, comprises a general conditioning programme, aiming the improvement of 1st Grade cadets' physical condition. The purpose of this study was to test the efficiency of this physical training programme by evaluating various physiological parameters pre and post its application on male and female cadets.

Methods

A total number of 60 cadets (43 males and 17 females) recruited from the Hellenic Army Academy, participated in the present study. For male cadets average ± SD values for age, height, body mass and body fat percentage were 19.1±0.7 years, 174.9±6.0 cm, 72.8±9.6 and 13.2±4.9 respectively. For female cadets average ± SD values for age, height, body mass and body fat percentage were 19.5±1.8 years, 163.3±6.5 cm, 64.7±8.9 and 23.5±4.6 respectively. All cadets followed a 16-week physical conditioning programme combining callisthenics, strength (body mass bearing exercises) and endurance (running and swimming) exercises for 90 minutes per day 3 times a week. Prior and post this training period the following evaluations were performed:

- Flexibility: using the sit and reach test (SRT)
- Leg muscle power: using the Standing Jump (SJ), the Counter Movement Jump without (CMJ) and with arm movement (CMJA).
- Cardiovascular Fitness: using the 20m shuttle run test and predicting maximum oxygen uptake (VO2max)
- Pulmonary functions: using a hand held spirometer and measuring Forced Expired volume in one second (FEV1), Forced Vital Capacity (FVC) and FEV1/FVC ratio
- Body composition: using bioelectrical impedance and estimating body fat (BF)
- Upper muscle endurance: using the Bench Press Endurance Test (BPET)
- Hand maximal strength: using hand dynamometry for Dominant (DOM) and Non-Dominant hand (NDOM)

Results

Male cadets (post versus pre training) improved on (FEV1; $p<0.01$) 3.7±0.6 versus 3.5±0.6 litres, (FEV1/FVC ratio; $p<0.05$) 0.8±0.1 versus 0.8±0.1, (SJ; $p<0.01$) 30.3±4.2 versus 28.9±4 (CMJ; $p<0.001$) 31.4±4.5 versus 34.5±4.7 (CMJA; $p<0.001$) 37.2±5.3 versus 34.5±4.7 (VO2max; $P<0.001$) 52.1±3.7 versus 48.0±5.7 ml/kg/min, (BF; $p<0.001$) 10.1±4.6 versus 13.2±4.9%, (SRT; $p<0.05$) 38.9±7.7 versus 25.5±8.9 cm, (BPET; $p<0.001$) 30.7±10.1 versus 24.0±9.3 repetitions, (DOM; $p<0.01$) 42.0±7.2 versus 39.6±9.5kg and (NDOM; $p<0.05$) 40.0±6.1 versus 38.8±7.0kg respectively. In contrast, female cadets presented an improvement only in (BF; $p<0.001$) 20.0±3.8 versus 23.4±4.5%, (BPET; $p<0.05$) 54.4±18.9 versus 47.8±16.0 repetitions, (SJ; $p<0.05$) 23.8±3.7 versus 21.6±3.2 and (VO2max; $P<0.001$) 44.6±6.2 versus 41.8±6.2 ml/kg/min respectively.

Discussion/Conclusion

The present results suggest that the current physical conditioning programme is effective on both performance (cardiovascular fitness and strength) and health related parameters (body composition) which comprise Greek cadets' physical capacity.

ORGANIZATIONAL BASIS OF RATIONAL LONG-TERM PREPARATION SYSTEM

Shynkaruk, O.

National University of Physical Education and Sport of Ukraine, Ukraine

Introduction. Optimization of the Youth sport system in country on the basis of up-to-date science and world practice data is one of the most important reserves of increasing of effectiveness of the Olympic preparation. One of the main problems of the Ukrainian Olympic sports is work with the sport reserve, insufficient intensive supplement of national teams with young perspective athletes, and as a result, big number of athletes, which don't have real future for achieving high results on the Olympic arena, there.

Material and Methods. Analysis of the scientific literature and official documents, questioning, statistic methods were used in the work.

Findings. It is very important not only to optimize organizational structure, but to provide implementation of some positions during formation of the organizational basis of rational long-term preparation system at its different stages – in national teams, future and perspective reserve. First position is to put equal attention to all organizational structures, to all stages of long-term preparation process, concerning staff, scientific-methodological and medical supplement. Concentration attention on the main staff of the national team and neglecting work with future and perspective reserve will negatively result in effectiveness of the Olympic preparation.

Second position concerns the provision of the optimal disposition of the quantity of participant at different stages of the long-term preparation process, which is oriented on the constant outflow of the perspectless athletes during this process and inflow of the perspective youth.

Third item is about methodics of the long-term sport preparation. Rational methodics is mostly defined with the organizational basis, such as positions about different organizations, in which the long-term sports preparation is conducted, their programs and academic plans, criteria of the effectiveness of the coaches' work with the Olympic athletes at various stages of the preparation, and so on.

Conclusions. That's why it is urgently important to connect the organizational aspects of the national teams' preparation, their future and perspective reserve with the regularities of the rational long-term preparation process. Imperfection of the organizational basis of the long-term preparation system, fault criteria of evaluation of effectiveness of the coaches' work, engaged in youth sport, irrational sports calendar at different stages of the long-term preparation might negatively influence at the effectiveness of the sport reserve preparation.

GENERAL THEORY OF ATHLETE PREPARATION IN OLYMPIC SPORTS AND METHODOLOGICAL ASPECTS OF ITS BUILDING-UP

Platonov, V.

National University of Ukraine on Physical Education and Sport, Ukraine

Intensive and versatile activities of several generations of specialists have led to formation of a complicated and integral system of knowledge in the field of athlete preparation theory which at present has got quite a comprehensive and full mounting as an independent teaching and scientific discipline. Applied disciplines (morphology, physiology, biochemistry, psychology, sociology, organization and management etc) and some general science disciplines and theories (cybernetics, operation researches, adaptation theory, functional systems theory, a systematic approach and the like) played a significant role in its formation. Finally this allowed formulating a theory of athlete preparation as an integrative theory of an analytic-synthetic character but not a collective one. The process of integration of biological knowledge into general theory of athlete preparation should be considered as bilateral. It is hard to say whom the priority belongs here. Specialists in an area of general theory preparation, who made an appreciable contribution in its development, build up their activities on understanding of organic interrelation of sportive-pedagogical material with the knowledge from applied disciplines of biological cycle. The representatives of sport-relating medical-biological disciplines conducted their researches proceeding from the tasks of sport practice and development directions in general theory of athlete preparation. Absence of strict formalization of knowledge in a field of athlete preparation theory supported by a wide application of mathematical apparatus in a give case is a reflection not a weak elaboration of the theory as it is sometimes seen but its extraordinary complexity. Theory of athlete preparation can be formalized neither in full, nor in its generalized parts, that however does not exclude a possibility of quite a hard formalization of separate elements of theoretical knowledge including mathematical ones. Important methodological moment of modern knowledge system construction in an area of athlete training is an application of systematic-integral approach where it is not typical to study one-side connections but such interrelations and interconnections between different knowledge elements when there not only integral qualities of the system are defined by the contents of knowledge about separate sub-systems, chains, elements, but in its turn the nature of the latter depends on the qualities of the whole system. That is why when forming the athlete preparation theory there are two aspects of full knowledge vision – systematic and elementary, which are so interconnected that a definite interpretation of one of them leads to a strictly definite interpretation of the other. Finally a system of knowledge acquires new qualitative characteristics, and new necessary prerequisites are created for implementation of theoretical knowledge into practice.

THE CHARACTERISTIC OF RELATIONS BETWEEN TRAINING EFFORT AND THE LEVEL OF AEROBIC CAPACITY IN YOUNG FOOTBALL PLAYERS

Szmatlan-Gabrys, U., Bakalarski, W., Gabrys, T.

Academy of Physical Education in Warsaw, Poland, Poland

Introduction. The main objective of training sessions is to obtain changes in the level of organism adaptation to the effort which is required from a player during a sport contest by applying strains [Reilly, 2005, D'Ottavio, Castagna 2002]. The objective of this research was to determine the impact of training effort on the level of aerobic capacity in 16-17 year-old football players.

Material and methods. 30 16-17 year-old players (body weight 65,23±7,03 kilos body height 173,8±7,36cm) were subjected to tests carried out during a 6-month training period (3-month periods:preparatory and starting one). VO2max, VO2AT, HRmax and HRAT were determined during a progressive test on a treadmill Saturn(HP Cosmos). During traning sessions the level of HR was monitored using a Polar Team monitor (Polar). 4 zones of strain intensity described by HR were determined, defined by %VO2max(Borg 1986): VHI very high (86-100%); HI–high(76-85%); MI–average(51-75%); LI-low(31-50%); AR an active regeneration (15-30%). The rank correlation analysis was applied in order to determine correlations between the level of oxygen function and the magnitude of training strain. The results of research were drawn by Statistica(StatSoft). Financed by MNiI AWF DS.53

Results. The effort increase in the AR zone during preparatory period demonstrated a negative impact on VO2max growth (r =-0,401 p≤0.05), HRmax (r=-0,658 p≤0,001) and HRAT (r=-0.591 p≤0,01). The strain in LI zone is characterized by a similar impact on the parameters of oxygen function as observed in case of AR strain. The values of the parameters: HRmax (r=-0,542 p≤0,01) and HRAT (r=-0,533 p≤0,01) are decreasing with the increase of work volume in this zone. In a starting period a negative correlation between VAT (r=-0.386 p≤0,05) and the level of LI strain was observed. In a preparatory period the HI strain shows relation with VO2max(r=0,561 p≤0.01) and %VO2AT(r=0,440 p≤0,05). VHI strains show an impact in a preparatory period on both VO2max(r=0.688 p≤ 0,001) and HRmax (r=0,675 p≤0,001) as well as on HRAT(r=0,653 p≤0,001). In a starting period it was observed that there is a negative relation of the effect of strain in HI and VHI zones onVO2max (respectively VO2max (r=-0,471 p≤0.05, r=-0,495 p≤0,05)

Conclusion. The increase of VHI means in a preparatory period influences the rise of aerobic capacity. In a starting period tendency is opposite. In a preparatory period the increase of AR and LI means has a negative effect on parameters of aerobic capacity. It was proved that in 16-17 year-old players the drop in the increase of aerobic capacity while applying effort on LT level as well as the lack of a significant effect of increase in MI intensity

Bibliography

1.Borg G. [1982]. Med. Sci. Sports. Med. V. 14 :377.

2.D'Ottavio, Castagna [1999]. Science and Football IV, E and F. N. Spons, London :151-156

3.Reilly T. [2005] J.Sports Sci. 23 (6) :561-573.

FEASIBLE MISTAKES IN THE INCREASE OR MAINTENANCE OF THE BONE MINERAL DENSITY

Glaner, M.F., da Silva, R.A.

Catholic University of Brasília, Brazil

Many researchs have shown a significant (p<.05) increase or maintenance of bone mineral density (BMD) before/after physical activity and diet programs, prostheses implant and supplementary medicaments. However, they lack for information about the quality of this data of BMD measured by dual-energy X-ray absorptiometry (DEXA). Thus, the aim of this study was to compare the paired BMD analysis of the lumbar vertebrae (L1 to L4), maked in different days, derived from a single scanning. The subjects for this study were 26 women and 13 men (age= 45.1 sd14.8 and 32.0 sd11.9 years old; body mass= 63.2 sd13.6 and 75.0 sd16.8 kg; stature= 161.2 sd6.9 and 176.8 sd5.0 cm - women and men, respectively: sd = standard deviation). Each subject was scanned just once (MEASURE 1). This MEASURE 1 of BMD was taken according to the handbook of the manufacturer's Lunar DPX-IQ v.4.x, and the machine was calibrated regurarly using the manufacturer's phantom model. The first analysis was maked in the same day of the MEASURE 1, and the results were printed, but not recorded in computer. The second analysis was maked 30 days after the MEASURE 1. All scanning and analysis were conducted by the same technicist, who has 3 years of experience in this function. The data of the BMD (g/cm2) of the L1 to L4 obtained in the first and second analysis was compared by paired t-test and Pearson's (r) correlation (ap<.05). The results for the first and second analysis were, respectively: L1a= 1.1170 sd.2171 and 1.1258 sd.2217; L2a= 1.2038 sd.2180 and 1.2114 sd.2204; L3= 1.2537 sd.2318 and 1.2565 sd.2318; L4= 1.2268 sd.2374 and 1.2155 sd.2364; L2-L4a= 1.2281 sd.2235 and 1.2364 sd.2249. High correlation was evident between all L1 to L4 (ra= .935 to .998). Although previous studies have revealed increase or maintenance in BMD of the L1 to L4 due to physical activity and diet programs, prostheses implant and supplementary medicaments, in this study were found differences (ap<.05) between BMD of the L1, L2 and L2-L4 obtained by MEASURE 1. This suggests that other factors may also contribute to the increase or maintenance of BMD, e.g. the removal of surrounding soft tissue, incorrect determination of the intervertebral disk space and abdominal fat. It is possible because the analyses are maked using the finger-board of the computer. Thus, there is no security that, in two or more analysis in the same subject, will be removed the same amount of surrounding soft tissue in the lumbar spine. Other studies are required to confirm or not these findings.

SIMPLIFIED DOUBLE BOUTS EXERCISE METHOD FOR NON-EXHAUSTIVE AEROBIC CAPACITY DETERMINATION IN SEDENTARY RUNNING RATS

de Barros Manchado, F., Contarteze, R.V., Gobatto, C.A., Luciano, E., de Mello, M.A.

Sao Paulo State University - UNESP, Brazil

The exercise physiology often uses experimental animal models to observe the physiological responses to exercise, but few studies deal with the exercise intensity. Therefore, it is necessary to develop simple methods for physical evaluation of exercise rats. The aim of this study was to simplify the double bouts exercise method for non-exhaustive aerobic conditioning determination in running rats, based on the protocol originally described by Chassain (1986) for human beings and adapted to rats by Manchado et al. (2006).

Adult Wistar rats (n=10) were used. The running animals were selected and adapted to treadmill running. All rats accomplished 4 tests at different velocities (10, 15, 20 and 25m.min-1) with intervals of 48 hours among them. The Chassain's method is characterized by double bouts exercise at the same intensity separated by a passive recovery. In present study, the rats run two efforts of 5 minutes each at the same intensity, separated by 2 minutes of rest, with blood collection for lactate analysis. For each velocity, it was calculated the value of delta lactate, by subtracting the blood lactate concentration at the end of the first effort (LACE1) from the lactate concentration at the end of the second effort (LACE2). With the delta lactate for each velocity, an individual linear interpolation was plotted, which enabled the determination a "null" delta lactate, equivalent the critical load (CL). For amplified the applicability of test, the CL was also determined using only deltas lactate at two velocities: 10 and 25m.min-1. The rats also were submitted to maximal lactate steady state protocol (MLSS) to verify the stabilization of the blood lactate, composed by 25 minutes of continuous exercise at 15, 20 and 25m.min-1 velocities, with blood collection every 5 minutes.

One-way Anova was used to compare the CL determined using all deltas lactate, CL obtained using only two deltas and MLSS velocity. We also observed the Pearson correlation between CLs (P≤0.05).

The estimated CL using four deltas was 16.9±0.8 m.min-1, with significant linear regressions (R=0.94±0.02). The CL obtained for two points interpolation (10 and 25m.min-1 deltas) was 16.5±0.82 m.min-1. The MLSS was observed at 20 m.min-1 for all animals, in blood lactate concentration at 3.7±0.2 mmol.L-1. There was no significant difference in CL determined by the two different methods and these parameters were highly correlated (r=0.85). In both the determination methods, CL was 20% less than MLSS velocity.

The results suggest that the simplified non-exhaustive simplify protocol using two velocities underestimate the MLSS in 20%, but showed similar results to the standard protocol using four intensities. Due to easier and faster utilization with rats, the simplified protocol seems to be more applicable than the standard protocol.

Supported by FAPESP (proc n° 04/07070-5), CNPq (proc n° 300270/2004-6) and CAPES.

REFERENCES

Chassain, A. Science & Sports 1:41-48,1986

Manchado et al., Med Sci Sports Med 38(5) supp (in press).

EFFECTS OF COMPUTER-GUIDED STRENGTH TRAINING WITH ECCENTRIC OVERLOAD IN TRAINED ATHLETES

Klute, K., Bauer, T., Kinscherf, R., Vorwald, S., Bischoff, D., Müller, H., Weber, M.A., Kauczor, H.U., Bärtsch, P., Billeter, R., Friedmann, B.

University Hospital Heidelberg, Germany

It was recently reported that computer-guided strength training with eccentric overload (desmodromic training) leads to distinct adaptations towards a stronger, faster muscle in untrained subjects (Friedmann, B. et al. 2004). The aim of the present study was to find out if in trained athletes desmodromic strength training has greater effects on strength (concentric one repetition maximum, 1RM), performance in jumping tests, muscle cross sectional area (CSA, magnetic resonance imaging), fiber cross sectional area (FCSA) and fiber type distribution (biopsies from vastus lateralis muscle). 26 athletes from a variety of sports who regularly perform quadriceps strength training were

randomly assigned to either desmodromic (DES, 24.1 ± 3.6 yrs, 185 ± 7 cm, 80.0 ± 8.4 kg) or conventional (CON, 24.5 yrs, 184 ± 7 cm, 80.5 ± 7.8 kg) knee extension exercise 3x/weeks for 6 weeks with 5 (DES) or 6 (CON) sets of 8 repetitions to compensate for the (1.86 fold) higher eccentric training load in DES. Afterwards, subjects performed jump training 2x/week for 3 weeks. After strength training, 1RM and CSA were significantly ($p<0.001$) increased in both groups by 16.3 ± 8.4 kg (DES), 16.4 ± 6.7 kg (CON) and by 6.0 ± 6.1 cm2 (DES) and 8.0 ± 5.9 cm2 (CON), respectively. Both groups improved maximal performance in the jumping tests [Countermovement by 2.2 ± 2.9 cm (DES) and 1.2 ± 3.7 cm (CON), Squat by 3.3 ± 2.3 cm (DES) and 1.7 ± 4.2 cm (CON), Drop, reactivity index by 0.26 ± 0.38 (DES) and 0.09 ± 0.49 (CON)], however, the increases were significant ($p < 0.01$) only in DES. There was a tendency towards a higher percentage of type IIA fibres in CON before strength training (38.1 ± 13.0 vs. 28.3 ± 7.1 % in DES, n.s.); after training this difference reached significance [43.1 ± 14.8 % (CON) vs. 30.1 ± 7.5 % (DES), $p = 0.029$]. Accordingly, the increase in percentage type IIA area was significantly greater in CON than in DES (6.8 ± 7.5 % vs. 2.8 ± 10.9 %, $p = 0.018$). There were no significant changes of % type I and type IIX fibres nor of the respective FCSAs or mean FCSA.

The significant performance increases in the jumping tests in DES point to a specific adaptation to desmodromic strength training in trained athletes. However, the greater increase of percentage type IIA area in CON and similar increases in CSA in both groups show that the morphological adaptations to desmodromic strength training seem not to be superior to equivalent conventional strength training in trained athletes.

Reference: Friedmann, B., Kinscherf, R., Vorwald, S., Müller, H., Kucera, K., Borisch, S., Richter, G., Bärtsch, P., Billeter, R.: Muscular adaptations to computer-guided strength training with eccentric overload. Acta Physiol. Scand.182: 77-88, 2004.

SPORT-SPANNING TRAINING VARIABILITY AUGMENTS INDIVIDUAL SUCCESS POTENTIAL IN ELITE SPORT

Güllich, A., Emrich, E.

University of the Saarland, Germany

We recently presented results from retrospective reports of German national squad athletes (questionnaire; n=1,558) indicating, that a higher training volume in other sports beyond the individual's current main sport and a higher variability of played sports is mostly associated with deceleration of the juvenile training- and performance-related development in his or her current main sport, but with higher long-term success in elite sport. Each, juvenile success, training volume in the main sport, and volume of support interventions, does not have such success-discriminating effect (Güllich & Emrich, 2006).

In the present study, the according hypotheses are tested in longitudinal design: 244 squad members volunteered for two measurements (t2-t1=33 months), 119 of them aging over sport-specific junior age at t1. A special coding technique enabled the inclusion of success data in regression and manova procedures (Bortz, 2005; Güllich & Emrich, 2006). Explanation of elite sport success at t2 was approached by iterations of independent variables (stepwise inclusion) including complexes of former and current success, training volume and continuity in the main sport and in other sports, and duration of inclusion in support programs, each measured until t1.

Among elite athletes, training volume in the main sport does not contribute significantly to the explanation of success at t2. On the other hand, just two variables, success at t1 and the training volume in other sports, clear considerable success variance at t2: R2adj=0.41; n=106. Further significant contributions were found for the duration of injury-induced training reduction and for the period of training age with inclusion in support programs (R2adj =0.51; n=89). The data signify that more durable and voluminous training in varying sports, longer periods of injury-induced training reduction, and a longer period of development beyond support programs – and their intended steering effects – are associated with higher success in the long run.

The empirical findings indicate considerable inconsistence between a socially constructed ideal-type of long-term careers and empirically displayed conditions for success. Furthermore, the results partially even disaccord the hard core of assumptions underlying traditional long-term training and support concepts, e.g. commonly assumed positive long-term correlations of each, juvenile performance, volume of sport-specifically goal-directed training, and corresponding steering of performance and training, with later success. Possible intervention- and selection-effects and their additive, selective, and/or interactive patterns are suggested and discussed from perspectives of training science, time-economy, and social sciences.

References: Bortz, J. (2005): Statistik für Human- und Sozialwissenschaftler. Heidelberg (Springer)

Güllich, A. & Emrich, E. (2006): Evaluation of the Support of Young Athletes in the Elite Sport System. EJSS (i. pr.).

THE STRUCTURE OF EFFORT INTENSITY IN AN ICE HOKEY GAME OF POLISH NATIONAL TEAM

Gabrys, T., Bakalarski, W., Szmatlan-Gabrys, U.

Academy of Physical Education in Warsaw, Poland

Introduction.The method is based on the assumption that HR increases linearly vs.VO2 (Astrand et al. 2003). The objective of the research was to apply HR assignment to VO2 values to the level of effort intensity occurring during an ice hockey match.

Material and methods. The research was carried out on selected 23 ice hockey players of a Polish national team during 4 international matches. VO2 zones and HR values corresponding to them were determined during an ergometric progressive test. The VO2 level capture was carried out with a gas analyzer Kb4 (Cosmed), and the HR readings with a Polar Team monitor (Polar). 5 zones of effort intensity were determined accounting for %VO2max: VHI– very high intensity (86-100%); HI - high intensity (76-85%); MI– an average intensity (51-75%); LI- low intensity(31-50%); AR- active regeneration (15-30%); SR– rest (≤14%). The percentage structure of work in each intensity zone was defined. In order to determine dependencies between the level of oxygen function and the ability for highly intensive work and the speed of restitution a correlation analysis was carried out between the time of work in each zone and the individual level of VO2max. The results of the research were drawn up by Statistica (StatSoft). The work and research were financed by KBN project AWF DS.53

Results. In the first period of the matches the examined group was doing 46-51% of total work in the VHI sphere in next periods the decrease of the parameter to the level of 36-40% was observed. Simultaneously the increase of the work in the MI zone from 17-20% in the first period to 23-28% in the second and third period was observed. In the first period high correlation between the level of VO2max and the time of work in the spheres from LI to SR (r=493 do 561 p≥0.05) was stated. In the second period with work in the spheres LI, MI, VHI (r=.487 do .649 p≥0.05).

In the III period with work in the spheres LI and VHI (respectively r= .497 i r=.723, p≥0.05).

Conclusion. The redeployment of performed work between the I and III period from the intensity VHI in the direction of MI and LI and the gradual disappearance of intensity SR and AR in the II and III period was recorded. With the passage of a game time the effort intensity in the examined group is decreasing. The correlation between VO2max and the game time showed that the level of oxygen function influ-

ences the effort intensity during a game. It conditions the speed of restitution (the transition from an AR and SR sphere) and in the III period it conditions the ability to work in the VHI sphere. The presented method allowed to assess the realization of the team potential during a match basing on the players VO2 individual level.

Bibliography: 1.Astrand P-O, et all (2003). Textbook of work physiology. Human Kinetics:168, 284-286.
2.Borg G. (1982). Med. Sci. Sports. Med. V. 14 :377.
3.Heller J. (2004). Hokejovy trener No. 3 :10-16.

CORRELATION BETWEEN SHORT DISTANCE VELOCITY AND DRIBBLING IN YOUNG ELITE FOOTBALL PLAYERS

Laudenklos, P., Herdener, L., Lottermann, S., Weber, K.

German Sport University Cologne, Germany

INTRODUCTION: In football the short distance velocity – up to ten meters – is an important performace factor (Verheijen, 1999) just like the dribbling, which is one of the basic skills (Bisanz & Vieth, 2001). The aim of this study was to analyze whether a correlation exists between these two parameters in young football players.

METHODS: The players were members of youth teams from German Bundesliga-Clubs (LZ) (n = 873) in the age-groups (AG) 1987 to 1994. They had to execute a 10 meter linear sprint (LS) and a dribbling test (DT) (Lottermann, Laudenklos & Friedrich, 2003). Every test consisted of two heats by which the better one was evaluated. The test-times were measured by light barriers. The Product Moment Correlation Coefficients (Pearson) were analyzed for every single age-group on a significance-level of 5%.

RESULTS: In LS the means varied from 1,86 ± 0,08 s (n1987 = 34) to 2,13 ± 0,09 s (n1994 = 115). The means of DT ranged from 9,87 ± 0,79 s in AG 1987 to 10,95 ± 0,72 s in AG 1994 (n = 112). The correlation coefficients decreased from AG 1987 ($r = .39$; $p < .05$) to AG 1990 ($r = .09$; $p = 0.30$; n = 151), followed by an increase up to AG 1994 ($r = .49$; $p < .01$; n = 112).

CONCLUSION: The results show a significant correlation between LS and DT in the oldest as well as in the youngest age-group. In the remaining age-groups no significant correlation between these two performance-relevant parameters was detected. The part of the combined variance is 15% in AG 1987 and 24% in AG 1994. Thus, the common factor(s) in these age-groups has/have to be identified and developed in practice. In further studies it is to clear up whether one combined factor is the acyclic fast strength.

REFERENCES: Bisanz, G., & Vieth, N. (2001). Fußball von morgen. Grundlagen- und Aufbautraining (S. 35). Münster: philippka.
Lottermann, S., Laudenklos, P., & Friedrich, A. (2003). Techniktraining – mehr als reine Ballarbeit. Fußballtraining, 21 (4), 6-15.
Verheijen, R. (1999). Die physische Belastung von Fußballspielern. In R. Verheijen (Hrsg.) Handbuch Fußballkondition (S. 23 – 39). Leer: bfp.

PHYSIOLOGICAL PROFILE OF ELITE PORTUGUESE TRIATHLETES

Martins, F., Oliveira, E., Ascensão, A., Magalhães, J., Soares, J.

Faculty of Sport, University of Porto, Portugal

Portugal has a know tradition in sport long distance events, especially in marathon. More recently, triathlon becomes a popular sport with relevant international sport results. The main objective of this study was to evaluate the physiological profile of Portuguese triathletes, participants in international championships. Were evaluated 12 male athletes of Triathlon with high training level and leaders of the national team (30±6.8 yrs; 70.2±6.4 kg; 177.5±5.4 cm; 6.7±1.9% fat and 5.2±0.5 yrs of specific training). The stature and body fat of Portuguese athletes were similar to other international participants. In spite of the bilateralism of this sport, significant differences between right and left side, were found in peak torque (isokinetic evaluation in Cybex System 2) in knee extension at 90°/sec and at 360°/sec (7.3±4.2% and 9.9±6.1%, respectively).

Portuguese athletes showed a lower maximal power, evaluated by the Wingate Test, when compared to triathletes of other countries participating also in international events (10.2±0.9 W/Kg vs 11.2± 1.2 W/kg). The VO2 max, obtained in treadmill, (64.2±7.7 ml/kg/min) is similar to other high level triathletes but slightly lower than the values found in elite Portuguese long distance runners (75.4±4.2 ml/kg/min) observed in our lab. The anaerobic threshold might be considered similar to the values found in other countries (76.2±3.8 % of the VO2 max.). The maximum race velocity was set at 19.6±1.2 Km/h.

The results show that Portuguese triathletes have similar physiological characteristics than the described for other international elite racers. Moreover, the bilateral differences found in knee extension might be carefully observed in order to maximize performance as well as to prevent possible soft tissue injury due to probable muscular unbalance.

EFFECT OF CYCLIST SPECIFICITY ON THE SELECTION OF THE PREFERRED PEDALLING CADENCE IN SEATED AND STANDING POSITION

Duc, S., Bertucci, W., Pernin, J.-N., Grappe, F.

Institut FEMTO ST (UMR CNRS6174) - Laboratoire de Mécanique Appliquée R. Chaléat, Université de Fran, France

Purpose - Competitive cyclists use generally a lower preferred pedalling cadence (PPC) in uphill than in flat race (1). This reduction could be due to i) the decrease of the power output, ii) the increase of the road slope, iii) the limited gear ratio and iiii) the frequent switch of body position (2). The specificity of cyclists can also affect the selection of the PPC. At our knowledge, none study had compared the PPC between flat terrain specialists and climbers.

Methods – Eight trained cyclists classified as flat terrain specialists (n = 4) or climbers (n = 4) performed two pedalling trials of three minutes at 80% of maximal aerobic power on a motorised treadmill with a slope of 4%. Two positions (seated and standing pedalling) were studied in a randomized order. During the first minute of each trial, the subjects had to choose their PPP with adjusting their gear ratio and then kept this rate until the end. Throughout the tests, the pedalling cadence and the power output were measured and controlled with a Powertap hub. The statistical analysis was performed with using the Mann-Withney Rank Sum test.

Results – This preliminary study showed that climbers choose a higher PPC in standing position (78  6 rpm) than the flat terrain specialists (68  3 rpm). The PPC in seated position is not significantly different between the two groups: 81  7 vs 76  5 rpm, respectively.

Conclusion – We suppose that flat terrain specialists choose a lower PPC during standing pedalling in order to generate greater peak pedal force and to decrease the number of vertical elevations of pelvis, which increase energy cost (due to their higher weight). Theses results must to be confirmed with increasing the sample size of the two groups.

References: 1. Lucia A et al. (2001). Preferred pedalling cadence in professional cycling. MSSE; 33: 1361-6.

2. Millet GP et al. (2002). Level ground and uphill cycling efficiency in seated and standing positions. MSSE; 34: 1645-52.

KNEE RANGE OF MOTION IN HEALTHY ADULTS: A NON INVASIVE STUDY DURING TREADMILL WALKING

Lovecchio, N., Turci, M., Shirai, J.F., Mantovani, E., Sforza, C.

Università di Milano, Italy

Introduction - Walking is one of the most important weight-bearing activities performed by humans. In a previous study, we developed a method for the quantitative assessment of lower limb movements during treadmill running and walking (1). In this investigation, we assessed the normal knee movements during treadmill walking in a group of healthy sedentary adults.

Methods - Fifty-seven healthy men (mean age 30 y, SD 15, range 19-79; mean standing height 175 cm, SD 7; mean weight 73 kg, SD 12; mean BMI 23.8 kg/m2, SD 3) and 46 healthy women (mean age 33 y, SD 13, range 20-69; mean standing height 166 cm, SD 6; mean weight 59 kg, SD 8; mean BMI 21.5 kg/m2, SD 2.6) walked at 1 m/s on a treadmill set at 0° inclination. Twelve steps were recorded for each subject using a 9-TVC optoelectronic instrument operating at 120 Hz (2, SMART System - B.T.S., Milan, Italy). Twelve passive, retroreflective markers identified the thighs and the legs (two sets of three markers for each limb). Three-dimensional left and right knee joint movements were assessed, and angular motions were divided into the three anatomical planes using original software (2). Bivariate analysis was used for descriptive statistical calculations. Comparisons were performed using Watson-Williams' tests (the analogue of Student's t test for angular data) and correlation analyses, with a level of significance set at 5%.

Results - In men, the mean movements in the sagittal plane (flexion-extension, direction of motion) were 65° (SD 1°) for both sides. In women, the mean movements were 67° (SD 1°) for both sides. The difference was statistically significant (Watson-Williams' test, $p<0.05$). In the frontal plane (rotation), no significant sex-related differences were found ($p>0.05$): men had mean motions of 23° (SD 0.9°, right side) and 20° (SD 0.7°, left side); women had mean motions of 23° (SD 0.7°, right side), and 22° (SD 1°, left side). The movements were symmetric (no side related differences; Watson-Williams' test, $p>0.05$ in both sexes); in both sexes, no significant relationships with age were found ($p>0.05$ in all occasions).

Conclusions - The method was fast and not invasive, and allowed a complete measurement of the dynamic characteristics of the knee during treadmill walking free from projection errors (2). Data can be used as normative values for sedentary healthy persons, and for future comparisons with patients with alterations of the lower limbs, before and after rehabilitation of the knee joint. In particular, considering that a mean range of motion of 67° is currently judged necessary to allow a normal swing phase of gait (3), the quantitative assessment of the actual movements in the single patient could be a useful tool for rehabilitation.

1. Proc. 7th Annual Congress ECSS, Athens 2002, p. 703

2. Clin Biomech 2002;17:611-4

3. J Orthop Surg 2002;10:194-202.

PRELIMINARY STUDY OF CONSTRUCT VALIDITY OF THE DEMOCRITUS-PSYCHOMOTOR ASSESSMENT TOOL FOR PRE-SCHOOL CHILDREN

Kambas, A., Venetsanou, F., Aggeloussis, N.

DEMOCRITUS UNIVERSITY OF THRACE, Greece

Democritus-Psychomotor Assessment Tool for Preschool Children (PAT-PRE) (Kambas, Aggeloussis, Gavrilidou, 2003) is a new assessment battery for children 4-6 years old, based on Motoriktest für vier- bis sechsjährige Kinder (MOT4-6) (Zimmer & Volkamer, 1987), one of the most known and valid testing batteries for this particular age. The most important consideration in evaluating and selecting an assessment tool is its validity (Dunn, 1989). The purpose of the present study was the preliminary examination of the competence of PAT-PRE to differentiate among i) different age-groups and ii) contrast groups. PAT-PRE was administered to: a) 88 non-disabled children which were divided in four age groups [48-59 months (n=19), 60-71 months (n= 24), 73-85 months (n= 24), and 86-96 months (n= 21)], b)16 children aged 75-95 months identified by the local Diagnosis, Assessment and Support Centre as having learning difficulties, and c)14 children aged 75-96 months which attended Elementary School for children with special needs. One–way analysis of variance (ANOVA) that was applied to the total PAT-PRE scores revealed that there were statistically significant differences among the motor performance of the above groups ($F=41,058$, $p<.001$). Post hoc comparisons using Sidak test followed, with alpha set at .05. According to the results, the non-disabled group of 86-96 months had the highest performance, followed by: a) the non-disabled of 73-85 months, b) children with learning difficulties, c) the group of 60-71 months, d) the group of 48-59 months and e) children with special needs. From the above results the construct validity of PAT-PRE battery is supported. As the administrative traits of the battery (short duration for test administration, inexpensive equipment, game like items) support its ecological validity (Zittel, 1994) and render it a very attractive and viable tool for the motor assessment of preschool –aged children, a further examination of the rest validity criteria is needed, so as the technical adequacy of the battery to be established.

References

Dunn, W. (1989). Validity. Physical and Occupational Therapy in Paediatrics, 9, 149-168.

Kambas, A, Aggeloussis, N. & Gavrilidou, Z. (2003). Democritus-Psychomotor Assessment Tool for Preschool Children- Unpublished User's manual. Komotini.

Zimmer, R. & Volkamer, M. (1987). Motoriktest für vier-bis sechsjährige Kinder. Manual. Winheim: Belz.

Zittel, L. (1994). Gross Motor Assessment of Preschool Children with Special Needs: Instrument Selection Considerations. Adapted Physical Activity Quarterly, 11, 245-260.

EFFECTS OF ISOKINETIC TRAINING USING SUBJECTIVE EFFORT TO REGULATE INTENSITY ON MUSCLE STRENGTH IMPROVEMENT

Onodera, K., Iwaoka, K., Yamaji, K.

University of Toyama, Japan

PURPOSE: The purpose of this study was to examine the effects of isokinetic training using subjective effort to regulate intensity on muscle strength improvement. METHODS: Sixteen healthy male subjects (age:47.9±5.7 yrs, height:168.0±4.5 cm, weight:67.8±8.2 kg) participated in muscle training program (three times a week for 6 weeks). In this study the integer scale from 0 to 10 (maximum) was adopted in evaluation of subjective effort and rating of perceived exertion. Subjects isokinetically trained the right and left quardriceps femoris keep-

ing constant of a given level of subjective effort for 30 repetitions using COMBIT-CB2 at an angular velocity of 60 deg.s-1. Subjects divided into three groups: one group (GI,N=5) trained at 10 level of subjective effort, a second group (GII,N=5) at 8 level and a third group (GIII,N=6) at 6 level. RESULTS: In training, muscle force decreased gradually with repetition in spite of maintaining the same level of subjective effort. However relative value to maximal work intensity kept constant at each point of repetition. Training induced increase in maximal peak torque of knee extension (left leg : GI, 152.0±27.7Nm to 174.5±6.5Nm, GII, 157.6±32.2Nm to 167.6±51.7Nm, GIII, 103.9±28.3Nm to 117.8±20.1Nm). Exponential regression line was indicated between subjective effort and exerted muscle force during the incremental test. Regression line shifted above according to muscle strength improvement after training, but it remained unchanged in case of relative muscle force to maximum (% of maximal force). CONCLUSIONS: Repetition maximum (RM) method for muscle training forced maximal effort to a person at the end of repetition. The results obtained in this study indicate that subjective effort is good index of muscle training intensity and also safe and effective means to muscle training for health.

Supported by Japanese MEXT Grant 16500400.

IS TRAINING ABLE TO INFLUENCE THE HEART RATE CIRCADIAN RHYTHM ?

La Torre, A., Roveda, E., Montaruli, A., Calogiuri, G., Carandente, F.

Institute of Physical Exercise, Health and Sport Activity, Italy

Introduction

Training can represent an important synchronizing factor that influence the circadian system. The physical exercise effect on HR circadian rhythm is of particular interest. We investigated the effect that physical exercise of different intensity and length, done at different time of the day, can have on the synchronization of HR circadian rhythm.

Materials and methods: Study 1 20 male endurance athletes (aged 20-25) carried out 2-hrs-daily training sessions at 75-85% of the HRmax for 5 consecutive days. Four different weekly training timetables (09-11;11-13; 16-18;18-20) were followed; each athlete trained in turn in each time slot for a week. In the fifth day of each week a 24hrs-HR-monitoring was carried out by the HR monitor (Polar S810). For all subjects four 24hrs-HR-monitoring were collected, one for each weekly training timetables.

Study 2 20 male subjects (aged 20-25), practising moderate physical activity, carried out 1-hour-daily training session at 50-60% of the HRmax for 3 consecutive days, in two different weekly training timetables (08-11;18-21). In the third day of both weeks a 24hrs-HR-monitoring was carried out. For every subject we collected three 24hrs-HR-monitorings, two for each training session time and one during a sedentary life day (basal).

Data were analysed by the single and mean cosinor methods; the HR population circadian rhythm was compared using the Hotelling Test. Data were analysed excluding the HR data recorded during training sessions and the 2 hours following the training session.

Results: Study 1 Rhythmometric analysis, carried out on 7 subjects who strictly observed the study protocol, revealed a statistically significant circadian rhythm for all monitorings.The mean cosinor, calculated grouping the HR monitorings with the same training session, demonstrated a statistically significant circadian rhythm in all 4 experimental sessions. The Hotelling Test showed statistically significant difference of HR achrophases between the 09-11 and 18-20 training sessions: the HR achrophase for training done between 18-20 is delayed approximately 3 hours compared to that one of training done between 9-11.

Study 2 Rhythmometric analysis, carried out on 14 subjects, revealed a statistically significant circadian rhythm for all monitorings. The mean cosinor demonstrated a statistically significant circadian rhythm in all 3 experimental sessions. HR achrophase for evening session shows a shift of approximately 1 hour compared to the basal condition nevertheless the Hotelling test showed no statistical differences in the different experimental sessions.

Discussion : An intense training program can modulate the HR temporal structure. Instead a moderate physical activity program seems to be insufficient to change the HR temporal structure.

References: Carandente F. - Int. Congr. of Appl. Chronobiol. and Chronomed., Antalya, Turkey, 44-45, 2005

Nelson W. - Chronobiologia 6, 305-323, 1979.

ANAEROBIC EXERCISE TESTS IN TAEKWON-DO ATHLETES: A COMPARISON OF AN INTERMITTENT ANAEROBIC TEST AND A 60-S BOSCO JUMP TEST

Vodicka, P., Heller, J.

Faculty of Physical Education and Sport, Charles University, Prague , Czech Republic

The most common anaerobic performance tests are of a constant nature (such as the Wingate test); however, many anaerobic activities such as martial arts fighting are of an intermittent nature. Therefore, the purpose of the study was to investigate and compare the results of the two anaerobic performance tests, an intermittent anaerobic cycle ergometer test (IAT) and 60 s Bosco jump test in elite male and female taekwondo (WTF) contestants.

A group of elite male (n= 31, age 17.6 +/- 2.7 (SD) years, body mass 68.5 +/- 6.5 kg) and female (n= 13, age 16.8 +/- 2.1 years, body mass 53.8 +/- 6.3 kg) taekwon-do athletes performed, the IAT and 60 s Bosco jump test in a randomised order, on the same day. The IAT (computerised cycle ergometry) consisted of 10 repetitions of 5 s all-out exercise loads (at a resistance load 6 W.kg-1 and 5 W.kg-1, for the males and females, respectively) separated by 30 s recovery breaks (Heller and Psotta, 2000). The main results of the IAT were: 5-s peak power (PP), mean power (MP) and/or total work (A, kJ), power decrease (W) and/or fatigue index (FI, % of PP). The second test, 60 s Bosco jump test (Vodicka and Heller, 2003) determined total work (AB, kJ), power decrease, and a theoretical peak power (PPB, W, defined as an intercept of linear dependence of work throughout the test on time, at a time equal zero). The values of PPB, 305 +/- 39 W in males PP were significantly related to the absolute values of PP in IAT (1002 +/- 114 W, r= 0.67, p<0.01) but were unrelated to relative values of PP in IAT (14.6 +/- 0.8 W.kg-1, r= 0.06, n.s.). In females, the values of PPB, 206 +/- 26 W were significantly related both to the absolute and relative values of PP in IAT (583 +/- 61 W, r= 0.87, p<0.01, and 10.8 +/- 0.5 W.kg-1, r= 0.63, p<0.01). The total work from the jump test (AB, 17.3 +/- 2.5 kJ in males and 11.3 +/- 1.4 kJ in females) was significantly (p<0.01) related to the A and/or MP values in the IAT (42.2 +/- 4.2 kJ, 844 +/- 85 W, r=0.85, in males, and 26.1 +/-2.8 kJ, 522 +/- 56 W, r= 0.66, in females, respectively). Regardless the relationships found in PP and total work, the power decrease and/or fatigue indices from the two tests were unrelated one another.

The results of the study had demonstrated that both the 60 s Bosco jump test and IAT may be good predictors of explosive strength (peak power) and general anaerobic capability (total work), regardless of different nature of these tests. On the other hand, power decrease and/or fatigue index in jumping and supramaximal cycling seems to be test-specific, and not a valid predictor of fatigability in taekwon-do athletes.

Heller J. & Psotta R. (2000) J. Sports Sciences, 18(7):513-514.
Vodicka P. & Heller J. (2003) ECSS 2003, Salzburg, pp.46-47.

SOFTWARE FOR REGISTER AND EVALUATION OF LOAD IN TRIATHLON

Kovar, K., Suchy, J.

Charles University, Faculty of Physical Education and Sport Prague, Czech Republic

Quality training records are an integral part of managing the training process. They facilitate the routine analysis of training, an evaluation of its effect, and operative changes in planning. The choice of appropriate parameters for the records, and the flawless processing of data on training and its use, have not been entirely resolved and run into a number of problems. The use of information technology to record and analyse a training programme can greatly simplify that.

This abstracts summarises the current level of knowledge on training records in the multi-endurance sports - triathlon. On the basis of research results, we have selected and theoretically justified training indicators suitable for the recording of the training process in the selected disciplines. Training indicators refer to programme intensity and specificity in relation to the competition programme. Work on this theme has required a systematic analysis of data, computer programming and processing, modelling and verification.

We have organised the selected training indicators into a theoretical model, facilitating their computer recording. On the basis of that model, as part of this dissertation we have designed and developed special software to process training records. The programme allows the data entered to be analysed and evaluated for the needs of planning training for triathlon.

RELATIONSHIP BETWEEN A NEW FUTSAL INTERMITTENT ENDURANCE TEST (FIET) AND REPEATED-SPRINT ABILITY IN PROFESSIONAL FUTSAL PLAYERS

Barbero-Álvarez, J.C., Miladi, I., Ahmaidi, S.

Universidad de Granada y Faculté de STAPS, Amiens, Spain

To perform at a high level, the futsal players need a well-developed capacity to perform high intensity activities such as cruising and sprinting, as well as the capacity to recover properly during low-intensity activities such as walking and jogging over different periods. For this reason, the physiological requirements of futsal are reported to be met by both aerobic and anaerobic metabolism.

In futsal performance is related to the athlete's ability to repeatedly perform intense exercise. Therefore, an important fitness component of these sports is what has been termed repeated-sprint ability (RSA). Aerobic fitness (i.e., VO2max) has been often suggested to be an important determinant of RSA, by means of speeding up the recovery processes. A significant correlation was observed between Futsal intermittent endurance test (FIET) performance and aerobic fitness (see another abstract). This study aims to investigate the influence of an individual's FIET performance on RSA in professional futsal players.

All subjects (n=15) were competitive, professional team sport male athletes in futsal (mean ± sd: age 24.2 ± 4.9 y, height 186.0 ± 0.18 cm, mass 86.2 ± 13.8 kg). The RSA test used in the present study comprised 8, 25-m running sprints separated by 25-s of recovery. Total sprint time (TST) and fatigue index (FI) were calculated for the RSA test. The correlation coefficients were determined and tested for significance using Pearson's product–moment test.

The mean results for the FIET and RSA showed a significant inverse correlation between FIET performance and total sprint time in the RSA test ($r = -0.718$, $P = 0.029$) whereas this was not the case for the fatigue index ($r = 0.30$, $P = 0.379$).

The total time is considered as a index of the anaerobic work capacity performance (Dawson et al., 1993), therefore these results reporting a strong correlation between the FIET performance and the repeated sprint ability. However, the FIET score was not related to sprint decrements (i.e., fatigue index). In accordance with previous studies (e.g., Bishop and Spencer. 2004), this suggest that factors in addition to aerobic fitness are likely to be important for the recovery of muscular power output during repeated sprints. In conclusion, the Futsal intermittent endurance test is a field test who provides information not only on fitness aerobic of the player, but also with his ability to carry out a work anaerobic or an intermittent work of maximum intensity in concordance with the physiological requirements of futsal.

HEART RATE MONITORING DURING OFFICIAL SOCCER MATCHES

Stanganelli, L.C., Eliotério, E.C., Bortolossi de Souza, O., Frisselli, A., Dourado, A.C.

State University of Londrina, Parana State, Brazil

Soccer is an open-skill interval activity characterized by high unpredictability inherent to individual and team behavior between matches and individual players (EKBLOM, 1994). Considering this model of sport, it is important to use the heart rate (HR) based methods to monitor intensity since there are few studies regarding their application in soccer official matches. Thus, to assess and to analyze the HR during a match is important because it could evaluate the internal training load induced by this situation and an objective way to prescribe exercise intensity in soccer. The main purpose of this study was to monitor the HR of the under-20 players of a professional team during two official matches of the Parana State championship – Brazil. The sample was composed by 10 athletes from the Londrina Junior Team aging from 17 to 20 years old. A short-range radio telemetry system "team system" (Polar Electro Oy, Finland) for monitoring HR was used voluntarily by the subjects simultaneously during two official matches. Average temperature was 32°C e 31°C for matches 1 and 2, respectively and humidity ranged from 41% to 45%. Both matches started at 3 and 3:30 pm, respectively. The results showed that maximal HR ranged from 190 to 210 bpm (mean: 202 bpm). In general, the average intensity of the two matches was 81% of HRmax. According to the positional roles, the intensities (%HRmax) were: full back, 83%; forwards, 82%; midfielders, 81% and defenders (right and left), 80%. Related to the absolute values and using the classification for the intensity zones presented by GOMES (2002) it was possible to verify that the HR remained above 160 bpm as following: midfielders, 69%; forwards, 64%; full back, 60% and defenders, 58%. In conclusion, it could be seen that intensity during the two matches were above 80% of HRmax for all positional roles but the midfielders spent more time at higher intensities compared to the others positions. These data are according to BANGSBO, 1994 who stated that the average intensity for a soccer player in a 90 min match is close to 80-90% of HRmax. Also, these results could be important for those professionals who are responsible for prescribing the training loads of the soccer teams based on scientific information about the intensity induced by a match.

TRAINING ADAPTATION ON JUMP CAPACITY OF ELITE VOLLEYBALL PLAYERS IN THREE DIFFERENT MACROCYCLES

Stanganelli, L.C., Dourado, A.C., Oncken, P., Mançan, S.

State University of Londrina, Parana State, Brazil

The main objectives of the present study were to verify periodically the training adaptations on jump capacity of the under-19 Brazilian volleyball team during the preparation for the world championships of 2001, 2003 and 2005 and to compare the results among these three different macrocyles aiming to have reference values for training adaptations on volleyball players after a systematic period of training. The athletes were submitted to the squat jump, countermovement jump and height and vertical jump for specific tests for spike and block. A Pre test (1st week) and a Post test at the 18th week (2001), 14th week (2003) and 17th week (2005) was applied for both teams. The adaptations were expressed as percent changes on the performance of four different types of tests and calculated between these two moments. The Post test toke place just before the teams departed from Brazil to the countries where the championships happened. The sample was composed of 36 athletes, divided in 11 for the 2001 (age: 18,0±0,5 years; height: 197,1±3,9 cm; weight: 87,8±6,3 kg); 13 for the 2003 (age: 17,90±0,4 years; height: 197,6±3,9 cm; weight: 86,2±6,1 kg) and 12 for 2005 (age: 17,7±0,7 years; height: 197,4±8,0 cm; weight: 88,9±12,1 kg). Descriptive statistics were computed and the ANOVA was utilized to test differences among all groups of means with the Tukey HSD follow-up test as a pos hoc. The significance level was set at p0.05. The results showed that the mean improvement for the three groups in the squat jump and in the countermovement jump was 2.4±6.8% and 3.1±8.0%, respectively although these adaptations were not statistically significant. On the other hand, the height of spike reach showed significant adaptation among all groups (2001: 2.9±0.9%; 2003: 4.2±1.4%; 2005: 1.6±1.1% at p=0.0000) while the vertical jump during spike demonstrated changes only between the 2003 (19.5±7.6%) and 2005 (9.6±8.2%) groups at p=0.0073. The result of the test for the height of block reach also revealed positive and significant adaptations among the 2001 (3.47±1.4%) and the 2003 groups (3.83±1.8%) when compared to the 2005 group (0.9±1.17%) at p=0.0000. The same happened when analyzing the vertical jump of the block which presented significant improvement of the performance in the groups of 2001 (20.6±7.7%) and 2003 (20.0±4.9%) when compared to the 2005 group (3.1±6.6%) at p=0.0000. All the evaluated variables demonstrated positive adaptations during the macrocycles and the three groups of athletes showed different responses to the training stimulus which could be normal considering the individual characteristics and the training loads applied. Besides, it is still difficult to point out the main reasons for the verified responses to the systematic volleyball training and more data should be collected regularly aiming to determine a profile of these adaptations in such a young group of athletes.

OXYGEN UPTAKE RESPONSE TO 800-M AND 1500-M RUNNING RACES

Hanon , C., Thomas, C., Levêque, J.-M., Vivier, L.

INSEP, France

The present study was designed to determine the profile of VO2 response during an 800-m and a 1500-m races on an outdoor track in well-trained middle-distance runners. We hypothesised that maximal cardio-respiratory stress assessed by maximal oxygen uptake would be reached by the end of the races due to the high running intensity occurring usually at the beginning of races as observed by Gajer at al (2001).

On an outdoor track, 16 trained middle-distance male runners first performed an incremental test to determine VO2max (VO2maxIncr) and then at least two days later, a supra-maximal 800-m (n=5) or 1500-m (n=11) running test, realized on the respect of the competition strategy. VO2 response was measured from the start to the end of the exercise with the use of a miniaturised telemetric gas exchange system (Cosmed K4). Blood samples were taken from the earlobe before, just after and 3, 5, 7 and 10 min after the end of the supra-maximal exercise.

The mean exercise relative intensity of the 800-m and 1500-m was respectively 120,8 + 3,4% (mean ± SD) and 107,6 + 2 %VO2maxIncr. As observed in competition, the velocity at the onset of the races were systematically greater than the mean velocity. At the end of the races, the velocity decreased for all the subjects (800-m) and for a part of the subjects (1500-m).

VO2maxIncr was reached by all the subjects at 45 + 11 s (i.e., 316 ± 75 m), and 78 + 17 s (i.e., 463.63 + 67.4m) after the onset of the 800-m and 1500-m races, respectively. During the 800-m races, VO2max was maintained during 33 ± 6 s (i.e., 219 ± 41 m). An unexpected significant decrease in VO2 (24.1 ± 7.0%; $p<0.05$) was observed in all subjects during the final 38 ± 17 s (i.e., the last 265 ± 104 m).

During 1500-m races after reaching a value of VO2 significantly greater than VO2maxIncr (VO2Peak1500), and although the velocity for all subjects was at any time of the races above v-VO2maxIncr, VO2 remained stable during the following 800-m in a value equal to 93 + 3,5% of VO2peak1500. and to VO2maxIncr and decreased significantly from 1200-m to 1500-m.

On the two distances, the slowing down period of VO2 is significantly related to the velocity decrease ($p<0.05$). Furthermore, the decrease in VO2 was concomitant with a decrease in the tidal volume (VT) for all the athletes ($p<0.05$ and $p<0.0001$ on 800 and 1500-m respectively).

Unlike the results observed on treadmill running at constant velocity (Spencer et Gastin, 2001 ; Heugas et al, Draper et al), all the subjects of these studies reached VO2max.

We can conclude 1) that the race profile used in middle-distance competition (fast start followed by even pacing) is not without any consequence on metabolic parameters as already shown by Bishop et al (2002) with kayak athletes 2) VO2max can be reached during supra-maximal exercises of 2 to 4 min 3) an unexpected significant decrease in VO2 was observed at the end of the two race distances.

REPEATABILITY OF THE STABILOMETRIC ASSESSMENT OF BODY SWAY

Galante, D., Shirai, Y.F., Pallavera, A., Ferrario, V.F., Sforza, C.

Università di Milano, Italy

Introduction - Small amounts of sway can be seen during the standing position in human beings. This position involves both voluntary movements and postural reflexes that compensate for minor oscillations of the body. The eyes, the vestibular receptors, and a combination of cutaneous and kinesthetic mechanoreceptors embedded in the skin surface, muscles, joints and tendons, provide the input to the central nervous system to determine such corrections (1). Some influence is also claimed to be provided by oral proprioceptors (2, 3). Within clinical contexts, body sway is usually measured using stabilometry, and the modification of the position of the centre of foot pressure (COP) on a force plate for a period of time is assessed (1, 2). The COP is the centre of gravity of the vertical forces that act on a support surface. Literature reports on the intra-day and day-to-day repeatability of COP variations are scanty.

Methods - Five men (age 22-29 y, standing height 172-188 cm, body weight 60-78 kg) and five women (age 22-44 y, standing height 160-170 cm, body weight 53-60 kg), were assessed. Body sway was assessed either with open (EO, looking in a mirror) or closed eyes (EC), in

the morning (9:00 AM) and afternoon (2:00 PM) of two week days. A computerized platform (Lizard, Lizarmed, Como, Italy) with two separate left- and right-side sensors was used. Data collection begun approximately 10 s after the correct vision (eyes open or closed) condition had been assumed by the subject, and lasted for 30 s for each test. The variations of COP were analyzed through bivariate analysis, and the area of the 90% standard ellipse was computed. The velocity of COP oscillation was also measured. Data collected in the four repetitions were analyzed by calculating intraclass correlation coefficients (ICC).

Results - When considering all four repetitions, COP velocity was more repeatable than the area of the 90% standard ellipse, and the closed eyes condition was more repeatable than the open eyes condition (ICC area EO 0.342, EC 0.443; velocity EO 0.417, EC 0.626). Intra-day repeatability appeared larger in the first day in most occasions (ICC area EO, day 1: 0.22, day 2: 0.471; EC, day 1: 0.579, day 2: 0.413; velocity EO, day 1: 0.627, day 2: 0.433; EC, day 1: 0.744, day 2: 0.66). Day-to-day repeatability appeared larger in the afternoon than in the morning (ICC area EO, AM: 0.005, PM: 0.431; EC, AM: 0.308, PM: 0.59; velocity EO, AM: 0.069, PM: 0.644; EC, AM: 0.546, PM: 0.573).

Conclusions - Overall, repeatability in the stabilometric assessment of body sway was limited, and further assessments are warranted within each clinical contest: a particular care should be given to the experimental conditions, and the timing of measurements. The better intra-day repeatability of COP velocity vs area is in accord with previous investigations (3).

1. J Visual Imp Blind 2000;94:97-107

2. NeuroSci Lett 2004;356:228-30

3. NeuroSci Lett 2006;392:140-4.

CONTINUOUS VERSUS INTERVAL AEROBIC TRAINING IN 8-11 YEAR-OLD CHILDREN

Baquet, G., Thevenet, D., Gamelin, F.-X., Nourry, C., Nottin, S., van Praagh, E., Berthoin, S.

Faculté des Sciences du Sport et de l'Education Physique, Université Lille, France

Introduction: Several studies have demonstrated that both well-designed continuous and intermittent training protocols induced significant aerobic fitness improvement in prepubertal children (Baquet et al., 2003). However, to our knowledge, few studies have compared simultaneously both training modalities on a same population. The aim of the present study was, therefore, to compare the effects of a continuous and an intermittent training on children aerobic performances. Methods: 65 children (9.6±1.0 years) were divided into an intermittent training group (ITG, 11 girls and 12 boys), a continuous training group (CTG, 13 girls and 10 boys), and a control group (CG, 9 girls and 10 boys). During 7 weeks, ITG and CTG followed three 30-min running sessions per week. Before and after training, they underwent a maximal graded test in order to determine Maximal Aerobic velocity (MAV), with continuous heart rate monitoring (HR, Polar Accurex+, Finland). Intermittent training consisted in short intermittent runs with exercise/recovery sequences lasting 5/15s, 10/10s, 15/10s, 20s/20s and 30/30s. Intensities were set from 100 to 190% of MAV. For continuous training sessions, exercise/recovery sequences lasted 4*6', 3*8', 2*10', 2*12', 1*15', 1*18', 1*20' with 5' recovery between each set. Intensity was set from 80 to 85% of MAV. Running intensity was gradually increased in proportion of the training sessions. All groups participated in regular physical education classes. Training effects were analysed with a two way ANOVA (group x time). When necessary, Tukey post-hoc test was used to confirm data differences. Statistical significance was set at $p < 0.05$. Results: At baseline, no significant group difference occured between values for MAV and HRmax. Any group by time interaction was found for HRmax values. HRmax values were (pre- vs post-test) 201±9 vs 200±7 bpm for CTG, 202±6 vs 201±6 bpm for ITG, and 203±9 vs 201±7 bpm for CG. Analyzing pre- and post-test MAV values revealed a group by time interaction ($p<0.001$). After training, MAV was significantly ($p<0.001$) improved in CTG (10.7±1.1 vs 11.6±1.1 km.h-1), ITG (11.3 vs 12.1±0.7 km.h-1, $p<0.001$), while no difference occurred for the CG (10.9±1.4 vs 10.9±1.4 km.h-1). Discussion: Our results demonstrated that both continuous and intermittent running sessions induced significant increase of MAV. They were similar to those of McManus et al. (2005) who reported similar improvement in aerobic power in children performing continuous or intermittent cycling exercises. Therefore, when adequate combinations of intensity/duration exercises are offered to children, many modalities of exercises can successfully be used to increase their aerobic fitness.

References

Baquet G et al. (2003) Endurance training and aerobic fitness in young people. Sports Med 15:1127-1145

McManus A et al. (2005) Improving aerobic power in primary school boys : a comparison of continuous and interval training. Int J Sports Med 26 :1-6.

INFLUENCE OF RECOVERY INTENSITY ON THE TOTAL OXYGEN UPTAKE DURING A SINGLE INTERMITTENT SESSION IN YOUNG ATHLETES

Thevenet, D., Leclair, E., Tardieu-Berger, M., Prioux, J.

UFR STAPS , France

Introduction: It has been established that the efficiency of an exercise for the development of the aerobic system, is greatest when it allows subjects to maintain a long time at maximal oxygen uptake (tVO2max) (Billat et al., 2000). However, tVO2max is not the only significant parameter accounting for the effectiveness of an exercise. In fact, the total oxygen uptake (TotO2) during an exercise will account for the impact of an exercise on the aerobic system of a subject. In other words, the more an exercise will request the aerobic system, the more the total oxygen uptake during the exercise will be significant. The aim of this study was to analyze, during a short supramaximal intermittent exercise model (30s-30s), the effects of the recovery intensity on TotO2 in young athletes. Methods: 8 endurance trained males (15.88 years(0.48)) performed 4 field-tests until exhaustion: an incremental test to determine their VO2max (57.42 ml.min-1.kg-1(2.17)) and MAV (17.88 km.h-1(0.16)), then in a randomized order, 3 intermittent exercises consisting in repeating 30s runs at 105% of MAV alternating with 30s active recovery: 1/ 50% of MAV (IE50), 2/ velocity (vLT) associated with second lactate threshold (LT-IELT) and 3/ velocity (vLT-d) ranging between 50% of MAV and LT (IELT-d). The delta (d) is the velocity associated with LT minus half of the difference between vLT and 50% of MAV (For a LT corresponding to 75% of MAV: vLT-d=62.5% of VMA:[75-[(75-50)/2]]). We calculated the TotO2 in absolute value (ml.kg-1) and in relative value i.e. related to covered distance and mean intensity (ml.kg-1.km-1.km.h-1). After, we determined the TotO2 during the first part of IE50 (IE501) and IELT-d (IELT-d1) i.e. while basing ourselves on IELT total exercise duration (tlim-tlimIEP501 and tlim IELT-d1=tlim IELT). Results: tlim was significantly longer for IE50 than IELT ($p<0.001$) and IELT-d ($p<0.01$) and it was significantly longer for IELT-d than IELT ($p<0.05$). TotO2 in absolute and relative values were significantly lower during IELT compared with IE50 ($p<0.001$) and IELT-d ($p<0.05$), and they were significantly higher during IE50 compared with IELT-d ($p<0.001$).The same results were observed for TotO2 determined as a function of IELT tlim. Discussion: Our results highlight that TotO2 is more significant during IE50 than during IELT or IELT-d. It can be explained by the fact that oxygen uptake could depend on muscle structure. Thus, when more and more

motor units are recruited at higher speeds, the importance of Type II fibers increases together with anaerobic energy metabolism (Kyröläinen et al., 2003), that is why we could think that TotO2 decreases while recovery running speed increases. Thus, it seems that recovery at 50% of MAV could lead to a higher aerobic system solicitation because of a longer exercise duration and a more higher TotO2.

References

Billat VL et al. (2000). Eur J Appl Physiol 8:188-96.

Kyröläinen et al. (2003). Med Sci Sports Exerc 35(1):45-9.

PLASMA GLUCOSE, ENERGY EXPENDITURE, VO2MAX AND POWER MARKERS AFTER A RUNNING-BASED ANAEROBIC SPRINT TEST (RAST) IN FEMALE COLLEGE STUDENTS

Ghanbari-Niaki, A., Fathi, R., Ghorbanalizadeh-Ghazian, F.

Tarbiat Modares Universit (TMU), Iran

Anaerobic power and capacity are two key physical variables in power and sprit sports. It seems that Wingate anaerobic test is more common for assessment of the anaerobic power and capacity. However , there is another less known field anaerobic test for this matter named Running-Based anaerobic test (RAST) which is reliable for anaerobic power and capacity measurement. The purpose of this study was to assess plasma glucose, HRmax, VO2 max , and maximum ,average power and fatigue index, and energy expenditure after two consecutive RAST in female college students. Twenty-six female physical education students (age 22.34±0.3 year, 160.2 ± .84cm,55.65 ± 1.6 kg, 21.62 ± 0.48 in BMI, and VO2 max 36.3 ± 3ml/kg/min-1)(Shomal University Amol , Mazandarn) volunteer to participated in the present study. Subjects were asked two RAST sparated with 1 minute rest. A paired T student was used for analysis Plasma glucose concentration significantly (P<0.01) was higher the end of test. HRmax, VO2max, and energy expenditure were significantly (P,0.01) increased after second test. A significant (P,0.01) reduction in Power max and Power Avawere observed. The present study provide the first data about glucose response and VOmax , and HRmax and energy expenditure to RAST. RAST can be used as a stimulus for some exercise-induce adaptation for power and sprint-base sports.

THE SIGNS OF STRAIN AND DISABILITY CARDIOVASCULAR ADAPTATION TO THE TRAINING LOADS IN ELITE ATHLETES

Yashchenko, A.

State scientific research institute of physical culture and sport, Ukraine

It is general accepted that the most possibilities for realization of functional reserves of the athletes and for increasing their special workability are depending on improving the exercise programmes. In such case stays not enough appreciate the functional fitness of the athletes. Meanwhile the effectiveness of the training process, especially in modern sport conditions, considerably depends namely from the adaptation of active functional systems in the athletes to the training and performance loads.

Complex and regularly control of the athletes' functional fitness provides with double connection between the coach and the athletes, as also can assist to increasing the special workability of last one. Detail knowledge on the character and intensity the signs of functional system adaptation or on the appearance the strain's signs of adaptation are the crucial with regard to the increasing of the special workability of the athlete.

The purpose of this presentation is to review the main signs of cardiovascular system adaptation's strain to training loads with taking into account the direction.

It was shown that initial sings of strain adaptation in some functional systems are reversible [1]. Using the regular control for functional fitness of the athletes, it is possible to correct as the volume and intensity, as also the character of the training loads for control of the effectiveness of these measure. The main signs of adaptive strains or disturbances in systemic blood circulation are increasing the heart rate during rest conditions above 80.0 b•min-1, systolic arterial pressure (APs) above 140 mm Hg; diastolic arterial pressure (APd) above 95 mm Hg; decrease the cardiac index (CI) under 2.0 l•min•m-2; increase the total peripheral resistance of the vessels more than 2500 din•s•sm-5.

As concern the signs of the strain in peripheral circulation adaptation they are for brain blood circulation following: asymmetry of the pair hemodynamic parameters above 25 %; increase the vascular tone of arteriole and venule above 90 %; appearance of the signs of venous outflow disability and diminishing of the blood supply in the studied vascular region. As concern the muscle circulation it is necessary to stress that some of signs, with the strain adaptive shifts are similar to sings of disability for brain blood circulation, only one peculiarity of these shifts is the decreasing the vascular tone of arteriole and venule under 25 - 30 %, it is necessary to add that such decreasing as usual manifests only on the one side of extremity.

Reference:

1. Alla Yanshchenko, Michailov A.V. Dynamics of brain blood circulation in elite weightlifters annual preparation//6th Annual Congress of the Eurepean College of Sport Science. – Cologne. – 24-28 July. - 2001. – P. 930.

WAYS OF SOLUTIONS IN THE FORCE-SPEED RELATION IN THE TRANING OF JUNIORS RUNNERS – THE EVENT: 100 M HURDLES

Mihailescu, L., Mihailescu, N., Mihailescu, L.

University of Pitesti, Romania

In sprint runs, hurdles, the athlete defeats the force of resistance of his own body; he develops the suitable speed for defeating those forces of resistance and tries to maintain the index of the maximum speed during the distance of the contest.

The classic conception concerning the development of the muscular force aims at the rise of the mechanical force by using the weight lifting, which leads to a reduction of the speed according to the Hill relation.

The purpose of this paper is to validate the truth of this hypothesis which laid at the basis of this research: training using the system of simulation of condition II. ERGOSIM can establish the growth of the force at maximum and minimum speed required in events as hurdles sprint.

The main method of research was pedagogical experienced; those who took part in this experiment were 12 juniors II (16-17 years old) hurdles runners.

As a work experience in training of forces at maximum and minimum speed it was used the system of simulation of condition II. ERGOSIM technology worked out by the National Institute of Research, Bucharest.

Those exercises used on the system of simulation were: drives, attack, trailer, the foot extension.

If the speed and the charge can be shaped, than the exercise can be performed with the characteristics selected by the coach.

During the experiment one can establish: mechanic work, the time work, length, active power and speed, the movement of the set upon foot at a speed of 6.5 m/s.

The results of the experiment confirm the hypothesis of work: the sportswomen improved their strength simultaneous with the technical improvement of their own exercises with feed-back reactions offered by the work technology.

- The training method based on the ERGOSIM system of simulation : emphasises the link between speed – strength during the hurdles runner's training
- The perfect synchronization between force and speed leads to best results concerning both the physical training and the competition.

COMPARISON BETWEEN CONTINUOUS AND INTERMITTENT TRAINING IN CHILDREN 8-11 YEARS OLD CHILDREN

Baquet, G., Dupont, G., van Praagh, E., Berthoin, S.

Faculty of Sport Sciences and Physical Education, University of Lille, France

Introduction: The knowledge of time to exhaustion (TTE) is an easy way to indicate which exercise duration is acceptable for an individual. However, it is not possible to measure multiple TTE. An alternative is to calculate general performance models based on the linear relationships between exercise distance to exhaustion (DTE) and TTE (convenient: critical velocity concept). The purpose of this study was to compare running performances obtained either by continuous or short intermittent high-intensity running exercises, and to apply the critical velocity concept on a prepubescent children population. Methods: Eleven 8 to 11-year-old children underwent a maximal graded field test to determine peak oxygen uptake (peakVO2, Cosmed K4b2, Italy) and maximal aerobic velocity (MAV), three continuous runs (90%, 100%, and 110% of MAV) and three intermittent runs (120%, 130%, and 140% of MAV) until exhaustion. Intermittent exercises consisted of repeated 15-s runs separated by a 15-s passive recovery. For continuous and intermittent exercises, linear DTE versus TTE relationships were calculated to determine continuous (CVc) and intermittent (CVi) critical velocities. Result: Values for peakVO2, and MAV were 45.8±5.3 ml.kg-1.min-1 and 10.5±1.0 km.h-1, respectively. Mean continuous TTE were 551±173s, 278±93s, 137±38s at 90%, 100%, and 110% of MAV, respectively. Mean intermittent TTE were 421±121s, 233±56s, 136±34s at 110%, 120%, and 130% of MAV, respectively. A significant relationship was found between mean DTE and TTE for continuous ($r^2=0.99$, $p<0.05$) and intermittent ($r^2=0.99$, $p<0.05$) exercises. Mean values for CVc and CVi were 9.0±1.0 km.h-1 (85.5±3.8 %MAV) and 11.4±1.2 km.h-1 (108.0±6.1 %MAV), respectively. A significant relationship ($r^2=0.86$, $p<0.001$) was noticed between CVc and CVi. Significant relationships were found between peakVO2 and both CVc ($r^2=0.60$, $p<0.01$) and CVi ($r^2=0.47$, $p<0.05$). Discussion: In prepubertal children a linear relationship was observed between DTE and TTE for 15s/15s intermittent exercises. PeakVO2 was significantly correlated to CVc, and to a lower extend with CVi, suggesting that this parameter is an index of aerobic fitness. Continuous aerobic performances are mainly determined by peakVO2, energy cost of running, or velocity at ventilatory/lactate thresholds. Additional factors such as a faster adjustment of energy production to energy requirement at the onset of exercises and a faster recovery may influence intermittent performances, and explain the lower coefficients of determination observed between VO2peak and CVi than between peakVO2 and CVc. In conclusion this study provides original data on children's intermittent performances and shows that the "critical velocity" concept can successfully be applied to children's intermittent performances. Moreover, it is of practical interest that the intermittent exercise duration (repetition of 15-s runs) can be adapted to the abilities of the child.

A STUDY OF AN ELITE BACKSTROKE SWIMMER WHO MADE RAPID PROGRESS

Yoshimura, Y., Tanaka, T., Oishi, K., Yasukawa, M., Matsuo, A.

Chuo University, Japan

A speed meter that measures a subject's moving velocity by pulling a fine wire over a generator (Maglischo, 2003) for a distance of 25 m was developed for use with competitive swimmers. In our previous study, the authors used the speed meter to check for skill differences between competitive breaststroke swimmers of international achievement and collegiate breaststroke swimmers who had not reached national or international levels. The results showed that this method was useful for identifying differences in skill between the two groups of swimmers. In this study, the authors used the speed meter to determine skill changes for a male collegiate backstroke swimmer who made very rapid progress over the course of one year. The subject improved 1.38sec for 200m backstroke swimming (an improvement about 1.16%) within 12 months. A computerized video analysis of his 200m backstroke races both before (120.17 sec) and after improvement (118.79 sec) revealed that the primary reason for his reduced time was an improvement in his underwater dolphin kicking. The speed meter was also used to record his intracyclic velocity changes during a 25m maximum effort backstroke swim which included approximately 12 m of underwater dolphin kicking. Speed meter measurements were made before, and after the swimmer improved his time for the 200m backstroke. The speed meter velocity curves indicated that his mean velocity was significantly greater during underwater dolphin kicking after the time improvement took place (Wilcoxon rank sum test, $p=0.02518$). Before and after improvement velocity curves for both the up-kicking and down-kicking of one complete dolphin kicking cycle were compared. It was concluded that the down-kicking was the most improved portion of the dolphin kicking cycle. The mean velocity of the up-kicking before improvement was similar to that after improvement (Wilcoxon rank sum test, $p=0.05958$). However, the mean velocity of the down-kicking after improvement was significantly higher than before improvement (Wilcoxon rank sum test, $p=0.00025$). These results suggested that improved down-kicking during the underwater dolphin kicking was primarily responsible for this swimmer's improved performance.

CAFFEINE HAS A TRIVIAL EFFECT ON 5 KM RUNNING PERFORMANCE

O'Rourke, M., O'Brien, B., Knez, W., Paton C.

University of Ballarat, Wintec, Australia

Purpose The purpose of this study was to investigate whether caffeine ingestion improved 5 km running time trial performance in endurance and recreational athletes. Methods 15 endurance trained and 15 recreational athletes consumed either 5 mg.kg-1 of caffeine (No Doz) or placebo approximately one hour prior to performing a 5 km time trial on a 400 metre running track in a double blind randomized cross-over study. Results Data is reported as mean ± standard deviation. The endurance trained group completed the 5 km time trial in 1047 ± 69 seconds in the caffeine treatment and in 1058 ± 68 seconds in the placebo treatment. The recreational athlete group com-

pleted the 5 km time trial in 1286 ± 86 seconds the caffeine treatment and in 1298 ± 84 seconds in the placebo treatment The improvement in 5 km time trial performance in the caffeine treatment was statistically significant for both the endurance and recreational athlete groups ($p < 0.05$). Conclusion Our results show that caffeine ingestion will improve 5 km running time trial performance by approximately 12.5 s in endurance trained and recreational athletes. However, the improvement in running performance attributed to caffeine is similar to the re-test error of 1 and 1.4% for the endurance trained and recreational athlete groups. Therefore caffeine only has a trivial effect on 5 km running performance.

A META-ANALYSIS OF SINGLE-SET VS. MULTIPLE-SET-TRAINING

Fröhlich, M., Gießing, J.

University of Saarland, Germany

Introduction: Single-set training (SST) has gained popularity as an alternative training method to multiple-set training (MST). Proponents of SST point out that SST produces similar results as MST but requires less much training time. However, many trainees, especially those who compete on an elite level, still apply MST. Methods: 52 primary studies with a total of 1934 subjects were analysed according to an open a priori coding scheme. The meta-analysis consisted of a descriptive analysis of all 52 studies, looking at several aspects of testing and training methods, specifications concerning methods and evaluation of each primary study as well as an analysis of the conclusions drawn by the authors. 19 of the 52 reviewed studies presented enough data to calculate the effect size (ES) for the factor "increase in 1-RM" which made it possible to compare the effectiveness of SST to that of MST. Results: 75% of the primary studies contained information concerning training parameters. Intensity ranged from 40 to 90 % of 1-RM, however, no study contained explicit information concerning which degree of training intensity was applied. Total training sessions averaged 42.0 +/- 27.8 over a period of 14.9 +/- 9.2 weeks. 2.8 +/- 0.7 training sessions per week were performed. 75% of the primary studies presented information on the testing procedure used. Although MST showed an insignificant advantage of efficiency of 61.4 %, there were no consistent significant differences between SST (ES = 0.70 +/- 0.69) and MST (ES = 1.13 +/- 1.06) ($t(1, 26) = -1.27$; $p = 0.21$). No significant differences (main effect) were found for the factors "number of subjects" (more or fewer than 30 subjects) ($F(1, 24) = 1.38$; $p = 0.25$) and "age" (younger or older than 22 years) ($F(1, 20) = 0.03$; $p = 0.86$). A significant difference (main effect) between SST and MST was found for the criteria "trained/untrained subjects" ($F(1, 24) = 12.88$; $p < 0.01$). When periodization was applied, the following results were found: a) main effect number of sets ($F(1, 24) = 1.63$; $p = 0.21$); b) main effect periodization ($F(1, 24) = 2.03$; $p = 0.17$) and c) interaction ($F(1, 24) = 0.22$; $p = 0.64$). Discussion and conclusion: The majority of the primary studies favour MST (cf. Fröhlich in press). Studies which favour SST show similar but not superior improvements of 1-RM-strength. Although there is a lack of information concerning the factor "training intensity" in the studies reviewed, the results of this meta-analysis imply that SST appears to be an appropriate method for untrained persons, recreational athletes or those whose primary goal is improving their health whereas MST appears to be more appropriate for experienced athletes in general and elite competitive athletes in particular.

Literature:

Fröhlich, M. (in press). Zur Effizienz des Einsatz- vs. Mehrsatz-Trainings. Eine metaanalytische Betrachtung. Sportwissenschaft.

THE AEROBIC POWER IN RELATION TO SUSTAINING OF HIGH TRAINING LOADS IN YOUNG GYMNASTICS

Sawczyn, S., Zasada, M.

Academy of Physical Education and Sport, Gdansk, Poland, Poland

Introduction. It is known that maintenance of short-term, intense exercise as it proper for gymnastic exercises relies on high rate of ATP regeneration, an increase glycolytic flux, and production and accumulation of metabolites. But recovery from bouts of such exercise as it takes place in gymnastic training session may be related to aerobic capacities. We supposed that aerobic power of gymnasts may agent of training stability. Study of the level of aerobic power in relation to survivability of training loads in the best young gymnastics was the purpose of the research.

Methods. Twenty male 13-17 years old gymnasts performed test of maximal oxygen uptake (VO2 max) in incremental test protocol and 30 s anaerobic tests. Monitoring of training loads by S. Sawczyn (2000) and sports results stability (CV) has been made for one year before measurements. The comparison was made for the best gymnasts (group 1, n=7) and remaining part of young athletes (group 2, n=13).

Results. Results showed that calculation of VO2 max (kg body mass) has shown presence of the tendency to their decrease with age in-group 2. The analysis has shown a large range of oscillations of personal levels of VO2 max - from 39,5 up to 63,9 ml.min-1·kg-1. The range of oscillations for the «perspective» gymnasts was smaller - 46,3 - 63,9 ml.min-1·kg-1. The mean value of VO2 max in-group 1 was significantly more than in-group 2 ($p<0.05$). The analysis for all gymnasts' shows significant interrelation of VO2 max with a volume of training loads ($r=0,60$; $p < 0.05$) and the tendency interrelation with sport results stability ($r=0.41$; $p<0.1$). The interrelation of aerobic and anaerobic power for the young «perspective» gymnasts only was significant ($r=0,65$; $p<0.05$).

Conclusion. The results confirm the suggestion about a role of aerobic power for successful process of training of young gymnasts. It was connected with the main role of aerobic power in overall physical working capacity and in recovery possibilities. In this connection there is a necessity taking into account of the standards of general working capacity for different stages of long-term preparation of young gymnasts. The data can indirectly testify to the relevant role of interdependent development anaerobic and aerobic power, as a factor of increase of general special training endurance capabilities.

Sawczyn S (2000). Training loads of young gymnasts in the process of many-years preparation, Gdansk;358.

INFLUENCE OF RESPIRATORY TRAINING ON ATHLETES' CARDIORESPIRATORY FAST KINETICS AND SENSITIVITY TO CO2 AT FATIGUE INDUCED BY EXHAUSTIVE TRAINING SESSIONS

Tomiak, T., Mishchenko, V.

Academy of Physical Education and Sport, Gdansk, Poland, Poland

Increased (in relation to volume of lung ventilating) the activity of respiratory muscles in some cases induce increase of cardiorespiratory (CR) reactivity (Mishchenko V et al, 2004). It may be related to CR response to exercises in training session. There is unknown the effects of respiratory training on CR reactivity changes at fatigue induced high training loads. The purpose was to determine the influence of respiratory muscle training (RMT) on CR sensitivity to hypercapnia and fast kinetics in endurance athletes at fatigue induced several exhaustive training sessions.

Sixteen high performance rowers 18-24 yrs (VO2 max=69.7±1.5 ml.kg-1.min-1) executed special designed intermittent type of training exercises, which consist in 5 exhaustive training sessions for week. It was weekly high loading micro cycle of high performance rowers. Part of rowers (n=9) in final part of training sessions were performed RMT (3 x 30 inhalation at about 70% of max power, Powerlung). The other part of rowers (n=7) did not conduct RMT. The lung ventilation response sensitivity to hypercapnia (ΔVE/ΔPACO2, re-breathing) and fast kinetics (T50) of VE, VO2, VCO2 (breath by breath) and HR in monoexponential function (5 min exercise 2 wt.kg-1, "Concept 2") were measured before and 12-14 hours after last training session of the micro cycle. Mean power and blood lactate (1-st min recovery) at sport specific 6 min max rowing test were measured before and after the micro cycle of training.

The results showed that CR sensitivity to hypercapnia of rowers without RMT was significantly decreased (-19.6±4.6%, $p<0.05$) 12-14 hours after the last exhaustive training session of weekly micro cycle. There were no significantly changes of CR sensitivity to hypercapnia in rowers, who applied RMT in final part of training sessions (-4.7±0.9%, $p>0.05$). The decrease of CR sensitivity to hypercapnia was related to increase T50 of VE, VO2, and VCO2 (r= -0.71; -0.67; and –0.70 respectively, $p<0.05$). Mean power of 6 min max rowing test was higher (8.9±1.1%) and blood lactate was lower (6.7 ±0.7%) after the exhaustive training sessions in rowers that applied RMT in comparison to group rowers that did not used RMT ($p<0.05$). The utilization of VO2 max in 6 min max test was significantly higher also in rowers that used RMT (12.9±1.7%). Before the exhaustive training sessions there were no significant differences those indices.

The results showed that fatigue induced by several consecutive exhaustive training session influences were connected with transient decreases of CR sensitivity to CO2 and CR fast kinetics. RMT applying in several exhaustive training sessions resulted in maintenance of CR responsiveness in exhaustive micro cycle of training and thus has the fatigue correction effect.

Mishchenko V, Tomiak T, Kuehne T (2004) Influence of respiratory muscle training on cardiorespiratory response sensitivity and fast kinetics in endurance athletes.9th Congress ECSS:189.

THE COMBINED EFFECT OF TIME OF DAY AND MENSTRUAL CYCLE ON VARIOUS METABOLIC VARIABLES

Forsyth, J., Reilly, T.

North East Wales Institute of Higher Education and Liverpool John Moores University, United Kingdom

The combination of diurnal and circamensal rhythms and their effect on performance has not been investigated extensively. In women, menstrual cycle phase could interact with circadian variations, and by not controlling for time of day, underlying effects may be accentuated or masked. The purpose of this study was to examine the isolated and combined effects of time of day and menstrual cycle phase on various metabolic variables in response to incremental exercise. Eleven female, endurance-trained athletes (mean±SD age, 32.4±6.9 years) completed a continuous, multi-stage, 3-min incremental protocol to exhaustion on the Concept II rowing ergometer at 06:00 h and 18:00 h and at two phases of the menstrual cycle, the mid-follicular and the mid-luteal phase. Rectal temperature (Trec) was measured at rest; power output, oxygen consumption (VO2), pulmonary ventilation (VE), heart rate (HR), respiratory exchange ratio (RER) and blood lactate concentration were recorded at rest, throughout the exercise test, and post-exercise. There was a significant ($F1,10,=12.00$, $p=0.006$) menstrual cycle phase effect for Trec, with mean values being higher in the mid-luteal phase compared to the mid-follicular phase. There were no significant circamensal differences in resting or maximal values of VO2 and RER. Mean maximum values for VE reached significance ($F1,10,=4.96$, $p=0.05$), being higher in the mid-luteal phase than in the mid-follicular phase (77.3±15.6 and 74.7±15.7 l.min-1, respectively). Although no differences existed for HR at rest, at maximum exercise, values were significantly higher ($F1,10,=5.47$, $p=0.041$) in the mid-luteal phase. Mean resting VO2, VE and HR were significantly higher at 18:00 h than at 06:00 h in both phases of the menstrual cycle, coinciding with the peak in Trec. There were no significant differences due to time of day for maximum values of HR, VO2, VE and RER. Interaction effects for values of maximum blood lactate concentration approached significance ($p=0.06$), being higher at 18:00 h than at 06:00 h, and higher in the mid-follicular phase compared to the mid-luteal phase. In this instance, the elevated levels of blood lactate concentration observed in the mid-follicular phase were more apparent when tests were carried out in the evening compared to the morning. Although interaction effects were not apparent for the majority of variables measured, the findings suggest that, when using metabolic variables in physiological assessment, independent consideration should be given to the menstrual cycle phase and time of day in which the test is carried out.

STRUCTURE OF TECHNICAL PREPARATION OF ACROBATS

Niznikowski, T., Sadowski, J., Booban, W., Mastalerz, A., Niznikowska, E.

Józef Pisudski Academy of Physical Education in Warsaw, Poland

The increasing of complexity and difficulties of programs' range for gymnastic competition introduced by International Federation of Gymnastic (FIG), is manifested by the new, more effective means, forms and methods of teaching. Therefore complexity of motion structure causes unknown difficulties in teaching process.

Diagnostic questionnaire, pedagogical experiment, literature analysis and poll questionnaire were applied to the group of acrobatics coaches (n = 25, length of work – 20-45 y.). Cinematographic analysis systems were also used to analyze acrobatic jump (n = 30, age 11 – 25 y., 60 Hz - JVC GR – DVL9800 NTSC camera and APAS 2000 - Ariel Dynamics Inc).

Structure analysis of acrobats technical preparation (PT) allows to formulate their three components. It was established, that described components are suited to long-term sport improvement: "motion school" – versatile period, special technical preparation – direct period and sport technique of competition exercises – expert period. Such components are functionally connected to each other, and they support training process.

Results received from pedagogical experiment allow to affirm that special technical preparation with biomechanical indices of junction elements performance in acrobatic evolution is more effective ($p<0,05$) then traditional manner of training.

MODIFICATION OF CYCLING BIOMECHANICS DURING A SWIM-TO-CYCLE TRIAL

Delextrat, A., Tricot, V., Bernard, T., Vercruyssen, F., Hausswirth, C., Brisswalter, J.

London Metropolitan University, United Kingdom

The recent apparition of multi-sport activities, such as triathlon (swimming, cycling, running) raises many questions relative to the influence of locomotion mode transitions on kinematic adaptation during each discipline. The aim of this study was to investigate the influence of a prior 750-m swim on cycling kinematics, and to relate these alterations to the metabolic demand of cycling. Eight well-trained male triathletes underwent three sub maximal sessions in a counterbalanced order. These sessions comprised a 10-min ride on a cycle ergometer at 75% of maximal aerobic power (MAP) and at a freely-chosen cadence. This exercise was preceded either by a 750-m swim

performed alone at competition pace (SCA trial), a 750-m swim in a drafting position (i.e., swimming directly behind a competitor) at the same pace as during SCA (SCD trial) or a cycling warm-up at 30% of MAP for the same duration as the SCA trial (CTRL trial). A number of biomechanical and physiological parameters were measured during cycling. Differences between SCD, SCA and CTRL trials were analysed using a Wilcoxon test. The level of confidence was set at 0.05. No significant difference between SCD and CTRL trials was observed for all the parameters measured. When compared to SCA trial, the swimming bout of SCD trial was performed with significantly lower heart rate values (-6.4%, P<0.05) and blood lactate values (-28.8%, P<0.05). This decrease in swimming metabolic cost was associated with a significantly lower pedal rate (85.0±6.2 vs. 90.2±8.8 rev.min-1, P<0.05) and significantly higher mean torque exerted during the downstroke of the dominant leg (31.3±3.2 vs. 30.2±3.5 Nm, P<0.05), mean torque exerted during the downstroke of the non dominant leg (29.8±3.4 vs. 28.6±3.5 Nm, P<0.05), peak torque exerted during the downstroke of the non dominant leg (44.8±6.6 vs. 43.6±6.9 Nm, P<0.05) and gross efficiency (19.5±1.6 vs. 18.5±0.6%, P<0.05) in SCD trial vs. SCA trial. It could be suggested that following the high intensity swim (SCA trial), involving a possible decrease in leg muscular capacity, the subjects intrinsically adopted a pedal rate close to the theoretical mechanical optimal cadence (90 rev.min-1, Neptune et al., 1999) in order to minimize neuromuscular fatigue. Conversely, following the swim at lower relative intensity (SDC trial), the subjects were less fatigued and therefore spontaneously chose a lower pedal rate associated with higher torques, but a lowest energy expenditure (Brisswalter et al. 2000). Brisswalter, J., Hausswirth, C., Smith, D., Vercruyssen, F. & Vallier, J.M. (2000). Energetically optimal cadence vs. freely-chosen cadence during cycling: effect of exercise duration. International Journal of Sports Medicine, 20, 60-64.

Neptune, R.R. & Hull, M.L. (1999). A theoretical analysis of preferred pedaling rate selection in endurance cycling. Journal of Biomechanics, 32, 409-415.

Poster presentation (PP)

PP3-03 Health and Fitness 1-5 - "Exhibition Hall"

VALIDITY OF UNIAXIAL ACCELEROMETRY ESTIMATING THE ENERGY EXPENDITURE OF WALKING AND RUNNING IN EARLY CHILDHOOD

Sunami, Y., Shiomi, Y., Okishima, K., Nishimuta, M., Yoshitake, Y., Adachi, M.

Fukuoka Jo Gakuin University, Japan

It is known that low levels of physical activity and physical fitness during childhood increase the risk of obesity leading to life-style-related diseases later in life. There are a number of different techniques that have been used to assess energy expenditure and physical activity. According to these assessments, accelerometry was thus found to be a useful method for measuring the intensity, duration, energy expenditure, and the step rate of daily physical activities for youth, adults and elderly. The purpose of the present study was to evaluate the validity of a uniaxial accelerometer which estimated energy expenditure of walking and running for early childhood in comparison to oxygen consumption and metabolic equivalents (METs).

The subjects considered of eleven male healthy children who were all 6 years old. After the experiment was explained, informed consent was obtained from the parents of all children. Each subjects underwent a submaximal exercise test at two walking speeds (3.0, 5.0 km/h) and one running speed (7.0 km/h) on a treadmill at a 0% grade. The duration of each stage was set at 3 minutes. During the walking and running, each subjects wore a uniaxial accelerometer (Lifecorder, Suzuken Co. Ltd, Japan) on their waist belt. Each grade of exercise was separated by a two-minute rest periods. Expired air was collected in a Douglas bag using the standard open circuit spirometric techniques during the last one minute of each work load. The volume of expired air was quantified with a respirometer. The VO2 and VCO2 were calculated by measuring the oxygen and carbon dioxide concentrations using mass spectrometry (ARCO-1000, ARCO System Co. Ltd, Japan). Furthermore, after overnight fasting for 12-14 hours, the subjects were walked calmly to kindergarten from their home. Thereafter, all subjects rested on a chair for over ten minutes before the resting metabolic rate was measured. In this study, MET values was directly measured for each subject by dividing the measured energy expenditure by their resting oxygen consumption. Energy expenditure was calculated using a simplified version of Weir's formula.

The activity level of walking and running estimated by means of an accelerometer showed a significant increase from 3km/h to 5km/h, and also from 5km/h to 7km/h. The activity levels measured by the Lifecorder correlated positively with the VO2 ($r=0.88$, $p<0.001$), METs values ($r=0.83$, $p<0.001$) , and the energy expenditure as calculated by Weir's formula ($r=0.90$, $p<0.001$). Based on our obtained data, we consider the threshold of walking to running intensity in early childhood to be about 3 to 4 METs, and 6 to 7 activity levels detected by Lifecorder.

The findings of the present study suggest uniaxial accelerometry to be a valid and reliable device for quantifying walking and running in early childhood. Moreover, this device is also useful for assessing the physical activity corresponding to the MET categories for the children.

OCCURRENCE, CLUSTERING AND ASSOCIATION OF CARDIOVASCULAR RISK FACTORS IN ADOLESCENTS FROM PORTO (1998 – 2003)

Martins, C., Gaya, A.R., Silva, F., Ribeiro, J.C., Santos, P., Mota, J.

Faculty of Sports Porto University Catholic University of Brasilia - Brazil , Portugal

INTRODUCTION: Epidemiological studies have identified several risk factors for coronary heart disease, many of which are present in youngsters (McMenemy, 1999) and tend to cluster (Boreham et al.,1993). OBJECTIVE: The aim of the present study was to examine the occurrence of single cardiovascular risk factors as well as its clustering among two cohorts (1998 and 2003) of adolescents. METHODS: The sample comprised 248 adolescents (58 boys and 80 girls in 1998 and 44 boys and 66 girls in 2003), aged 14-15 years-old. Risk factors were the follows: BMI, calculated from the ratio of weight / height2; Systolic and Diastolic Blood Pressure were assessed according to procedures described by Gillman et al. (1995); Total cholesterol was analysed by Reflotron Analyser – Boheringer Mannheim Diagnostics, Indianapolis); Cardiorespiratory fitness was assessed by shuttle-run test from Fitnessgram (Prudential Fitnessgram, 1994). The cardiovascular risk factors (risks of obesity, hypertension, hypercholesterolemia and \low cardiovascular fitness) were determined by international cut-off points. Statistical analysis was performed using SPSS (Windows version 12.5). A two-tailed t-test and a qui-square test were used for comparison between cohorts. Pearson correlation and Multivariate linear regression analysis was used to determine correlation coefficients between various cardiovascular risk factors. Level of significance was set up at p≤0.05. RESULTS: Cardio-

respiratory fitness decreased significantly (p=.05) in boys and girls in the second cohort. In 2003, there were an increased percentage of adolescents with two or more CVD risk factors. The percentage of adolescents below the healthy zone of cardiorespiratory fitness increased for both sexes in 2003. Cardiorespiratory fitness was associated with BMI (p=.01) and its decrease was associated with increasing values of BMI for girls in 2003 (P=.04) as well as with clustering of CVD risk factors in boys in 1998 (p= .01). CONCLUSION: Upon five years, the percentage of adolescents in cardiorespiratory healthy zone decreased significantly in both sexes. CVD risk factors clustering tend to increase in second cohort. Decrease in cardiorespiratory fitness healthy zone was significantly associated with changes in BMI in girls.

DETECTION OF HEALTH AND FITNESS RELATED LEVELS OF TURKISH CYPRIOT CHILDREN THROUGH GRADING OF THEIR EUROFIT TEST RESULTS

Tnazc, C., Emiroglu, O., Burgul, N., Atamtürk, H.

Near East University, North Cyprus, Cyprus

To reveal the level of health and fitness in prepubescent children of Turkish Cypriot population 7425 EUROFIT test results of 9-11 years old junior school children from all 90 schools of North Cyprus were graded on percentile table. Height and weight measurements, test for skinfold thickness, flamingo balance test, plate tapping, sit-and-reach test, standing broad jump, handgrip strength, sit-up test, bend arm hang test, 10m*5 sprint and shuttle run tests were comprising 12 EUROFIT tests.

For this purpose each parameter of the EUROFIT test has been classified from 5% to 100% on the percentile scale. Consequtive grading of percentile table has given us ranges between 5 and 100 points for health and between 1 and 90 points for fitness related tests (some tests assessed both health and sports related fitness).

Analysis of obtained points has shown that children with 90th percentile of their test results and above were fit enough to be successfully engaged in sports activities, which vary with age and gender, whereas those children with data below 23rd percentile had risk of facing with health problems in the future.

Assessment of age differences of test results also indicated on different impact of this factor on health and fitness levels of children. We revealed that percentile level for fitness decreased with age progression, whereas increase of health related percentile threshold pointed out on increase of risk for health with children's age.

LEISURE PHYSICAL ACTIVITY OF UNIVERSITY REQUIRED PHYSICAL EDUCATION COURSE STUDENTS IN HONG KONG

Cheng, Y.C.

The Chinese University of Hong Kong, Hong Kong

Introduction:

The promotion of health is one of the essential issues of the University's physical education curriculum. It is hoped that through this emphasis, students will develop their own lifelong exercise habit before they graduate and are more conscious of the fact that a sedentary lifestyle and obesity are positive risk factors to coronary artery disease (ACSM, 2006). Students are made aware that developing a healthy lifestyle from as early as the teenage years would reduce their acquiring the above mentioned risk factors.

Method: 208 male and 234 female students, who enrolled the required physical education course in the Chinese University of Hong Kong, were invited to participate in this study. A self-report activity questionnaire (Godin, 1997) was modified to assess leisure time physical activity patterns of the students. The content of the questionnaire included measurement frequency of their weekly different intensity physical activities.

Results: Results of the overall findings:

1 The mean and standard deviation of body mass index of the male and female students were 20.8 ± 4.5 and 19.1± 4.5 respectively.

2. There was significant difference between the male and female students in their average weekly leisure time physical activity pattern scores. (Scores were 43.1 ± 28.3 and 33.3± 21.5 respectively. ($p<0.05$)

3. No significant difference was recorded in the comparison between the individual and team sports courses students in their average weekly leisure time physical activity pattern scores.

4. There was significant difference in percentage between the male and female students in their response to their engaging of weekly regular activity long enough to work up a sweat. The percentage of male and female students answered to "often, sometimes and never/rarely" were 23%, 64%, 13% and 8%, 59%, 33% respectively. ($p<0.05$)

Discussion: The findings showed that male students exercise more in their leisure time than female students. More male students responded that they would often engage in regular activity long enough to work up a sweat than female students. The different kind of sports in the physical education course had no effect on students' daily leisure time physical activities. The male students' weekly leisure time physical activity average score was less than 50, which was light to moderate intensity, relative to healthy adults. There is room for improvement in their exercise intensity as improvement would bring about a strengthening of their cardiovascular fitness. The content of the physical education curriculum could include inspiring and motivating students to exercise on a regular basis. The limitation in this study is the difficulty encountered in the measurement of actual energy expenditure in their daily physical activities. Future studies could focus on the reasons affecting students' preference for leisure activities and the comparison of leisure physical activity patterns among different university students in Hong Kong.

ECRES, A SOFTWARE TO PREVENT THE EXERCISE INDUCED HYPOGLYCAEMIA IN TYPE 1 DIABETIC PATIENTS: PRELIMINARY RESULTS

Francescato, M.P., Geat, M., Tosoratti, E., Noacco, C.

University of Udine, Italy

Empirical reductions of the insulin dose are often suggested to type 1 (insulin dependent) diabetic patients in order to face the increased glucose turnover during exercise (ADA, 1997). However, the occurrence of exercise is often unforeseen, hence changes of the insulin dose cannot be easily made, giving importance to additional glucose ingestion to prevent hypoglycaemia. We report here preliminary data obtained by means of a newly developed software (ECRES, Exercise Carbohydrate Requirement Estimating Software), which allowed us to estimate the additional carbohydrates (CHO) required to maintain glycaemic balance.

The software is based on previous results showing that the amount of glucose oxidized during exercise can be estimated from heart rate also in type 1 diabetic patients (Francescato, 2005) and that the amount of CHO required to prevent exercise-induced hypoglycaemia is linearly related to insulin concentration (Francescato, 2004). The software runs as follows. After a setting procedure, handling the patient's personal data and his/her specific therapy and training habits, the software processes actual exercise parameters, thus yielding the amount of CHO to be consumed before/during the effort.

Eight type 1 diabetic patients (6M, 2F; HbA1c 6.7±1.4%, duration of diabetes 20±7 years) aged 18-50 years, gave their voluntary consent to participate, after being informed on the possible risks. Average body mass and height were 68±11 kg and 175±11 cm. Patients were asked to perform up to eight 1-hour outdoor runs, scheduled at different daytimes and at two different intensities (as set by predetermined heart rates; HR). Half an hour before the start and/or during the runs, the amount of CHO calculated by ECRES was given to the patients (mainly in the form of sugar-drops). During the trials, patients wore a HR monitor (Polar, Finland) and maintained HR as constant as possible. Glycaemia was tested at regular intervals by means of commonly used reactive strips (Glucotrend glucose, Roche Diagnostics, Switzerland).

Overall, thirty-one runs were performed. HR amounted on average to 109±10 beats/min; glycaemia at the start of exercise was 9.1±2.5 mmol/L and decreased to 6.6±2.3 mmol/L at the very end of the trials. In spite of the spreading of the trials over the whole day and of the different exercise intensities, only in 8 trials (25.8%) the glucose level fell below 3.9 mmol/L during the run, requiring the administration of further amounts of CHO.

In conclusion, the preliminary results obtained applying ECRES are promising. The percentage trials for which ECRES provides a satisfactory estimate of the CHO requirement is high, suggesting that the software can be a useful tool for type 1 diabetic patients to prevent the exercise-induced hypoglycaemia.

REFERENCES

ADA. Diabetes Care 1997;20:1908-12

Francescato MP et al. Metabolism 2004;53:1126-30

Francescato MP et al. Diabetes Care 2005;8:2028-30.

HEALTH RELATED HABITS AMONG HIGH SCHOOL STUDENTS IN SLOVENIA

Jurak, G., Kova, M., Strel, J., Starc, G.

University of Ljubljana, Faculty of Sport, Slovenia, Slovenia

Heterogeneous individually determined lifestyles are characterised by the main characteristics of modern information time: the imbalance between passive and active relaxation, and the related sedentary life style (Armstrong & Welsman, 1997; Hardman & Marshall, 2000; Dietz, 2001; Jurak et al., 2003; Strel et al., 2004; Brettschneider et al., 2004); improper nutrition (Hurson & Corish, 1997; Cruz, 2000; Samuelson, 2000; Gabrijelčič Blenkuš, 2001, 2005; Brettschneider et al., 2004) and abuse of intoxicating substances (Currie et al., 2004).

On the sample of 664 high school students of both sexes, averagely aged 18,05 years (±1,41 years), we studied the extent of some unhealthy habits and estimated the differences in this habits between the general population of the high school students and athlete students.

The analysis was carried out with a questionnaire while the data was analysed with discriminant analysis, t-test for independent samples, the calculation of Pearson χ2 coefficient and the calculation of appropriate correlation coefficients.

In general there are differences in life styles between athlete students and other students. Athlete students show less unhealthy habits. In general, this confirms the hypothesis that there exists correlation between involvement in sport and healthy life styles.

Both groups of students were most clearly determined by smoking. This factor shows the highest correlation with other health-risk factors. The analysis of individual factors shows that athlete students eat more regularly than other students but that they eat less than recommended. Athlete students in general use less intoxicating substances but there are no differences in the use of some substances. Athlete students smoke less, use less soft drugs and drink less coffee, while there are no differences between the use of vine and energy drinks between them and the general student population. Athlete students attend weekend parties in the same extent as other students but in a healthier manner.

According to a poorly developed system of nutrition for athlete students it is recommendable that schools with sport classes implement a system of nutrition for these students that are individually planned and adapted to their individual needs.

PHYSICAL ACTIVITY AND PERCEIVED ENVIRONMENTAL CHARACTERISTICS IN A PORTUGUESE SAMPLE OF MEN

Santos, R., Ribeiro, J.C., Santos, P., Mota, J.

Faculty of Sports University of Porto., Portugal

Background: There is a reason to believe that physical environments variables play an especially important role in the level of Physical Activity (PA). Few studies have examined the association between environmental variables and level of PA in Portuguese adults.

Objectives: This study aims were: (1) - to evaluate differences in perceived neighbourhood environment according to PA level, and (2) to determine which, if any, perceived neighbourhood environmental variables were associated with reported PA levels in an adult population.

Methods: The sample comprised 3 226 men, aged 39.42± 9.57. A questionnaire using the Environmental Module of the International Physical Activity Prevalence Study assessed Perceived Neighbourhood Environments. PA was also assessed by questionnaire (International Physical Activity Questionnaire – short version) and used as the dependent variable. Subjects were classified in two categories according to their level of PA: inactive (participants that reported less than 150 min/week of at least moderate-intensity PA) and active (participants that reported 150 min/week or more of at least moderate-intensity PA).

Results:

The active men were more likely to agree ($p<0.05$) that Access to Destinations (i.e. accessibility of shops and transit stops), Infrastructure for Walking and Cycling, Social Environment (i.e. see others being physically active in the neighbourhood) and Aesthetics of the neighbourhood are important environmental features. Logistic regression analysis showed that Infrastructure for walking and cycling (OR= 1.309; p= 0.001), were related to being physically active.

Conclusions: Some perceived neighbourhood environmental attributes were found to be associated with level of physical activity in men.

AN ACCELEROMETRY METHOD TO TRACK THE EFFECTIVENESS OF A WALKING PROGRAM

Schutz, Y., Hills, A.P., Lecoultre, V., Terrier, P.

University of Lausanne, Switzerland / Queensland University of Technology, Australia, Switzerland

It is commonly suggested that daily moderate-intensity physical activity (PA) is an important factor in the prevention, treatment and management of obesity. Although a theoretical 0.3kg weight loss per week would be possible with 1h walking/day, many studies conclude that this value is rarely reached. Hypotheses used include 1) the added exercise induces higher food intake; 2) poor adherence to activity programs may occur; 3) compensation for extra-exercise by an increased placidity may be observed.

The objective of the present study was to assess the effectiveness of 3 different walking programs. We used a motion sensor (bi-axial accelerometer) able to record daily PA profile over several weeks. The device can measure: 1) number of steps per day; 2) estimated total energy expenditure; 3) duration of walking activities per day from an analysis of activity profile.

Seventeen young women participated in the study (body mass 60±11kg, height 165±7cm, Body Mass Index (BMI) 22.3±4.6kg/m2). Participants wore the accelerometer during 8 consecutive weeks, from which 2x2 weeks (i.e. before and after the 4-week prescription) were the baseline activity, without exercise prescription. Three different PA programs were randomly assigned to the participants: 1) 30min walking; 2) 60min walking; 3) 90min walking. The prescription involved the completion of additional walking periods to one's habitual activity in "blocks" of a minimum of 30min walking, 5 days per week during 4 weeks. Adherence to the program was evaluated by comparing the duration of walking objectively assessed by the accelerometer with the prescribed duration. We tested whether the extra-walking imposed was partly offset by a lower spontaneous PA in pre/post exercise periods by comparing the average baseline activity level with the level during the program weeks.

The PA programs increased the average number of steps per day as compared to baseline level by 21% (30min, N=6), 36% (60min, N=5) and 60% (90min, N=6), respectively. In terms of total daily energy expenditure, increases were 3.6%, 5.8% and 10.2 %, respectively. The adherence to exercise averaged 93±32% (N=17, range 22-141%), with no significant differences among groups. All participants compensated for the imposed extra exercise by diminishing their spontaneous walking activities, except one. On average, the basal activity level (i.e. excluding the exercise periods) decreased by 25±16%, with a higher effect seen with 90min exercise prescription (37±19%, $p<0.05$ vs 30min) than for 60min (19±12%) and 30min (18±8%).

Despite good adherence to the activity program, we found that a substantial part of the effect of exercise on total daily activity was lost due to a decrease in spontaneous activity in pre- and post- exercise periods. This may in part explain the mitigated effect of prescribed exercise encountered in the literature. However, the large inter-individual variability we observed requires the conduct of further investigations to better describe the compensation effect.

ANTHROPOMETRIC MEASURES AS RISK PREDICTORS OF CARDIOVASCULAR DISEASES

Glaner, M.F., Lima, W.A.

Catholic University of Brasília, Brazil

Cardiovascular disease (CVD) is the number one of the causes of death in Brazil, and the obesity has increased. The major risk factors for CVD are elevated serum total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), triglycerides (TG), guclose (GL) and low serum high-density lipoprotein cholesterol (HDL-C) associated to %fat (%F) and topography fat distribution. The %F and topography fat distribution can be measured by anthropometric technique. The aim of this study was to verify how much those risk factors can be influenced by the %F and by different anthropometric measures. Were measured 76 men, with age = 34,4 +/- 9,4 years; stature = 168,6 +/- 7,3 cm; body mass = 73,2 +/- 10,6 kg; %F = 21,3 +/- 8,4 (dual-energy X-ray absorptiometry). The Blood to estimate TC, LDL-C, HDL-C, TG and GL was taken from the antecubital vein, after 12-hour overnight fast. These variables were analyzed using the enzimatic spectrophotometric technique (reagent: doles; Bioplus, BIO-2000). Stepwise regression analysis was used to determine the influence of the %F and anthropometrics measures in the risk factors. The independent variables were used: %F; body mass index (BMI); waist-to-hip ratio (WHR) (WHR1: abdominal perimeter 2.5 cm (ABp2.5) above to the umbilicus; WHR2: abdominal perimeter above to the umbilicus), neck perimeter (above to the laryngeal prominence), familiar history of CVD; diastolic and systolic blood pressure; body image perceive by researcher (BIPR) and by volunteer (silhouette: Stunkard et al., 1983). The mains results were: TC = 130,532 + 2,072 (%F), (R= 0,450, R2= 0,202, p= 0,0005); HDL-C = 51,627 – 2,472 (SPA), (R= 0,349, R2= 0,122, p= 0,002); LDL-C = 63,540 + 1,860 (%F), (R= 0,408, R2= 0,166, p= 0,0005); TG = 183,126 + 4,007 (ABp2,5), (R= 0,396, R2= 0,157, p= 0,0005); GL = 66,675 + 0,308 (ABp2,5), (R= 0,249, R2= 0,062, p= 0,030). The results shown that %F influences in 20,22% the TC and 16,6% of the LDL-C. The BIPR explained 12,2% the HDL-C. Whereas, the TG and GL are most influenced (TG 15,7%; GL 6,2%) by the ABp2.5. The remainder independent variables did not influence significantly the risk factors. By and large the ABp2.5 is the anthropometric measure that more influences the TG and GL. The %F is the variable that more influences the TC and LDL-C. In this manner, the ABp2,5 and %F are the better signs to CVD than the usual BMI and WHR. Therefore, it is important to avoid fat accumulation, essentially in the trunk, to prevent the precocious development of CVD.

PREDICTABILITY OF CARDIOVASCULAR FITNESS AT AGE 35 YEARS FROM BMI IN EARLY VERSUS LATE MATURING CHILDREN: A LONGITUDINAL STUDY

Taeymans, J., Hebbelinck, M., Borms, J., Abidi, H., Duquet, W.

Internationale Akademie Physiotherapie , Switzerland

Introduction

In adulthood, high VO2max is correlated with a decrease of cardiovascular disease and is important for sucess in many sports (1). It was the aim of this study to investigate the possible relationships between childhood BMI and some cardiovascular fitness (CVF) variables at age 35 yrs in former early and late maturers.

Methods

For this study, data of the Belgian longitudinal "LEGS", were used (2). Of the original 515 subjects who had been followed from 6 to 18 yrs of age, 119 (M=59; F=60) participated in this follow-up study at age 35 yrs. Informed consent was obtained. CVF can be expressed in terms of systolic (SBP) and diastolic (DBP) blood pressure and heart rate at rest (HR) and in terms of VO2max during exercise. At rest SBP and DBP, HR, height and weight were measured. VO2max was directly assessed during an incremental bike ergometer protocol until exhaustion. Age at peak height velocity (PHV) was calculated using the JPA method and software (3). Early (EM), moderate and late maturity (LM) groups were established using tertiles. For statistical analysis the SPSS 12.0 was used. Pearson correlations (r) were calculated. Significance was set at 5%.

Results

In EM girls BMI of all ages show moderate to very strong negative r (-0.4<r<-1.0) with VO2max at age 35 yrs (p<0.05).There are moderate and positive r (r>0.4; p<0.05) with HR, except at ages 13 and 14 yrs when r are weak (p<0.05). Correlations with SBP and DBP are positive low to moderate (0.2<r<0.5) until age 15 yrs but moderate to very high from age 16 yrs on (p>0.05). In former LM women, the r between childhood BMI and VO2max at age 35 yrs are very weak to moderate but negative (p>0.05), while r between childhood BMI and adult HR, SBP and DBP are very weak (until age 13 yrs) to moderate (from age 14 yrs on) but positive (p>0.05).In former EM men the r between childhood BMI and HR at age 35 yrs are positive weak to strong (r>0.6) and significant at the ages 7 and 11 to 18 yrs except at age 15 yrs. None of the other r are significant.This is also the case for all r between childhood BMI and CVF variables at age 35 yrs in former LM men.

Discussion

Our data suggest that former LM men and women have the more healthy cardiovascular outcome at age 35 yrs. In former EM women the predictability of adult CVF from childhood BMI values is very good. This is not the case in female LM. For each of the CVF variables prediction is not possible from BMI during childhood and adolescence in LM girls and in EM and LM boys. Our findings suggest that in the female subjects the childhood maturation status is discriminative for the predictability of selected adult variables of CVF (HR, SBP, DBP and VO2max) from childhood BMI.

Conclusion

Assessment of BMI in young EM girls may be a useful tool when screening them for adult CVF. In LM girls and in EM and LM boys, determinants other than BMI, will be needed to predict adult CVF.

References

1.Wilmore & Costill,2003

2 Hebbelinck et al.,1995

3 Abidi et al.,1997.

A PILOT STUDY OF THE COMPARISON OF ATTITUDES TOWARDS PHYSICAL ACTIVITY AND EXERCISE HABITS OF ALUMNI FROM UNIVERSITIES WITH DIFFERENT PHYSICAL EDUCATION PROGRAMS IN HONG KONG

Leung, F.L., Wong, H.S.

The Chinese University of Hong Kong, Hong Kong

The purpose of this study is to compare the attitudes and exercise habits of alumni from universities in Hong Kong with different PE programs. The findings are useful in formulating a curriculum and developing strategies in promoting PA.

Method

Participants were selected from the alumni of two research universities in Hong Kong. These two universities were chosen because they are similar in their campus environments, facilities, and student population characteristics. University A has a PE course requirement, and two credit hours of PE courses are required for full-time undergraduate graduation. On the other hand, University B does not have a PE course requirement, as their PE courses are provided as part of a noncredit recreation program. One hundred alumni (University A: 50; University B: 50) who graduated between 2001 and 2005 were invited to take part in this pilot study. A self-administered questionnaire was sent to them through e-mail, and they were requested to complete and return it likewise by e-mail. The questionnaire collected demographic data from the alumni, as well as their attitudes and exercise habits.

Results

The overall findings were as follows:

1. A significant difference was found between the two universities with regards to their alumni's perceived value of their respective universities' PE programs in terms of its contributions to their knowledge on fitness. The alumni from University A significantly (p< .05) valued perceived knowledge more than the alumni from University B.

2. No significant difference was found between the two universities with regards to the alumni's perceived value of their respective universities' PE programs in terms of its contributions to their attitude toward fitness.

3. No significant difference was found on the alumni's exercise habits in terms of the number of minutes per exercise workout and the number of workouts per week.

Discussion/Conclusion

The required PE course appeared to have had a positive effect on the perceived knowledge on fitness of the alumni (University A) who completed it as compared to the alumni (University B) who were not exposed to such a course. However, this positive effect did not lead to any significant influence on the attitudes and exercise habits of the alumni. However, there are some limitations in our study. First, the findings were from two research universities of Hong Kong, which means that the majority of the survey participants came from upper-middle class backgrounds. The ability to generalize the findings in other universities with more diverse academic requirements and students from different socioeconomic backgrounds was limited. Second, this study examined PE activity program, implications for conceptually based PE programs may be limited. Future studies could focus on the comparison of the long-term effects of PE activity programmes and conceptually based PE programmes.

GESUND BEWEGT - MOVE FOR HEALTH AND THE ENVIRONMENT: PHYSICAL ACTIVITY PROMOTION IN GENERAL PRACTICES IN SWITZERLAND

Handschin, M., Joss, M.K., Nüscheler, M., Braun-Fahrländer, C.

Swiss Doctors for the Environment, ecos ag, Institute for Social and Preventive Medicine, Basel, Switzerland

Background

Physical inactivity is increasing in the Swiss population. A Swiss pilot project in 5 private practises in Zurich showed that systematic screening of patients by the doctor and subsequent counselling increased physical activity in patients.

Aim

The project Gesund bewegt aimed at developing and testing a model for a systematic screening and counselling of patients in primary health care institutions suitable for a large number of general practitioners. A minimum of 25 general practitioners from the Northwestern region of Switzerland was planned to be recruited.

Method

Primary care physicians were invited to participate in the project through mailing, journal articles, presentations at meetings and personal contacting by physicians of the project team. Participating practices carried out a systematic screening about physical activity of patients aged 16-65 years by means of a short questionnaire distributed to the patients when they visited the practise. Distribution of questionnaires occurred during several two-week periods from January 2004 to July 2005. People identified as inactive were offered a brochure or a voucher for individual counselling with a trained physical activity adviser.

Results

44 primary care physicians participated in the project. 13 physiotherapists and 5 doctors were trained and certified as physical activity advisers. Recruitment of general practitioners for participation in the project was most successful when effected through personal contacts of a colleague of the project group. Physiotherapists were mostly recruited through information in their professional journal and after a presentation at a meeting of their professional association. Introduction of participating physicians into the practical and theoretical details of the project was mostly (68%) carried out face to face in the practise of the respective colleague because attendance of an introductory workshops was poor due to lack of time. Once recruited into the project effort was devoted to keep the general practitioners in the project and to adapt the screening schedule most flexibly to the needs of the individual practices. Eight screening cycles were run, most practices took part in 4 or less cycles because more time than scheduled was needed for their recruitment. During the eight screening cycles 7'455 patients were eligible for recruitment to the project and 4'987 (67%) filled in the questionnaire. Out of 4'621 analysed questionnaires 1'049 patients (22.7%) were identified as being physically inactive receiving further intervention.

Conclusion

Our experience shows that it is important to develop a concept that takes the reality of general practitioners into account, being flexible and minimizing the work load of doctors and assistants added by the project. It is essential that the project is supported by doctors to increase credibility and acceptance within the medical community.

EFFECTS OF WEIGHT EXCESS AND GENDER ON BLOOD PRESSURE VALUES IN A SCHOOL-AGED POPULATION SCREENING

Zaccaria, D. 1, Bottinelli, R. 1, Giussani, M. 3, Tono, V. 2, Sironi, A. 2, Galbiati, S. 2, Pieruzzi, F. 2, Genovesi, S. 2

1 University of Pavia, 2 University of Milano-Bicocca, 3 FIMP Milan, Italy

The raising in the prevalence of overweight and obesity in the paediatric population underlines the necessity to develop a programme of physical activity since youth. Weight excess is frequently associated to hyperlipidaemia, hyperinsulinaemia and hypertension also in children. The aim of our study was to evaluate the prevalence of hypertension in relation to the gender and the level of weight excess in a paediatric population.

Methods: in 5070 children (2473 females, 2597 males) from 6 to 11 years of age, we measured body weight, height and blood pressure. In children with systolic (SBP) and/or diastolic (DBP) blood pressure values obtained from a single measurement above the 95th percentile (corrected for the child sex, height and age,) three consecutive blood pressure measurements were performed in a different occasion. Elevated blood pressure in children was defined if the mean of the 3 blood pressure measurements was above the 95th percentile. Overweight (OW) and obese (OB) children were defined if BMI values were above the value corresponding to 25 kg/m2 or 30 kg/m2 of the adult, respectively, according to the International Obesity Task Force.

Results: OW children were 19.9% (521 females vs. 490 males, $p = 0.11$), while OB children were 5.7% (148 females vs. 141 males, $p = 0.42$). In 3.7% (187) of the children, SBP and/or DBP values were above the 95th percentile (110 females vs. 77 males, $p = 0.005$). In normal weight children, the percentage of females with elevated blood pressure was significantly higher as compared to the percentage of males with hypertension: 52/1804 (2.9%) vs. 22/1966 (1.1%), $p< 0.0001$, respectively. OW or OB subjects with elevated blood pressure values were equally distributed according to gender. The number of hypertensive children increased as the weight class increased: 74/3770 normal weights (2.0%), 49/1011 (4.8%) OW and 64/289 (22.2%) OB, $p <0.0001$. This phenomenon occurred equally in both genders.

Conclusions: these data show that in our population i) there is a high prevalence of overweight and obesity without differences between males and females, ii) the prevalence of hypertension is greater in females as compared to males given the higher prevalence of normal weight females with elevated blood pressure values, iii) weight excess is strongly associated with elevated blood pressure values and the percentage of hypertensive children is higher in subjects with greater weight excess.

Our screening suggests to use regular physical activity and alimentary education to control body weight and blood pressure starting from schools.

BASELINE CHARACTERISTICS OF EXERCISE ON PRESCRIPTION COMPLETERS AND NON-COMPLETERS

Sørensen, J.B., Jakobsen, R.B., Kragstrup, J., Puggaard, L.

University of Southern Denmark, Denmark

Introduction

Epidemiological studies have demonstrated that physical activity level and/or aerobic fitness are independent and strong risk factors of lifestyle diseases (e.g. 1). Exercise on Prescription (EoP) is used in many countries in an attempt to initiate physical activity among sedentary patients at risk of lifestyle diseases (e.g. 2). Adherence is vital for the success of EoP, and identifying characteristics of non-completers may be valuable. A Danish version of EoP is used in several counties. Sedentary patients with increased risk of lifestyle diseases are referred to an EoP clinic by their GP. The intervention involves physical activity counselling (baseline, and after 2, 4, and 7 months), and 4 months of supervised group training (twice a week for 2 months, and once a week for 2 months). The aim of this study is to describe completers and non-completers at baseline of Danish EoP. Non-completers are, in this study, defined as patients who drop out within the 7 months follow up. The hypothesis is that non-completers rate their health and physical activity lower than completers.

Methods

Subjects were 121 EoP participants in the County of Ribe (83 women and 38 men, age 53±12 years, height 169±9 cm, weight 91.4±17.2 kg, BMI 31.8±5.1, and VO2max 20.5±6.3 ml O2/(kg*min)). VO2max was measured using an indirect maximal cycle ergometer test. Self-reported measures were assessed by means of a structured interview. All tests were carried out by the EoP exercise specialist. Mean values were compared using an independent-samples t-test. Frequencies were compared using a Mann-Whitney test. Data are presented as mean±SD.

Results

Minor differences were observed in diagnoses between completers and non-completers. It seems that hypertension and Chronic Obstructive Pulmonary Disease associates with better adherence, whereas depression associates with poorer adherence.

There is a tendency to completers being older than non-completers (54±12 vs. 50±13, p=0.071). No difference was found in VO2max (21.1±6.4 vs. 19.8±6.1, p=0.260, completers and non-completers, respectively), and BMI (31.5±4.8 vs. 32.1±5.4, p=0.566). Furthermore, no difference was observed in self reported health (p=0.662), physical activity (p=0.490), and current smoking status (p=0.132). However, men dropped out more frequently than women (p=0.048).

Conclusion

The Danish EoP schemes target patients in need of a physical active lifestyle, and the majority of participants are women. The only variable assessed in this study, which is useful for identifying potential non-completers is gender. EoP exercise specialists should try to counter the increased drop out among men. Psychological and socioeconomic variables might prove more useful for identifying non-completers.

References

1 Blair, S. N., Cheng, Y., & Holder, J. S. (2001): Med Sci Sports Exerc. 33 (6 Suppl): S379-S399.

2 Elley, C. R., Kerse, N., Arroll, B., & Robinson, E. (2003): BMJ. 326 (7393): 793-798.

PHYSICAL ACTIVITY PRESCRIPTION IN THE COMMUNITY

Bellver, M., Banquells, M., Guerrero, A., Dinares, M., Rueda, J., López-Dóriga, A.

Consorci Hospitalari de Terrassa-Centre d'Alt Rendiment, Sant Cugat del Valles, Barcelona, Spain., Spain

Introduction: Physical activity has a role in disease prevention and is recommended to achieve good health1,2. Family physician departments are the ideal places to recommend healthy lifestyles3, but a few group of them recommend physical activity. Coordination between family physicians, sports physicians, physical educators is also essential to promote physical activity in the population and to lobby for changes in public policy and resources.

Objective: To compare physical parametres and health autoperception in a sedentary group "middle aged" with chronical pathologies , after the practise of supervised exercise during one year. To create a multidisciplinary team with sports professionals and primary care professionals. To apply techniques that we use in top athletes to the community.

Methods: We studied a group between 45 and 65 years old with medical history in the familiar health department (n=22) of hypertension, dyslipidaemia, obesity, diabetes, arthritis. We did a medical evaluation before participation and after the completion of the exercise program6. This evaluation includes a blood profile (blood glucose, total cholesterol, HDL-c, LDL-c and tryglicerides), an electrocardiogram, monitoritzed graded exercise test, kine-anthropometry, pulmonary function tests, Nottingham health profile, flexibility and dinamometry test. For ethical and legal reasons, all programs required an informed consent, which notified the participant of all procedures and potential riscs of participation.

This group practise supervised physical exercise twice per week , one hour per session. They play a circuit weight training, resistence training, walking, coordination and flexibility exercises.

Results: Blood profile, kine-anthrpometric parameters, Nottingham test, exercise test and pulmonary function tests improve with significant differences in glucose levels, weight and fat percetage, emocional reactions, systolic rest blood pressure and duration exercise test, FEF 25-75. Medication and number of medical controls have decreased.

Conclusions: 1) Physical activity improves quality of life: physical health, mental health and it also has social benefits,. in a group between 45 and 65 years old.

2) Advice from a family physician is one of the most influential factors in conviccting an individual to practise physical exercise. 3) We can use techniques that we apply in top athletes to the community.

References: 1Tully, M.A, Cupples, M.E, Chan, W.S, McGlade, K., Young, I.S. (2005). Brisk walking, fitness, and cardiovascular risk: a randomized controlled trial in primary care. Prev Med., 41(2), 622-8 2Richardson, C.R., Kriska, A.M., Lantz, P.M., Hayward, R.A. (2004).Physical activity and mortality across cardiovascular disease risk groups. Med Sci Sports Exerc., 36(11), 1923-9. 3Guiu Viaplana, A. et all.(1998): Evaluación de un programa de ejercicio físico supervisado en atención primaria. Atención Primaria. 22(8):32-38.

MOUNTAIN BIKING THROUGHOUT THE LIFE SPAN: PHYSIOLOGICAL DATA IN RECREATIONAL ATHLETES AGED 20 TO 60 YEARS

Heller, J., Vodicka, P.

Faculty of Physical Education and Sport, Charles University, Prague , Czech Republic

Off-road cycling or mountain biking has become increasingly popular for all ages – from youth to the elderly. The purpose of the investigation was to compare body composition, pulmonary function and aerobic capacity in recreational bikers (n= 144) aged 20 to 60 years in a cross-sectional study. The results of the bikers were arranged into 7 age groups, 20 to 25, 26 to 30, 31 to 35, 36 to 40, 41 to 45, 46 to 50, and 51 to 60 years of age, respectively, and compared with the Czech national population norms (Seliger and Bartunek, 1976).

Body fat and body mass index in bikers increased from the youngest to the oldest group, i.e. from 6.76 +/- 3.2 (SD) to 13.3 +/- 3.4 %, and from 21.8 +/- 1.4 to 25.3 +/- 1.9 kg.m-2 (correlation with age r= 0.46 and 0.46, p<0.01, respectively), being lower than national population norms (13.3 to 15.6 % of body fat and BMI 23.8 to 26.7 kg.m-2). Pulmonary function indices (FVC, FEV1 and PEF) expressed as percent of predicted values were unrelated to age, however, absolute values of FVC and FEV1 decreased significantly (p<0.01) with age (r= 0.418 and r= 0.455, respectively). As it could be expected, VO2max and maximum power output decreased with age, from 66.5 +/- 5.4 ml.kg-1.min-1 in the youngest group to 50.9 +/- 5.3 ml.kg-1.min-1 in the oldest group and/or from 5.8 +/- 0.5 to 4.2 +/- 0.5 W.kg-1, respectively. Correlation coefficients of VO2max and maximum power output dependence on age were r= 0.654 and 0.685, both p<0.01. These values corresponded to 150 % and 156 % of the VO2max values in normal population (44.1 ml.kg-1.min-1 at 22.5 years and 32.6 ml.kg-1.min-1 at 55 years of age). Similarly to this, the values of the maximum power output in bikers corresponded to 149 % to 157 % of the population norms (3.9 W.kg 1 and 2.7 W.kg 1 at the age of 22.5 and 55 years of age, respectively). As regards the VO2, power output and heart rate at the anaerobic threshold, the percentages of the parameters were constant across the age groups, corresponding to 77 % of VO2 max, 78 % of maximum power output, and 89 % of the maximum heart rate, respectively.

The results of the cross sectional study in recreational bikers demonstrate the positive effects of physical activity on body composition, maximum power output and aerobic capacity across the age from 20 to 60 years. The decline of physiological indices of physical fitness

during ageing was much more slower in recreational bikers than in the normal population. The results confirmed and quantified the positive effect of biking on physical fitness during ageing.

Seliger V. & Bartunek, Z. (1976). Mean values of various indices of physical fitness in the investigation of Czechoslovak population aged 12-55 years. Prague: ČSTV.

CIRCUIT TRAINING IMPROVES DAILY FUNCTION IN THE ELDERLY

Cummins, R.A., Hastie, R., Burden, S.

Waikato Institute of Technology, New Zealand

The process of ageing can be associated with declines in physiological variables such as strength and agility. These, in turn, may translate to declines in aspects of daily function, such as the ability to rise from a seated position in a chair. The purpose of this study was to examine the efficacy of a low cost circuit-training programme for improving aspects of daily function in the elderly.

Twenty-four residents from three local rest-homes participated. The intervention group (n=14: 5 females and 9 males; mean age 84 y) performed a circuit-training programme (Sutherland et al. 2005) whereas the control group (n=10 females; mean age 84 y) continued with their normal exercise programme. Both groups exercised twice a week for 30 min per session for eight weeks. Three tests (sit-stand, one-minute walk and grip strength) were used pre and post the intervention period to ascertain aspects of daily function. Confidence limits for comparison between groups of pre to post changes were derived via the t-statistic for samples of unequal size (Hopkins 2004). Two sets of comparisons were made: all intervention members versus all control members; female intervention members versus female control members.

The improvements demonstrated post-intervention by the circuit-training group relative to the control group with respect to all participants were as follows: sit-stand, 23% (90% confidence intervals, 13-35%); one-minute-walk, 15% (7-23%); grip-strength, 6% (0-12%). For the equivalent comparisons for females, the improvements were: sit-stand, 44% (17-76%); one-minute-walk, 33% (19-48%); grip-strength, 14% (0-29%).

We suggest that in rest-homes, long-term implementation of circuit-training programmes of this nature may be of benefit to residents by retarding the decline in daily function that accompanies ageing. In future studies we intend to: increase the duration of the study: increase the number of rest-homes involved; design extra circuit–training programmes to enable their rotation; and incorporate additional exercises specific to improving grip-strength (Hastie 2002).

Acknowledgements: We thank Trust Waikato and Wintec for funding and the staff and residents from participating rest-homes for their involvement.

References: Hopkins, W. (2004): Spreadsheet for controlled trials http://sportsci.org

Hastie, R. (2002) The effect of a grip-strength training programme on activities of daily living in the elderly, Honours thesis, Wintec, Hamilton, N.Z.

Sutherland, C., Cummins, R., Hastie, R. & Burden, S. (2005) Exercise for older folk. CD produced at Wintec, Hamilton, N.Z.

Prior presentation: These data have been presented at the 2005 Australian Conference of Science and Medicine in Sport, 13-16 October, Melbourne, Australia (J Sci Med Sport 8(4) (Suppl) abstract 204, p 120).

EFFECT OF EXERCISE TRAINING AND DIETARY RESTRICTION ON HEALTH-RELATED VARIABLES IN OBESE MIDDLE-AGED WOMEN - A 16-MONTH FOLLOW-UP STUDY –

Nakagaichi, M.

Research and Development Center for Higher Education, Japan

The purpose of this study was to investigate the influence of dietary restriction with exercise training on health-related variables in obese women. Subjects for this investigation were 17 obese middle-aged women (52.0±8.3 yr, 153.6±4.6 cm, 65.0±7.9 kg). These subjects participated in exercise and dietary restriction programs for 120 min, 2 days per week, consecutively for 3 months. Significant reductions were demonstrated in body weight (-4.8 kg), body mass index (-2.1), body fat percentage (-2.8 %) for 3 months. In addition, body weight had maintained 16 months after the program (-1.1 kg). In conclusion, the exercise training together with a proper dietary regimen is considered optimal with respect to favourable changes in various health-related variables.

ITALIAN TRENDS IN PERFORMANCE: RESULTS FROM THE EUROFIT JUMP TEST

Paleari, C., Lovecchio, N., Eid, L., Mantovani, B.

Università di Milano, Italy

Introduction - Physical activity and movement represent the basic elements for health and are important conditions to get well-being and quality in life. The Eurofit test battery provides a rapid and low-cost way to quantify physical well-being.

Materials and methods – After a national research in the Italian High Schools, and with the collaboration of the National Physical Education Teachers Association (CAPDI), data on 1020 boys and 870 girls aged 12-18 years were collected. From the Eurofit test battery (1), the Standing broad jump (SBJ) was selected: this test is determined both conditional factors and coordination.. The choice was influenced by the simplicity and low-cost of the required equipments, that are similar to Italian School standards. Current data were compared to those collected four years ago during a similar investigation on 3900 people of the same age.

Results - The present data showed trends similar to those found in the past survey. In boys, a generally constant trend of performances was observed in the 12-to-14 year old age group. The mean result in this age group was 160 cm (SD 25 cm), with a maximum jump of 262 cm. When the current 15-to-18 year old boys were compared to their peers assessed four years ago, an increase of the mean results was observed, with about 23 cm of increment in every age class. The central results varied from 189 cm (15 years) to 239 cm (18 years), showing a general increase of 45 cm (18 years) in comparison to the past. Despite the general increment in the mean values, a trend toward a diminution of the maximum values was found; in contrast, the minimum results increased. This trend justifies the smaller SD values obtained in the current group in comparison to the previous ones.

The youngest girls maintained a constant trend in comparison to the past (145 cm), with an improvement only in the minimum values. In contrast, the mean performance of the oldest girls raised from 143 cm (a value very similar to those found in the youngest performers) to 163 cm. Besides, the minimum performances in all age groups improved when compared to those obtained in the past.

Conclusions - The validity of the Eurofit test and the opportunity of longitudinal surveys could allow to elaborate activity programs that should help in the mantainement of well-being. In boys, the present results point to a general improvement in all ages, with a homogeneous trend. Instead, girls showed an improvement in the oldest age groups only. Despite that the number of people who practise sport at a competitive level is decreasing, the general physical state of Italian young people seems to be improved with a homogeneous course. Therefore, it will be important to promote life habits which can maintain optimal conditions of health and psychophysical well-being.

References: 1. Eurofit, European tests of physical attitude. Europe Council, Development of the sport Committee, Rome 1993.

THE RUNNING SPEED. AN INVESTIGATION TO SHOW THE PERFORMING LEVEL OF ITALIAN YOUNG PEOPLE

Paleari, C., Lovecchio, N., Eid, L., Cucco, F.

Università di Milano, Italy

Introduction - The relationship between performance and fitness is very close. Since 1976, the Council of Europe "Committee for Development of Sport" has been provided incentives for the use of tests to evaluate the physical efficiency in young people. A series of tests was completely arranged in 1986 to verify physical performance as an index of health and correct growth (Eurofit test battery). This method provides a rapid and low-cost way to quantify physical well-being.

Materials and methods - During the last school year, 1120 boys and 900 girls aged 12-19 years were recruited. They all were Italians, all performing non-agonistic sport activities. They were in good general health, free from present or past injuries to the lower limbs. During physical education lessons, the Shuttle Run Test (SHR, 10 x 5 m) was administered as indicated in Eurofit test protocol. Nobody knew the test in advance. The results of this test depend on conditional factors and coordinative skills.

Results – Overall, a good level of performance was found. The best individual results were obtained by two 18-year-old students: a girl (12.7 sec), and a boy (10 sec). On average, girls performed the 50 m of the test in 20.46 sec; the best result was obtained by 17-year-old girls (17.9 sec), while the worst was obtained by 12-year-old girls (22.44 sec). Students aged 17 and 18 were, on average, faster than the other students, but they showed the largest intra-group variability (SD = 3.5 and SD = 3.6 sec). Performance worsened in the oldest girls (19 years of age), with a mean time of 21 sec. In general, boys performed the test in 19 sec. The best times were found in the oldest age groups (17, 18 and 19 years) who performed the test in approximately 17 sec. Nineteen-year-old boys kept speed performance obtaining 17.7 sec on average. Intra-group variability was the largest for the faster age groups (SD = 3 sec).

Conclusions – The analyzed students showed good physical conditions: on average, each 5 m drive was run in 1.9 (boys) and 2 (girls) sec. These results, with a mean speed of more than 2.4 m/sec, are very positive considering the sample of non-agonistic sport subjects. The test proved to be a practical and low-cost method; it provided valuable information about the physical well-being of non-agonistic individuals. Considering the test characteristics, frequent follow-ups can be made.

EXERCISE-RELATED HEADACHE

Fontes Ribeiro, G., Cardoso, A.F., Félix, L., Fontes Ribeiro, C.A.

University of Coimbra, Portugal

Exercise-related headaches are commonly seen but not often associated with significant underlying pathology. The International Headache Society classification (IHS, 2004) describes some forms well, but overall reflects our lack of understanding of how exercise and headache pain are related.

Migraine headache is common and can be triggered by many factors, including exercise, which is one of the criteria for diagnosis. In addition, migraine may be worsened by many components of an active lifestyle or specific training, such as resistance exercise, endurance training, or valsalva maneuvers while training. Other factors are environmental exposure (heat and cold), dehydration, inadequate warm-up, altitude, fatigue, and dyspnea, which can occur during exercise. Exercise has not been related with tension-type headache, which is the most prevalent form of headache.

Another form of headache is primary exertional headache, which is a pulsating headache lasting from 5 minutes to 48 hours, specifically brought on by and occurring only during or after physical exertion, and unassociated with any systemic or intracranial disorder. It is normally found in 1% of the general population. IHS classification describes other forms of exertional headache (eg, cough, sexual). Primary exertional headaches have been described in swimmers, runners, and weightlifters, but presumably exist in athletes of all sports that require physical effort.

This study aimed to compare the prevalence of headaches in two populations of a hospital (nursing and medicine students), characterizing the headaches induced or aggravated by exercise. A specific questionnaire was developed and validated.

Headaches occur in 68.6% of the population studied. Migraine with and without aura affects 17.9 and 6.2 %, respectively, of the subjects, principally the nursing population, and is seen more often in women. Infrequent and frequent episodic tension-type headaches exist in 17.2 and 23.7 %, respectively, whereas primary stabbing or primary thunderclap headaches occur in 2.6 % and primary exertional headache in 0.7% of the population studied. Only one student refers chronic tension-type headache. Slight or routine physical activity is a trigger for migraine without or with aura in 18.4 and 17.6 %, respectively, of our population, and in only 6.4 and 4.6 % of the subjects exercise induces tension-type headaches. Migraine without aura and with aura, infrequent and frequent episodic tension-type headaches are aggravated by exercise in 51.0, 35.3, 12.8 and 20.0 %, respectively, of the subjects. Therefore, exercise significantly induces or aggravates migraine in comparison with tension-type headache.

In conclusion, the majority of migraineurs do not have exercise as a trigger factor and so they can exercise without the fear of headache. To lessen the risk of exercise-induced migraine, a plan should be developed with each individual to avoid exacerbating activities.

PHYSICAL FITNESS OF CHILDREN AGED 6 AND 7 AS A MEASURE OF HEALTH

Rokita, A., Surynt, A.

University School of Physical Education Wrocaw, Poland, Poland

Introduction

The level of physical fitness to a large extent influences the biological value of a human being, his/her frame of mind and the quality of living. It is mainly for these reasons that the physical fitness is commonly considered as a positive measure of health. The aim of our research was the assessment of the level of physical fitness of children aged 6 and 7 against the background of the standards of the

International Physical Fitness Test. The question that we tried to address was the following: what is the level of physical fitness of the examined 6 and 7 year-old children against the background of the Polish national standards?

Material and methods

The assessment of the level of physical fitness of children aged 6 and 7 was performed by means of the International Physical Fitness Test (Pilicz, 2002). The examinations were conducted in September 2004 in the Primary School in Czarny Bôr. The material constituting the subject of the present elaboration was collected in cross-sectional examinations which included a group of 78 children aged 6 (17 girls and 20 boys) and aged 7 (21 girls and 20 boys).

Results

Comparing the arithmetical means of the results (points) achieved by 6 and 7 year-old girls we came to the conclusion that they are below the level of 50 points assumed in the test as the average level of physical fitness of children in Poland. 6 year-old girls achieved a lower assessment of the general physical fitness than the standards elaborated in 2002 by 20,6 points whereas 7 year-old girls by 7,4 points. On this basis we can conclude that both younger and older girls are characterized by a low level of the general physical fitness in comparison to the standards presented in the test. Comparing the boys' (aged 7 and 7) results with the standards of 2002 we noticed, similarly to girls, a lower level of the general physical fitness than the average level of physical fitness of children in Poland. The 6 year-old boys achieved a lower assessment of the general physical fitness than the test standards by 19,2 points whereas the older boys got the result at 8,6 points.

Conclusion

The achieved level of the physical fitness by the examined children aged 6 and 7 is low and unsatisfactory. It is worth pointing out that children aged 7, both girls and boys, do not achieve the level of the general physical fitness and the level of the particular motor features, i.e. strength, speed, agility and power, that was presented by the 6 year-old children 20 years ago (Surynt 2003).

References

Pilicz S. (2002), Points of the level of physical fitness of the Polish young people according to the International Physical Fitness Test. Criteria of measuring of organism's physical efficiency by means of Cooper's test. Warszawa.

Surynt A. (2003), Physical and motor development of children aged 6 and 7 as a criterion of the age of starting school education. Human and movement, 1(7), pp. 82-91.

INDICES OF WAIST CIRCUMFERENCE AND THEIR RELATIONSHIP WITH TOTAL BODY FAT AND SUBCUTANEOUS ABDOMINAL FAT IN MIDDLE-AGED MEN AT RISK OF METABOLIC SYNDROME

Scott, A.T., Woolf-May, K., Swaine, I.L.

Canterbury Christ Church University, Canterbury, Kent, CT1 1QU, UK, United Kingdom

Introduction: Waist circumference, waist:hip ratio and waist:height ratio are used as simple anthropometric measures of body fat, in relation to health risk. The purpose of this study was to explore the relationship between waist circumference (WC), waist:hip ratio (W:HP) and waist:height ratio (W:HT), and body fat percentage and abdominal subcutaneous fat in middle aged men at risk of metabolic syndrome.

Methods: Twenty four men with a mean age 53.33 ± 7.72 yrs, height 1.79 ± 0.05 m, body mass 94.78 ± 14.59 kg and WC 105.89 ± 12.14 cm participated. WC was measured at the level of the umbilicus and hip circumference was measured at the largest circumference of the hips above the gluteal fold. Height was measured using a stadiometer (Seca) and W:HT and W:HP were calculated. Body fat percentage was estimated using 7 site sum of skinfold thicknesses (SF-fat) and air displacement plethysmography (Bod Pod; BP-fat) an abdominal subcutaneous adiposity was estimated using abdominal (AB) and suprailiac (SI) skinfolds. The relationships between waist circumference indices, body fatness and abdominal adiposity were explored using Pearson's product moment bivariate correlation.

Results: Each of the 3 waist circumference measures correlated with both SF-fat and BP-fat (r≥0.529; P≤0.011), and with AB and AB+SI (r≥0.534; P≤0.010). The relationships between SF-fat and WC (r=0.673; P<0.001), and between SF-fat and W:HT (r=0.645; P=0.001) were stronger than the relationship between SF-fat and W:HP (r=0.343; P=0.11). However, the relationships between BP-fat and WC (r=0.711; P=0.006), BP-fat and W:HP (r=0.687; P=0.010) and BP-fat and W:HT (r=0.690; P=0.009) were all strong but showed a similar pattern to the SF-fat measures. The relationships between abdominal skinfold thicknesses and the waist indices was strongest when abdominal fat was expressed as AB+SI rather than AB alone. The relationship between AB+SI and WC (r=0.668; P>0.001) was the strongest, followed by AB+SI and W:HT (r=0.609; P=0.002) and AB+SI and W:HP (r=0.433; P=0.035).

Conclusion: Despite the smaller numbers in this study, these relationships between waist indices and subcutaneous abdominal fat in middle-aged men at risk of metabolic syndrome are similar to the findings of Han et al. (1996), who argued that a simple measure of waist circumference was most reflective of abdominal fat, measured by computed tomography. In the present study, waist circumference was also most closely associated with total body fat percentage in these men, which has not been previously reported specifically in men at risk of the metabolic syndrome.

Reference:

Han TS, Lean EJ and Seidall JC (1996). Waist circumference remains useful predictor of coronary heart disease. BMJ 312: 1227-8.

THE IMPACT OF SWIMMING AND ROCK CLIMBING ON BLOOD LIPIDS AND BODY COMPOSITION IN MIDDLE-AGED MEN

Soultanakis, H., Vartelatos, G., Platanou, T.

Faculty of Physical Education and Sport Sciences, University of Athens, Greece, Greece

Comparative studies evaluating the health impact of various activities and sports at the recreational level are limited. The purpose of this study was to evaluate the lipid and body composition profile of middle aged men who engage in swimming, rock climbing or sedentary lifestyles. Twenty eight men, between 40 and 60 years old were distributed in three different groups. The sedentary group (Sed) led very sedentary lives with office type jobs (N=11). The second group (N=9) of recreational swimmers (Swm) and the third group (N=8) of climbers (Clmb) trained for at least 3 times per week for two consecutive years in their respective activity. Measurements of body weight, height and skinfolds were used to determine body mass index (BMI) and percent fat. Blood cholesterol and triglycerides were measured via the automated portable analyzer, by Roche. Statistical analysis was performed by multiple analyses of variance (MANOVA). Significantly lower values of both BMI and cholesterol levels were evidenced in both groups of recreational athletes when compared to sedentary controls (p<0.01). However, sedentary men and swimmers had significantly higher percent fat values than rock climbers (p<0.05). Specifi-

cally mean values of BMI , cholesterol and percent fat for all three groups were respectively: (24.6±2.35 kg/m2; 186.25±21.53 mg/dl; 19.13±3,22%) for the Clmb group, (24.88±2.58 kg/m2; 212.22±40.98 mg/dl; 22.70±5.60%) for the Swm group and (30.66±2.92 kg/m2; 256.81±25.76 mg/dl; 24.86±3.74%) for the Sed group. Triglycerides didn't differ in any of the groups. As it appears, all values of both groups of recreational athletes ranged within normal levels, while the Sed group values were above normal ranges. Both swimming and climbing appear to play a protective role as far as the development of hypercholesterolemia and obesity. However, climbers appeared to have a better overall profile by demonstrating signifant lower percent fat and lower mean values of the other measurements. This could possibly be attributed to the type of training and the level of intensity of the two different sports. Swimmers, trained continuously and at low intensities, while climbers trained in interval bouts of high intensity. Lipid profiles and body composition analyses as well as evaluation of physical fitness, training type and sport performed, may offer good prognosis and serve as the basis for exercise prescription to people of all ages (Giada F et al., 1995; Hafa Y et al, 2000).

1. Giada F, Vigna GB, Vitale E, Baldo-Enzi G, Bertaglia M, Grecca R, Fellin R. (1995). Effect of age on the response of blood lipids, body composition, and aerobic power to physical conditioning and deconditioning. Metabolism. 44 (2): 161-5.

2. Hafa Y, Nakajika K. (2000). Lifestyle and serum lipids and lipoproteins. Atheroscler Tromb,7(4): 177-197.

EFFECTS OF VIGOROUS AND MODERATE AEROBIC EXERCISES ON THE GENERAL HEALTH OF NON-ACTIVE MEN

Afzalpour, M.E. 1, Gharakhanlou, R. 2, Gaeini, A.A. 3, Seghatol Eslami, A. 1

1 Birjand University, 2 Tarbiat Modares University, 3 Tehran University, Iran

In order to study of the effects of vigorous and moderate aerobic exercises on the general health of non-active men in physical, anexiety and sleeping disorder, social output disorder and depression aspects, 43 individuals volunteered in this research. They were randomly divided into two experimental groups and a control group. Duration of training was 8 weeks and subjects 3 sessions per week and each session 30-45 minutes performed assigned aerobic exercises. Experimental group I (n=15) carried out vigorous aerobic exercise at 80 - 85, and experimental group II (n=16) carried out moderate aerobic exercise at 60-65% of maximal reserve heart rate. Control group (n=12) didn't perform any physical activity through research. General health of participants were evaluated by general health questionnaire (GHQ-28) of Goldber & Hillier in the initial and after 8 weeks of exercise. We applied one-way analysis of variance and LSD test for revelation results of study. Results showed significant improvement in physical signs($P<0.04$), and anexiety and sleeping disorder($P<0.03$) in the vigorous exercised subjects after 8 weeks. In addition, we observed an inclination for improvement (23/35 % reduction) in the general health score of moderate aerobic exercise group. Based on the results, performing of vigorous aerobic exercise at 80-85% of maximal reserve heart rate improved physical signs and decreased anexiety and sleeping disorder, and thereby caused better general health in the participants. Furthermore, change patterns of moderate aerobic exercise group suggest that the general health of these subjects improved and it may reach to the significant levels by increasing duration or frequency of weekly exercises.

RELIABILITY AND VALIDITY OF A NEW TEST TO ASSESS PHYSICAL PARAMETERS RELATED TO FALLS IN THE ELDERLY

Giné-Garriga, M., Guerra-Balic, M.

Facultat de Psicologia, Ciències de l'Educació i l'Esport BLANQUERNA. Universitat Ramon Llull, Spain

Introduction. The impact of physical decadence caused by the aging on the life style of the elderly includes several aspects such as the appearance of pain, decrease in autonomy and independence, a worsening of the postural attitude and the corporal image, as well as a decrease in strength, coordination, speed, balance, flexibility and security, among others.

Due to their frequency and its personal, social and economic consequences, falls in the elderly represent a high sanitary cost, but more importantly, a limitation of their everyday activities and the consequent welfare decrease.

The assessment and treatment of the physical parameters associated to falls (intrinsic factors) is a complex task. Many of the available instruments have been developed for research purposes and are not suitable for use with older adults because of their length, complexity, safety concerns, and/or equipment requirements. Despite of the fact that several tests have been successfully used with older adult populations, each test is designed to assess a specific physical parameter. However, fall risk is indeed multifactorial and hence, difficult to capture with such specific tests.

Purpose. Design and implement a new test that encompasses the four principal physical parameters associated to the risk of falls in people older than 65 years: lower extremity strength, coordination, balance and gait.

Methodology. The new test will measure balance and gait with a modification of the Extended Timed-Get-Up-and-Go Test, coordination will be measured with a manual and cognitive task, while lower extremity strength will be measured with weight lifting in specific conditions.

A sample of 10 subjects and the interjudge reliability method will be used. Each subject will do the test once in front of four judges who will assess each subject individually. The factor K of Cohen is then calculated. The validation will be done with 30 subjects and we'll calculate the index of relation between the new test and the already existing ones.

Foreseeable results and Conclusions. The application of a single test that considers the main different physical parameters associated with the risk of falling will be more efficient than the application of several and independent tests. Its simplicity will allow control programs of prevention and intervention of physical activity in future studies.

GENDER AND OUTDOOR PHYSICAL ACTIVITY RELATIONS: CONSIDERATIONS FOR ACTIVE TRAVEL INITIATIVES AND ENVIRONMENTAL SUSTAINABILITY

Kilgour, L.

University of Gloucestershire, United Kingdom

High levels of physical inactivity are a cause for concern in the UK at present and, to add to this problem, women consistently report lower levels of physical activity than men. In terms of physical activity and health policy, the Government are looking to increase physical activity levels in the population to 70% by the year 2020. However, with many exercise scientists and health professionals identifying physical activity performed as part of daily life the only way for people to begin to reach recommended weekly levels of physical activity, some physical activity and health promotion specialists are looking to the outdoor environment to provide the solution to the problem.

It has been reported that certain environments engender physical activity participation, while other environments can prevent physical activity, with psychological, social and cultural explanations for this. Similarly, we have evidence from neighbouring European countries

that both urban and rural landscapes can be developed to increase outdoor physical activity opportunities that are seen to be both safe and inclusive. Research that has focused on active travel initiatives often produces findings that lean towards the need for improved provision of existing facilities, particularly where accommodating women's needs are concerned. Further, research that has focused solely on women's participation in physical activity has outlined the changes required to outdoor environments that will provide more safer and pleasant opportunities.

This poster presents findings from a recent large scale study that focused on women's experiences of outdoor physical activity, with specific reference to feelings of fear and perceptions of risk. These findings link in with broader issues relating to environmental sustainability, presently a key issue for many western leaders. The main argument here is that by making outdoor environments safer for outdoor physical activity to be performed by 'at risk' groups such as women, and linking this with improved public transport, while at the same time lowering car use, we can move some way to increasing physical activity levels in the population, through lifestyle physical activity such as active travel, while simultaneously protecting the environment.

Burgess, J. (1993) Perceptions of Risk in Recreational Woodlands in the Urban Fringe, London: Countryside Commission.

Department of Culture, Media and Sport/Strategy Unit. (2002) Game Plan: A Strategy for Delivering Government's Sport and Physical Activity Objectives. London: Strategy Unit Cabinet Office.

Joint Health Surveys Unit. (2003) Health Survey for England: Summary of Key Findings. London: HMSO.

Stokols, D. (1996). Translating social ecology theory into guidelines for community health promotion. American Journal of Health Promotion, 10(4), 282-298.

THE RELATIONSHIP BETWEEN THIGH SKINFOLD MEASURE, HAND GRIP STRENGTH AND TRUNK MUSCLES ENDURANCE: GENDER DIFFERENCES

Doymaz, F., Cavlak, U., Kuçuk, M.

Pamukkale Univ.,School of Physical Therapy & Turkish Red Crescent Society, Denizli Medical Center, Turkey

Aim: The aim of this study was to analyze the relationship between thigh skinfold measure, hand grip strength and trunk muscles endurance in terms of gender.Methods: In the current work 111 females and 89 males, totally 200 healthy subjects with mean age of 31.58±13.78 years without any acute disease were evaluated. Trunk muscles endurance was examined using curl up, static back endurance and horizontal side bridge tests (1, 2, 3). The results were analyzed by Kruskal Wallis test, Mann-Whitney U test with Bonferroni correction and Spearman's correlation coefficient.Results: Significant differences between females and males were found regarding curl up and horizontal side bridge tests (p≤0.05). However there was no difference concerning static back endurance test scores between both sexes (p>0.05).We found a negative relation between thigh skinfold measure and all trunk endurance tests among females (range; r=-0.454/-0.501). Rather a negative poor relation was also found among males (range; r=-0.182/-0.348).We found no correlation between hand grip strength and trunk endurance test scores among females. However, there were a significant positive correlation between hand grip strength and endurance tests except for static back endurance test among the males.Conclusion: We conclude that physical characteristics like skinfold measure and hand grip strength are also important factors which may affect the trunk muscles endurance in healthy subjects. Therefore, gender differences related to skinfold measure, hand grip strength and trunk muscles endurance should also be taken into account. Thus physical therapists should evaluate properly the physical characteristics of the healthy subjects while planning muscle endurance programs to improve their quality of life.

References:

1.Desrosiers J. et al. Isometric grip endurance of healthy elderly men and women. Arch Gerontol Geriatr. 1997 Jan-Feb;24(1):75-85.

2.Ito T et al. Lumbar trunk muscle endurance testing: An inexpensive alternative to a machine for evaluation. Arch Phys Med Rehab 1996; 77:75-9.

3.Davies BN. et al. Gender difference in the relationship of performance in the handgrip and standing long jump tests to lean limb volume in young adults. Eur J Appl Physiol Occup Physiol. 1988;58(3):315-20.

ANALYSING THE EFFECTS OF PHYSICAL CHARACTERISTICS ON TRUNK MUSCLES ENDURANCE IN HEALTY SUBJECTS

Doymaz, F., Cavlak, U., Kuçuk, M.

Pamukkale Univ.,School of Physical Therapy & Turkish Red Crescent Society, Denizli Medical Center, Turkey

Aim: The purpose of this study was to investigate the effects of physical characteristics such as; age, gender, mass, height, body mass index (BMI) and waist-hip ratio on trunk muscles endurance. Methods: In the current work 111 females and 89 males, totally 200 healthy subjects with mean age of 31.58±13.78 years old without any acute disease participated. Trunk muscles endurance was examined using curl up, static back endurance and horizontal side bridge tests (1, 2, 3, 4).Subjects were classified into four different groups in terms of age: first group subjects were younger than 20 years old, second group subjects were between 20–30 years old, third group subjects were between 30–40 years old and fourth group subjects were 40 years old and more. Each group was consisted of 50 subjects. The results were analyzed using by Kruskal Wallis test, Mann-Whitney U test with Bonferroni correction and Spearman's correlation coefficient. Results: The first group had the best scores concerning endurance tests. On the other hand the fourth group had the lowest scores. There was a significant negative correlation between all trunk muscle endurance tests and age (p≤ 0.05). When all subjects were analyzed in terms of gender; males had better scores comparison to the females regarding the curl up and horizontal side bridge tests (p< 0.05). However, there was no correlation between gender and static back endurance test (p>0.05). There was a significant negative correlation between mass, BMI and endurance tests scores (p<0.05). We also found a significant positive correlation between height and the endurance tests scores (p<0.05). And also there was a significant negative correlation between waist- hip ratio and curl up, static back endurance test (p<0.05). However no correlation was found between waist- hip ratio and horizontal side bridge test (p>0.05).We conclude that increasing age, mass, BMI and waist- hip ratio are important factors which cause a decrease in endurance tests scores in healthy subjects (5). We suggest that the effects of physical characteristics on trunk muscles endurance should be taken into account while planning endurance programs for healthy subjects. References:1.Smith DA et all.: Abdominal diameter index: a more powerful anthropometric measure for prevalent coronary heart disease risk in adult males. Diabetes Obes Metab. 2005 Jul;7(4):370-80. 2.Plowman SA.:Muscular strength,endurance and flexibility Assesments.Fitnessgram Reference guide.The Cooper Institude Dallas.2001. www.cooperinst.org. 3.Liebenson C.: Documentation of physical capacity: It's purpose in rehabilitation. Dynamic Chiropractic, 2000. Volume 18,issue 08. 4.Ito T et all.: Lumbar trunk muscle endurance testing: An inexpensive alternative to a machine for evaluation. Arch Phys Med Rehab 1996; 77:75-9. 5.Brill PA et all.: Muscular strength and physical function. Med Sci Sports Exerc. 2000 Feb;32(2):412-6.

BMI, %FAT AND VO2MAX IN COLLEGE FEMALES

Nakhosin Roohi, B., Talebi, E.

Islamic Azad University-Ardebil branch, Iran

Aims:
The purpose of this study was to examine obesity and fitness of the female staff of Ardebil Azad University.
Material and method:
37 staffs of Ardebil Azad University participated in this study voluntarily. Primary measurements of interest in the present study were height, body mass Index, subcutaneous skin folds, and cardio respiratory fitness determined by1 mile walk test.
Results:
The achieved measurements were considerable, especially in %Fat and BMI and it's relation to VO2max, according to the other researcher's achievements. According to finding, women in Ardebil Azad University are more obese and less active.
Conclusions:
Social/lifestyle factors such as the level of education, marital status, exercise habits, dietary habits and smoking habits may be related to overweight/obesity in females of Ardebil. It was concluded that there isn't sufficient sport facilities and equipments for females in Ardebil Azad University and there are some cultural problems lead to females be low active.

THE RELATIONSHIP BETWEEN PHYSICAL FITNESS WITH ANXIETY AND DEPRESSION OF DORMITORY FEMALE STUDENTS OF KURDISTAN UNIVERSITY

Sadeghi Boroujerdi, S.

Kurdestan University, Iran

Graduates who are in dormitory are more exposed to stresses such as anxiety and depression due to special problems for their health (especially girl students).
Educational experts and researchers have always tried to find the ways to prevent and reduce psychological disorders among this large social stratum. However, the effect of physical fitness on anxiety and depression has not attracted due attention.
The purpose of this study was investigating the between the physical fitness and anxiety and depression on the female students in dormitory of Kurdistan University in Iran.
Statistical population of this research includes all the female students in dormitory of Kurdistan University (874 students) and 240 of them participated in this study.
Statistical way of this research for the descriptive statistical, t- tests and Pearson Correlation were used.
The descriptive results showed that the level of physical fitness of dormitory female students was nearly the same and were in level of average.
The level of anxiety of dormitory female students was very high from mean.
The level of depression of dormitory female students was very high from mean.
The Hypothesis conclusions showed that: There was not a meaningful correlation between physical fitness with depression and anxiety among dormitory female students.
A significant correlation exists between anxiety and depression of dormitory female students.
A meaningful difference between physical fitness, anxiety and depression of dormitory female students was not observed.

THE EFFECT OF CREATINE SUPPLEMENT ON STRENGTH, ENDOURENSE AND COMBINATION ATHLETICS PERFORMANCES

Senobar Tahaei, S.N., Sadeghi Boroujerdi, S.

Kurdestan University, Iran

In recent years, using creatine supplements, especially in different courses of body building have been had most popularity, so it emphasized on necessity of researching in this case, to do that whether answers and information that are in this case should be increased or if peoples believes about help of acrogenic with abuse creatine is correct or not.
In this way present study that is a semi experimental study with pre-test plane and post-test in two groups of experimental group (using creatine) and control group (using something like drug) is considered that influence of using creatine mono hydrate (using 20gr daily in 6 alter native days and using 2gr in 28 days later) with resistance exercises 8 weekly on actions of powerfully, resistance and body combination (fat weigh and lean body mass of body) body builders are investigated.
In order to do that, among 43 athletes in Kurdistan University that statistic society was doing this study, 20 individuals that are choose and in same situation divided to two groups of experimental and control. Then all of sequences studies are performed regularly.
Powerful resistance and body combinations tests are performed among both of pre-test group and post-test group.
So finally with statistic analyzing, the results of pre-test and post-test of influence of using creatine complement will recognized and finally these follow results are found.
1- Signification increasing of power in scat movements front arm and bench pressing group of using creatine.
2- Signification increasing resistance in scat movements front arm and bench pressing group of using creatine.
3- Increasing weight-increasing weight lean body mass without change in weight of body fat in group of using creatine.

COACHES AND THEIR FIGHT AGAINST DOPING

Peters, C., Selg, P.J., Ohanian, J., Habermann, K., Schulz, T., Pabst, H., Michna, H.

Technical University of Munich, Germany

Coaches are very important attachment figures in athletes surroundings. Frequently, they were addressed by their athletes concerning several sport specific aspects. With regard to doping there are just a few academic examinations about the coaches´ knowledge and

their point of view (Laure et al. 2001). Therefore, we conducted a project (VF 0407/03/41/2003-2004, financially supported by the Federal Institute of Sport Science/Bonn) to examine doping related state of knowledge of athletes and coaches from diverse sports associations as well as flow of information.

By means of a written survey, we asked 620 coaches of different levels (reflux 40.7%) and 1757 high-level athletes (handicapped and non-handicapped; reflux 45.6%) about several doping related aspects.

Coaches claim to be frequently reflected in the doping problem. Besides health aspects, it seems to us, that doping controls and fair play are the most commanding spots. Most disturbing is, that the coaches are poorly informed and just 50% of them owned the current forbidden list. However, most coaches are not proactive and want to be informed by their sports association.

Additionally, a lots of athletes claim to frequently think about doping related topics and in many cases, the coach is their main contact person. Athletes are not proactive at all but were informed by colleagues or other parties. Often national anti-doping associations, diverse booklets or internet information are unknown by athletes.

We conclude, that there are urgent needs to change the information policy of sports associations, Olympic training centres, coaches and physicians which was critically evaluated by athletes. The majority of athletes know the severe side-effects of doping. One third of the athletes could observe physical and psychological side-effects of doping substances used by their colleagues.

The number of coaches, who rate their relation to the athlete as "good" is not to be sneezed at. Therefore, we think that this could be a chance for doping prevention and one efficient way to go. But this requires, first of all, to enhance the state of knowledge of the coaches. They need to use the current knowledge on doping to convince their athletes of the perilous side-effects of doping and starting to lecture them at an age of at least 10 to 15 years. This requires, that not only coaches of high elite athletes but also of lower degrees and levels, who mainly work with younger athletes, need to be informed about doping in particular.

Laure P., Thouvenin F. & Lecerf T. (2001). Attitudes of coaches toward doping. Journal of Sports Medicine and Physical Fitness, 41, S. 132-136.

EFFECTS OF MODERATE OUTDOOR-CYCLING VS WALKING ON AEROBIC ENDURANCE, ANTHROPOMETRIC VALUES & BODY COMPOSITION DURING 5 MONTHS MONOTHERAPEUTICAL THERAPY

Sperlich, B., Wilke, C., Wehner, S., Wienke, C., Knigge, H., Latsch, J., Montiel, G., Falkowski, G., Predel, H.-G., Froböse, I.

German Sport University, Cologne, Germany

Introduction: Obesity is one of the most serious health problems in future. Aerobic training (AT) appears to play a critical role in the loss & maintenance of body weight (BW). A key link to BW loss with AT seems to be an increase in aerobic capacity (AC) & in muscle mass (MM). The specific differences of the most common endurance modalities outdoor-cycling & walking are yet to be investigated. The aim of the study was to investigate the effects of moderate cycling, walking & jogging during a 5 month monotherapeuthic intervention in obese men as the differences may pertain to AC, anthropometric values & body composition.

Method: 60 elderly physically inactive overweight men (54.3 ± 4.9 yrs; 98.1 ± 8.4 kg; BMI 30.5 ± 2.0 kg/ m2) participated in two training groups (TG): bicycling group (BG, n=16); walking group (WG, n=24) & one control group (CG=20). The subjects were randomly selected into TG or CG or chose their preferred exercise modality. All subjects were examined before & after 5 months training. Workload (WattLa2) & heart rate (HRLa2) at 2mmol/l blood lactate (La2) were analysed in an incremental WHO-ergometer test (ET) & a field test (FT). BW, body fat (BF), MM & waist-to-hip-ratio (WHR) were noted. BW, BF & MM were measured using standardized bio-impedance. Both TGs exercised 3 times per wk at an intensity of La2. At first, training sessions (TS) covered 60 min, after 6 wks 90 min. Every TS was supervised by three coaches. CG was briefed not to perform any exercise during the complete study.

Results: ET: WattLa2 increases in all groups in ET ($p<0.01$) whereas HRLa2 remained unchanged ($p<0.05$). FT: Walking speed at LA 2 only increased ($p<0.01$) in WG. HR La 2 did not change in all groups ($p>0.05$). BW reduced in BG ($p<0.01$). There were no difference in WG & CG ($p>0.05$). No changes were found in MM in all groups ($p>0.05$). BF [kg] decreased in BG ($p<0.05$) & WG ($p>0.01$). There were no changes in CG ($p>0.05$). WHR decreased ($p<0.01$) in BG but not in CG & WG ($p>0.05$).

Discussion: Both TG show a visibly increase in AC (16-18%) after AT in ET. HR remains unaltered at higher workrate after AT which most possibly results from a greater peripheral oxygen utilisation & economical cardiac workrate. Cycling seems to have no effect on FT. Decrease of BW in BG most possibly results from an initial higher BW compared to the other groups. BW decrease seems to result from loss of BF. Chronic AT (3 times 60-90 min per week) additionally to daily activity without specific strength training does not affect MM increase, which seems to be one of the key links to BW loss.

Conclusion: Cycling & walking with comparable training stimulus but different muscle impact as monotherapeuthic intervention improved AC significantly. Moderate Cycling does not effect walking performance but vice versa. BW loss results from loss in BF. Chronic ET as practiced in this study does not increase MM.

ANALYSIS OF ANTHROPOMETRIC CHARACTERISTICS OF CADETS AND STUDENTS

Plavina, L.

National Defence Academy of Latvia, Latvia

Introduction

Physical activities and health-related behaviour is important for everyone to keep physical and mental health (1,2).specially for person who decides to connect his life to Army or to Sport(3).

The last research of public health indicated that individual spend for physical activities less time than in previous period. The rate of some diseases that connected to physical inactivity such as heart attack, heart failure stroke, obesity diabetes bone diseases increase.

The target of our work is to analyse and compare anthropometric characteristics of cadets, next officers and students –next Sport and biology teachers

Material and methods

We examined two groups: cadets- next officers and students- next Sport and biology teachers. We fixed main anthropometric parameters (height, body mass), determine anthropometric indices and fix physical fitness level (according Harvard step-test results).

Results

Analysis of the height parameter shows that average data of body height were close in the examined groups of cadets and students. The average body height parameters in the cadets` group in 2002-2004 were from 179.8 ±1.11cm to185.2±1.2 cm. Student's height parameters in the same period were close to cadets' data from 175.9±12.6 cm to 180.5±9.7 cm. The body mass is the most yielding characteristic.

The body mass parameters in cadets' group were from 78.9±1.8kg to 81.2±4.3 kg. In the students' group average data of body mass were lower 70.3±5.34 kg to 79.2±11.6kg Absolute characteristics need evaluation by index-coefficient system using. The weight-height index characterised the load of body mass upon one height cm .The weight-height index for cadets in 2002 –2004 exceeded top standards over 5-7 %, from433.7±45.6 g per cm to 441.7±10.7 g/cm. In students group weight-height index data were closed to standards, from 394.8±18.3 g/cm to 437.6±62.2 g/cm. We used physical load test – Harvard step tests for evaluation the physical fitness. The HSTI data in cadets group support the good level of physical fitness in2002-2004 from72.7±10.8 to 79.5±8.2. Students' physical fitness level according data of Harvard step-test were in the same level – good level of physical fitness, from 65.7 to 81.5±13.8.

Conclusion

1. Students next Sport teacher and cadets – next military officer have good level of physical fitness;

2. Height parameters of cadets and students are closed;

Body mass parameters of cadets are over standards per 5-7 %and over the average data of students;

References

1.E.Jalakas,M.Järvelaid (2004) Paper on Anthropology XIV,.-Tartu.- P.112-116.

2.M.Ojamaa,et all (2004) Paper on Anthropology XIII,.-Tartu. – P176-184.

3.A.Umbrasko (2004) Scientif.Proceedings of RTU Vol 8(6), Riga.-P 230-236.

THE DIFFERENT TYPES OF ISOKINETIC STRENGTH TRAINING IN REHABILITATION PROGRAMS OF OVERWEIGHT WOMEN

Sawczyn, S., Kuehne, T.

Academy of Physical Education and Sport, Gdansk, Poland, Poland

Strength exercises represent of great importance form of physical loads in rehabilitation programs of overweight women. Few studies have focused on the impact of resistance exercise training on fat metabolism. However, the effect of different types o strength exercises for treatment of obesity is not clear. The aim of the study was to compare the effect of low- and high resistance isokinetic strength training in rehabilitation training program middle age women without a concomitant diet on body mass and resting metabolic rate.

19 untrained overweight female (38-49 yrs, BMI 33,07±2,71 kg/m2) were matched for age, body mass index, training history and randomly assigned to high-resistance (group 1, n=10) and low-resistance (group 2, n=9) training groups. The subjects of group 1 were used supervised slow-speed resistance isokinetic strength training (Concept device) the lower and upper body at 75-85% and 60-70% of the individual 1RM (8-10/12-15 repetitions per set, 3 sets) 2 day per week for 16 weeks (duration of one session 80 min). The subjects of group 2 were used high-speed resistance isokinetic strength training. Baseline 1 RM testing was completed every week. The determining of fat folds and oxygen uptake in supine rest (indirect calorimetry – Cosmed) was performed before (week 0), on week 8 and 16.

The results showed that significant variation in resting oxygen uptake was observed between baseline measure (week 0) and 16 weak in both groups. Mean lower and upper body maximal strength significantly increases in-group 1 and 2 (10 and 16%, respectively). BMI in (1) and (2) groups was decreased (-6,7 and -7,1%). From 8 to 16 weeks training resting oxygen uptake significantly increase in low-resistance training group only from 108,9± 4,9 on week 8 to 126,5± 6,2 ml/min/m2 on week 16 ($p<0,05$). Post-trained decrease of percent of fat in group 2 was significantly more (-8,7±1,3%) than in group 1 (-5,2±1,1%). Resting oxygen uptake related to fat-free body mass showed a significant increase in low-resistance training group only (from 4,17± 0,06 to 4,98± 0,07 ml.kg-1.min-1).

We concluded that high intensity isokinetic low- and high-resistance strength training for 8 and 16 weeks significantly improve resting metabolic rate. The results support the supposition that strength training represents an adequate alternative to aerobic endurance training in women rehabilitation training programs. These data indicate that consideration of the role of physical exercises, as a mere factor of caloric expenditures is insufficient for explanation of its full effects, including the case of excessive weight rehabilitation. Available data demonstrate that low-resistance (high-velocity) strength isokinetic exercises are a more effective factor for enhancement in rehabilitation training the efficiency of metabolism self-regulation in obese women by increasing of energy expenditures in post-exercise rest in comparison to high-resistance exercises.

MUSCULAR ACTIVITY, AREA PRESSURE AND COMFORT RATING IN COMBINATION WITH ERGONOMICAL BICYCLE HANDLE BAR AHS FROM HUMPERT©

Sperlich, B., Niedermeyer, C., Guettge, C., Froböse, I.

German Sport University, Cologne, Germany

Introduction: Own findings show cyclist complaining about discomfort in hand (H) and wrist (W). Stretching of the ulnar nerve in W due to radial or ulnar abduction and chronic pressure (P) on H leads to numbness and pain in H and fingers. Common straight handle bars (HB) are not adjustable to the user´s anatomy and seem to increase chronic pain in H during cycling. The aim of the study was to investigate whether an adjustable HB system (AHS) may decrease P and electro-myographic activity (EMG) and increase comfort in everyday cycling.

Method: Study 1: 10 students (174,2±6,1cm; 78,2±8,7kg) participated to evaluate EMG in right arm of m. flex. and ext. carpi rad., m. brachioradialis, m. triceps med. brachii, m. deltoideus post., m. trapezius ascend in 16 different HB crank angles (HBCA) and bar end angles (BEA). The subjects cycled at 70 rpm at 1,0 Watt/kg for 60 seconds. HBCA were positioned randomly with a goniometer. Feeling of comfort (CR) was rated after every HBCA with an own developed scale (0 comfortabel-10 uncomf.). Study 2: 6 students (173,5±7,0cm; 65,8±8,6kg) participated to investigate P (Tekscan) on HB. Pmax was measured in 10 different HBCA and BEA. Test procedure and apparatus were equal to study 1.

Results: EMG differences were only visible in m. ext. carpi uln.: All BEA (0°, 20°,40°, 60°) and HBCA of 37,5° showed the lowest EMG in all subjects (2,4; -4,7mV). Highest EMG was found at HBCA of 7° and 0° (8,7 and 10,1 mV). CR: All BEA tests (0°, 20°; 40°; 60°) were rated most comfortable (0°=4,9; 20°=5,5; 40°=6,5; 60°=5,5). In most cases, the straighter HB was mounted the least comfortable W position was rated (0° HBCA= 7,5; 7,5° HBCA=7;2). P: We measured 3,4 times higher mean P on med. vs lat. H (220,6 vs 754,6 g/cm²). 10° and 30° BEA position showed lowest Pmax (2599,7 and 2176,3 g/cm²). Highest Pmax were found at vertical (10°-30°) and horizontal HBCA of 30° (3681,7 and 2933,7 g/cm²).

Discussion: Only m. ext. carpi uln. shows a obvious difference in EMG. For further investigation M located closer to HB seem to show clearer results. Numbness and pain in upper arm M from these findings should not necessarily resolve from a difference in HBCA. CR values underline the EMG data. In tendency, the straighter HB becomes the more uncomfortable the position is rated. Best values in EMG and CR are found in all BEA positions. HBCA of 30° increases P on W compared to HBCA of 0°-15° most likely because the trunk is held

completely by upper arm M. Therefore the straighter HBCA becomes the back M become more activated and hold the vertical trunk actively.

Conclusion: Common HB with fixed angles can not necessarily be adjusted to the individual anatomy. HBCA between 22,5° and 37,5° and BEA of 0°-60° show the least EMG activation and highest CR in everyday cycling. For comfortable and painless cycling in H and arms we suggest to mount an AHS with a multi positioning function to ensure a natural individual W angle.

EFFECTS OF SMOKING AND FATIGUE ON HEALTH CONCITION OF DAY AND NIGHT COURSE STUDENTS USING CORNELLMEDICAL INDEX

Sakamoto, N., Sakamoto, K.

Hyogo College of Medicine, Japan

The reduction school taught the Judo as essential training in one hour pre week. In this study, the physical and mental complaints of students were examined after the lecture using Cornell Medical Index(CMI).

Subjects were 196 healthy male students aged 18-23 years old, 107 subjects of the night course and 89 subjects of the day course students. Survey was down on day of judo practice using self-entry method on CMI.

The mode of distribution of complaint numbers of items of physical and mental categories and the rate of complaint of each category were examined between night and day course students. On the eye and ear category, the mode and the rate were (mode : one item, rate : 17.9%) in night course, and (no complaint, 15.2%) in day course. On the respiratory system, these were (six items, 18.5%) in night and (two items, 17.5%) in day. On the digestion system, these were (four items, 14.3%) in night and (three items,12.4%) in day. On the habit, these were (no complaint, 33.8%) in night and (two items, 33.6%) in day. Thus the night course student was more complaints of respiratory and digestion system to compare to that of the day course students. The effect of smoking on health condition was analyzed to 47 smokers and 147 nonsmokers by odds ratio. The odds values were significantly high as 1.68 for respiratory system, 1.32 for digestion system of physical category and 0.77 for maladjustment in mental category. On correlation analyses, smoking was correlated significantly with the respiratory system as r=0.26 and the digestion system as r=0.14. Thus, in these young students, the smoking made increase the complaints of respiratory and digestion system. But smoking effected to decrease the complaints of maladjustment, anxiety and tension as mental function, but did not effect to the depression and anger function. The effects of fatigue on the complaint of categories were examined using odds ratio. The subjects who was complaint of fatigue were 90 subjects of 196 students. The odds rate of fatigue was significant for all categories except the eye and ear category. Especially the muscle, nerves and maladjustment categories shown high the relative risk as 2.72, 2,51 and 2.59 respectively. On the correlation analysis, the fatigue was correlated positively significantly with the respiratory system as r=0.31, with muscle system as r=0.39, with nerves system as r=0.38 and with maladjustment as r=0.34. As a results, for the privation of the adult disease nonsmoking must practice in young persons. It seemed that the fatigue felling was related to the complaints of category of muscle, nerves and maladjustment.

Keywords: judo, fatigue. smoking Cornell Medical Index.

THE EFFECTS OF VITAMIN E , VITAMIN C OR COMBINATION OF VITAMIN E AND C SUPPLEMENTATION ON BIOENERGETICS INDEX

Tarverdizadeh, B., Azarbaijani, M.A., Jourkesh, M.

Islamic Azad University,Branch of Bushehr, Iran

Introduction , Materials and methods

In order to studying the effects of vitamin E , vitamin C or combination of vitamin E and vitamin C supplementation on bioenergetics index (aerobic and anaerobic power)36 physical education college (male) ,were selected non-randomly and they were set in 4 groups randomly .

Average of age ,weight , height and fat percentage of them was (22.48-+1.84)years , (64.93-+7.84)kilograms ,(175.4-+5.66)centimeters and (10.94-+5.29)millimeters , respectively. The period considered for consumption of vitamins by experimental groups was a three week period that in this period the first group consumed dose of (400 mg) vitamin E and second group(1000 mg) vitamin C and third group(400 mg VE plus 1000 mg VC) daily and fourth group (control group) consumed placebo. The test which have been exerted in this research consist of :

1) Assessment of anaerobic power by "RAST" test.

2) Assessment of aerobic power by cooper test. Finally data in four group was analyzed by one and two-way ANOVA statistically method

Results

Result indicated that there was not a significant (p<0/05) different between four group in anaerobic power whereas ,there was a significant (p<0/05) different between four group in aerobic power.

Discussion and conclosions

There fore we concluded that daily consumption of 400 mg vitamin E, 1000 mg ,vitamin C and 400 mg vitamin E plus 1000 mg vitamin C for period of three week dose not have any effect on the basis of improvement of anaerobic power ,whereas have effect on aerobic power.

THE EFFECTS OF SAUNA ON PAIN RELIEF AND RANGE OF MOTION IN RHEUMATOID ARTHRITIS PATIENTS

Tabatabaee, A.

Islamic Azad University - Quchan branch, Iran

Introduction:

Pain and pain relief have always been of great importance to man .The most important symptoms of rheumatoid arthritis is the pain.Sauna bathing may also alleviate pain and improve joint mobility in patients with rheumatic disease.(Hannuksela, 2001).

The physiologic effect of the sauna in human beings has been studied extensively, but only recently have there been studies to suggest sauna can be an effective therapeutic modality for patients .

The purpose of this study was to evaluate the effects of sauna on pain relief and effects on range of motion (ROM) of joints affected in rheumatoid arthritis (RA) patients.

Methods

45 male (RA) patients referring to medical center of mashhad were randomly selected.To extract demographic variables from the questionnaires to measure pain in people who go to rheumatology clinics of medical schools in mashhad According to criteria like being male,some patients were selected.

The patients were then randomly assigned to 3 groups,one group served as the control group while the other two groups use one session or two session of sauna weekly for 28 days.

The severity of pain was measured by visual analog scale (V.A.S.) in day 1,15, and 28 for all groups and day 16 and 29 for the experimental groups.

Results

Analysis of variance showed that the pain before research was the same in all groups.The pain in each group a day before and after sauna was significantly different .

There was a significant difference in reduction of pain between the first and the last day of using sauna among groups .

Next day just after sauna with use of cool water in experimental groups no increasing of pain meantion.

According to result , different groups median on the first day and the last day of the research are significantly different .($t = 7.21$, $df = 44$, $p < 0.05$) .

There was no significant difference in pain reduction in the two experimental groups.

Discussion/Conclusion

The results showed that using sauna causes a remarkable reduction in pain and increase ROM of joint affected specially in joints of the wrists, knees and ankle.

These effects may result from stimulation of sympathic system and in turn relieve pain as reported by sori and stimulate nervous system which causes the comfort and pleasure after sauna .

The result of this research a bout pain relief were similar to Nurmikko and Isomaki and Hannuksela.

According this result, and repeat of research again with more samples, it seems that, sauna maybe reduce pain of rheumatoid arthritis association of other non invasive treatment.

EFFECTS OF PHYSICAL ACTIVITY VERSUS CARDIORESPIRATORY FITNESS ON SELECTED CAD RISK FACTORS IN YOUTH

Al-Hazzaa, H.M.

King Saud University, Saudi Arabia

The aim of this study was to examine the effects of physical activity versus cardiorespiratory fitness on selected coronary artery disease (CAD) risk factors in Saudi youth. Participants were 41 young Saudi males (mean age (SD) = 20.5 (1.6)), came from predominantly middle-class family with good nutritional status. They were divided in separate analyses into two groups, based on levels either above or below the 50th percentiles of physical activity and cardiorespiratory fitness. Physical activity was classified according to the daily time spent above 50% of heart rate reserve (active (n=15) averaged 57.1 +/- 26.2 min/day, and inactive (n=25) averaged 10.9 +/- 7.9 min/day). Cardiorespiratory fitness was classified according to VO2 max levels (fit (n=21) averaged 53.8 +/- 3.7 ml.kg/min, and unfit (n=20) averaged 40.4 +/- 4.3 ml.kg/min. The findings of the present study showed that active young males did not differ significantly ($p < 0.05$) from inactive group in BMI, fat%, abdomen circumference, VO2 max relative to body mass, total cholesterol (TC), triglycerides (TG), LDL-C, systolic (SBP) or diastolic blood pressure (DBP). However, active males had significantly ($p < 0.05$) higher levels of HDL-C (40.5 +/- 5.2 vs 34.3 +/- 6.9 mmol/l) and HDL-C/TC ratio (28.6 +/- 5.9 vs 22.8 +/- 6.8). Fit young males, on the other hands, showed higher values than unfit males in BMI, fat%, abdomen circumference, TC, TG, LDL-C, HDL-C/TC ratio, SBP, DBP and daily time spent in moderate level physical activity. But, when data were reanalyzed while controlling for the effect of body fat%, the differences between fit and unfit males disappeared, except for TG and time spent in moderate level physical activity. It was concluded that cardiorespiratory fitness in youth appeared more important than moderate level physical activity in promoting favorable changes in CAD risk factors. The seemingly positive effects that cardiorespiratory had on CAD risk factors may operate through a lower body fat content.

WALKING LIKE A TOOL OF BODY COMPOSITION AND AEROBIC FITNESS INFLUENCE IN SENIOR WOMEN

Bunc, V., Stilec, M.

Faculty of P.E. and Sports Charles University, Prague, Czech Republic

Age related changes in body composition (BC) have implications for physical function and health. The redistribution and increase of fat and the loss of muscle mass result in substantial decrease in functional capacity. Fat mass (FM) plus fat-free mass (FFM) that contains of protein, water, and mineral, are equal total body mass.

Beginning in middle adulthood, FFM begins to decline gradually both in men and women, primarily due to the wasting of muscle tissue. Similarly like FFM decreases with age the body cell mass (BCM) in subjects without of systematically physical training. The BCM is the sum of oxygen-using, calcium rich, glucose-oxidising cells. This variable may indirectly characterize the ability of human to sustain a mechanical work, and indirectly in seniors as a criterion of independency.

One of the basic themes in exercise science research has focused on the relation of exercise on improvement of aerobic fitness (AF), usually measured as maximal oxygen uptake (VO2max).

When evaluating the influence of physical activity on the human it is important to know its energy requirement. A positive influence is exerted only by those physical activities, when during their application a certain minimal threshold is exceeded. The level depends on the purpose for which these activities are performed. An important physiological concept of exercise in rehabilitation and/or conditioning is the type of work that the body is performing. Dynamic work of endurance character like running, walking, swimming and cycling requires the movement of large muscle masses and requires a high blood flow and increased cardiac output. From these activities the walking is probably the most easily accessible, and often underestimated as a way to increase a subject's overall level of fitness in non-trained subjects or in selected groups of patients.

The aim of this study was to verify the moving programme based on walking for influence of BC and AF in women seniors. The walking at a level of 50 to 70% VO2max (HR ranged from 65 to 90% of HRmax) was used in a group of senior women (n=28, age=68.7±5.0 yrs, mass=69.9±7.9 kg, height=161.0±4.9 cm, body fat=37.5±5.1 %, VO2max.kg-1=25.9.1±4.0 ml.kg-1.min-1). The duration of one exercise session ranged from 30 to 70 min, and was performed 3-5 times a week. The total time of walking exercise ranged from 90 to 250 min. The energy output of walking ranged from 640 kcal (2675 kJ) to 1780 kcal (7740 kJ) [mean 950± 230 kcal - 3970±960 kJ] per week. After

12 months of training, the mass was not altered, body fat was practically constant, and BCM was significantly increased (10±2.7 % - p<0.01). Maximal oxygen uptake increased by 8±3.3% (p<0.01). Similarly as in VO2max was increase the performance in 1600 m walking test by 7.8±2.5 % (p<0.01). We may conclude that exercise with total energy content of 900 kcal (3760 kJ) per week may be enough for reduction of age dependent changes in BC, and AF in senior women.

EFFECTS OF AEROBIC EXERCISES ON THE SERUM OXIDIZED LDL AND TOTAL ANTIOXIDANT CAPACITY IN NON-ACTIVE HEALTHY MEN

Afzalpour, M.E., Gharakhanlou, R., Gaeini, A.A., Mohebi, H., Hedayati, M.

1- Birjand university, 2-Tarbiat Modares Uni., 3-Tehran Uni., 4-Gilan Uni.,5-Shahid Beheshti Uni. , Iran

BACKGROUND : It is suggested that physical exercise causes oxidative stress, which is potentially enhanced damage to muscles and other tissues due to production of free radicals. It seems that regular physical exercise enhances the antioxidant defense system and protects against exercise induced free radical damage. The question that arises is, what is interaction between intensity of aerobic exercises and production of oxidative stress resulting from that exercise?

METHODS : In order to study the effects of vigorous(80-85% 0f maximal reserve heart rate) and moderate(60-65% maximal reserve heart rate) aerobic exercises on the oxidized low density lipoprotein(ox-LDL) and total antioxidant capacity(TAC) , 44 non-active men volunteered for this research. These subjects were divided into three groups randomly, including vigorous aerobic exercise(WAE)(n=15), moderate aerobic exercise(MAE)(n=17), and control(n=12) group. Duration of training was 8 weeks, 3 sessions per week and each session lasted 30-45 minutes. Blood samples were taken 24 hours before the start of protocol(pre-test) and 24 hours after the last session of exercise in both middle (mid-test) and end (post-test) of protocol. Dietary intake of subjects during the 2 months of our study was recorded through a 24-hr dietary recall questionnaire. We measured TAC and ox-LDL by Randox kit of UK and DRG kit of USA, respectively. In order to extraction of results , we applied analysis of variance (ANOVA) test for repeated measures. Least significant difference (LSD) test was also used for coupled comparisons between times , groups and time-group interaction .

RESULTS : We observed that both aerobic exercises did not affect significantly serum TAC and ox-LDL. However, we observed significantly increase in high density lipoprotein (HDL) and HDL/total cholestrol ratio of WAE group(P<0.05) after 8 weeks. There was significantly increase(P<0.05) in maximal oxygen uptake(Vo2max) of both exercised groups after 4 weeks as well. There were no significant relationships among TAC ,ox-LDL and HDL , but we observed that TAC changes have significant negative correlation with total cholestrol(r=-0.65 , P=0.000), triglyceride(r=-0.40 , P<0.02) or LDL(r=-0.44, P<0.01) changes after exercise in all subjects. Besides, there were significant positive correlation among Vo2max and TAC(r=0.36, P<0.01) or HDL concentration(r=0.30, P<0.04). CONCLUSION : Although some of studies shown increases in TAC and decreases in ox-LDL due to exercise trainings, we observed that performed aerobic exercises could not produce oxidative stress, and thereby they did not affect TAC or ox-LDL. Moreover, correlation results suggest that improved physical fitness will be associated with higher antioxidant defense system and lower atherogenic risk factors.

OBESITY AND FITNESS IN COLLEGE MALES AND FEMALES

Nakhostin, B., Rahmani Nia, F.

University of Guilan, Iran

The purpose of this study is to investigate obesity and fitness of the staff of Ardebil Azad University. 69 staffs (32males and 37females) of Ardebil Azad University participated in this study voluntarily. Primary measurements of interest in the present study were height, body mass Index, subcutaneous skin folds, and cardio respiratory fitness determined by1 mile walk test. There weren't any significant differences in BMI between males and females. Fat percent were significantly higher (P<0.05) in women than men. Adversely, VO2max was significantly higher (P<0.05) in men than women. Social/lifestyle factors such as the level of education, marital status, exercise habits, dietary habits and smoking habits may be related to overweight/obesity in both genders in Ardebil. It was concluded that there isn't sufficient sport facilities and equipments for females in Ardebil Azad University and there are some cultural problems lead to females be less active than males.

Poster presentation (PP)

PP3-04 Sports Medicine 1-3 - "Exhibition Hall"

PULMONARY FUNCTION AND BRONCHIAL RESPONSIVENESS TO METHACHOLINE IN RECREATIONAL SWIMMERS: A CROSS SECTIONAL STUDY

Ferrari, M., Corradini, G., Cantoni, B., Giordani, G., Tonellotto, L., Buscemi, L., Masiero, M., De Vita, F., Papadopoulou, C., Lo Cascio, V.

University of Verona, Italy

The aim of the study was to evaluate lung volumes and bronchial responsiveness to metacholine in a cross sectional sample of recreational swimmers.

Seven hundred and eighteen swimmers (age 12-55 years, 419 females) performed force expiratory manoeuvres in to portable spirometer. Measurements included forced vital capacity (FVC) and forced expiratory volume in one second (FEV1). A randomly selected subgroup of 330 subjects, underwent methacholine challenge, expressing the results as the slope of the dose-response curve (the last dose divided by the percent decrease in FEV1 registered at the same time). Data on age, sex, smoking habits, respiratory symptoms, diseases were collected by mean of a standardized questionnaire. The swimmers were divided into three groups on the basis of time spent in swimming pool yearly (group1 <72 hours/yr, 268 subjects; group2 72-95 hours/yr, 216 subjects; group3 >95 hours/yr, 234 subjects). Asthmatics were defined the subjects responding positively to the question "have you ever had asthma?" and reporting respiratory symptoms and/or taking medicine for asthma.

In non asthmatic subjects (n.633) FVC%predicted (group1 101.9± 12.6%, group2 102.3± 13.1%, group3 106.6±15.2%), but no FEV1%predicted (group1 101.6±11.8%, group2 101.1±13.4%, group3 102.4±11.8%) resulted positively related to the hours spent in swimming pool (p< 0.01). In asthmatic subjects (n.75) no significant relationship between FVC and FEV1 on one hand, and swimming pool atten-

dance on the other, was seen (p> 0.05). No association between bronchial responsiveness to methacholine and swimming pool attendance was seen both in asthmatic and non asthmatic subjects.

Our results suggest that 1) recreational swimming is associated with a significant increase of pulmonary volumes in normal subjects, but not in asthmatics; 2) airway calibre and bronchial responsiveness seem not to be influenced by swimming pool attendance.

EXERCISE EFFECTS ON A MODEL OF EXPERIMENTAL ARTHRITIS: HORMONAL CHANGES

Vaisberg, M.W., Bacurau, F., Pontes, F., Costa Rosa, L., Navarro, F.

Federal University of São Paulo, Brazil

INTRODUCTION - Rheumatoid Arthritis is an autoimmune disease characterized by chronic inflammation of the joints. It is well established that exercise improves its evolution in patients and animal models, although the mechanisms responsible for this improvement have yet to be elucidated. Clinical and experimental observation has established the influence hormones have on the evolution of arthritis, which can be explained by the close relationship between the immune and neuroendocrine systems. OBJECTIVE - The aim of these experiments was to study the influence of exercise on the hormonal production in a model of experimental arthritis and the consequences for the course of the disease. MATERIAL AND METHODS - Female Wistar rats, weighing between 150-200 g were kept in ideal laboratory conditions and divided into three experimental groups: control (C), arthritis (A) and swimming/arthritis (SA). Experimental arthritis was induced by inoculation of type II collagen in complete Freund adjuvant into the right hindlimb. The training consisted of 5 weekly sessions of swimming for six weeks. Each session lasted one hour, during which a load, equivalent to 5% of the rat body weight, was attached to the tail. After the training protocol, the animals were decapitated. We proceeded with the dosage of the plasmatic hormones estrogen, progesterone, cortisol and prolactine using the "IRMA DPC" kit. RESULTS - We were able to demonstrate a decrease in the plasmatic concentration of progesterone in the arthritis group; these values normalize with training (C- 15,6 +_ 2,9, A- 8,4 +_ 1,3, SA- 13,5+_2,5, ng/ml). Prolactine values showed an increase in the arthritis group, and lowered with exercise (C- 189+_ 1,7, A- 196+_2,1 SA- 186+_2,4, ng/ml). Cortisol showed an increase in the arthritis group and a more significant increase in the swimming/arthritis group (C- 0,6+_0,06, A- 0,7+_0,06, SA- 0,8+_0,06, μg/ml). Estrogen did not show any statistical differences between the groups. Conclusion – Swimming training induced hormonal changes in this model of experimental arthritis, associated with a better course of the disease. The increased concentration of cortisol can be associated with a block of the inflammatory process. Diminution of prolactine can decrease the autoimmune process activation. The increase of progesterone, as described in medical literature, shows a beneficial effect on the course of the disease.

GASTROESOPHAGEAL REFLUX DOES NOT AFFECT THE SEVERITY OF EXERCISE-INDUCED BRONCHOCONSTRICTION

Ferrari, M., Corradini, G., Papadopoulou, C., Giordani, G., Tonellotto, L., Buscemi, L., Masiero, M., Lo Cascio, V.

University of Verona, Italy

Aim of the study was to evaluate whether the presence of acid in oesophagus has any role in eliciting exercise-induced bronchospasm (EIB). Thirty asthmatic patients not regularly treated with inhaled steroids (age 38.2±14.5 years; FEV1 90.0±12.7 %predicted) were studied in basal conditions and after a two week treatment course with omeprazole, 20 mg bid orally. Baseline investigations included 24-hour oesophageal dual-probe pH-monitoring, spirometry, and exercise challenge. The challenge was performed on a bicycle ergometer and was repeated, at the same hour of the day, at the end of treatment. The results of exercise test were expressed as the maximum percentage fall in FEV1 in respect to basal values (DFEV1). At baseline, exercise was performed at the same time of oesophageal pH monitoring.

Fourteen patients demonstrated a significant decrease in FEV1 (>15%) following exercise (DFEV1 25.5±11.4%), while the others were considered negative to the test (DFEV1 4.2±4.9%). In basal condition, there was no difference in FEV1, acid exposure time, number of refluxes measured during the 24h pH monitoring in the proximal and in the distal oesophagus, between patients with or without EIB. Moreover, there was no relationship between spirometry results and DFEV1 after exercise on one hand, and parameters of gastrooesophageal reflux (GER) on the other, both when the whole population studied was considered and when the analysis was performed separately on the patients with or without EIB. Four out of asthmatics with EIB (28.7%) and 7 out of patients without EIB (43.7%) had one or more episodes of GER during exercise challenge, without significant differences between the two groups. After gastric acid inhibition by omeprazole, DFEV1 did not change significantly in respect to basal values, both in asthmatic with or without GER.

Our results indicate that the presence of acid in the oesophagus or its inhibition by proton pump inhibitors has no influence on exercise-induced bronchoconstriction in asthma.

BONE MINERAL DENSITY IN MALE AND FEMALE APPRENTICE IRISH JOCKEYS

O'Brien, M., Byrne, A.M., Beades, M., Donne, B.

Trinity College Dublin, Ireland

Optimal skeletal development is a complex process requiring adequate nutrition and weight bearing exercise modulated by hormonal and genetic factors. Bone mass accrual increases with age, height and body mass throughout childhood and increases significantly during puberty (Bailey et al., 2000). Selection criteria for some sports include small stature and low body mass, factors which could potentially effect skeletal development and diagnosis of osteoporosis (Gafni and Baron, 2004). We examined whether bone mineral density (BMD) data was affected by small bone size and body mass.

Subjects participating in this study comprised 6 female (mean±SD; age 16.3±0.5 yr, mass 48.5±3.5 kg, height 157±9 cm) and 19 male (age 15.5±0.6 yr, mass 46.7±5.1 kg, height 160±5 cm) apprentice jockeys. Anthropometric data, dietary, exercise and fracture history were recorded, lumbar spine (L1-L4) BMD by DEXA (Hologic Ltd., USA), bone age by plain X-ray of the left hand and wrist using the Greulich-Pyle atlas, and fasting hormonal profiles were assessed. The menstrual history of female subjects (age at menarche and menstrual frequency) was also recorded. Using determined bone age the date of birth in the DEXA bibliography was adjusted to equate to bone age and the lumbar spine Z-score data re-calculated based on bone rather than chronological age for each individual. Data were analysed using non-parametric (Mann-Whitney, Wilcoxon) tests, values of P<0.05 inferred statistical significance.

Significant differences (P<0.05) between chronological and bone age were recorded in both male (192±6 vs. 171±11month) and female (202±9 vs. 181±9month) subjects. Mean BMD data for male (0.77±0.09 g.cm-2) and female (0.90±0.07 g.cm-2) subjects were significantly less than age matched norms, mean±SD Z score data were -2.2±0.8 (male) and -1.0±0.7 (female). Bone age adjusted Z-score calcula-

tions were compared with age- and gender-matched controls. This revealed significantly higher lumbar spine Z-score data for both male (-1.2±1.0) and female (-0.4±0.8) subjects, (P=0.02 and P=0.03, respectively).

Apprentice jockeys have low body mass and bone size, leaving their bone mineral density data open to misinterpretation by traditional methods of analysis and overestimating the incidence of low bone density. Using bone age rather than chronological age for calculations of Z-scores addresses the dilemma of small-for-age subjects and avoids erroneous diagnosis which potentially could lead to inappropriate treatment.

References

Bailey, D. et al. (2000). J Bone Miner Res, 15, 2245-2250.

Gafni, R. and Baron, J. (2004). J Paediatr, 144, 253-257.

CHILDREN PARTICIPATING IN COMPEITITIVE SPORT DO NOT GET INJURED MORE THAN THE AVERAGE CHILD

Mahler, P.B., Guinand, S., Schopfer, C., Duperrex, O.

Service de Santé de la Jeunesse, Switzerland

Sports Injuries is a preoccupation for young sportsmen, their families, coaches and for health professionals. Injuries are often brought up as a danger linked to sports participation, and little is known as to what extent participation in competitive sport leads to more injuries than the average. Furthermore some studies seem to show that parents avoid inscribing their children in sports because of the potential danger of injury.

We used a prospective successive cohort (3 year follow-up) injury database, drawn from 180 children (approximately half boys, half girls) per year, aged 12-16, participating in competitive sports (average 9.93 h of training/wk SD 1.05) and that followed an adapted school curriculum. The data was collected systematically, using an individually reported injury slip and verified during an annual medical evaluation. This has been done since 1990 which permits to establish a baseline injury rate .

The injury prevalence is expressed as injuries/child/year allowing comparison with two other studies carried out in the same geographical area and during the same time period. The injury rate among the competitive sports children was found to be 0.27 (SD 0.07) injuries/child/year and was relatively constant from 1990-2003. It was compared to two other studies; one hospital based study from 1990 that showed an injury rate of 0.22 injuries/child/year (RR:1.24, p=.16) the other was a school based survey from 2001 that showed an injury rate of 0.24 injuries/child/year (RR: 1.17, P= .15).

Conclusion: Taking the limitations of the different study designs in to consideration, it can be suggested that children practising competitive sports in this particular school setting do not get more injured than the average child. This could be due to the setting, but the relative stability of injuries prevalence over the 15 yr period among sportsmen and the similarity in injury prevalence in the two comparative studies leads to believe that independently of study design, there seems to be little difference between the groups.

PLASTICITY OF TRABECULAR BONE ARCHITECTURE FOLLOWING DENERVATION AND SUBSEQUENT REINNERVATION IN RAT PROXIMAL TIBIAE

Tamaki, H., Yotani, K., Ogita, F., Takekura, H.

National Institute of Fitness and Sports, Japan

Purpose: Disused rat hindlimb caused by sciatic denervation is characterized by skeletal muscle atrophy and bone loss accompanying alterations in trabecular bone architecture. We studied the effects of short term denervation followed by reinnervation on the two-dimensional architecture of trabecular bone using a unilateral sciatic nerve freezing model rat of temporary disuse.

Methods: Fischer-344 male rats (n=48) aged 10 weeks were anaesthetized by an intraperitoneal injection of sodium pentobarbitone. The left sciatic nerve was elevated using forceps and frozen by contact with a stainless steel rod cooled (<-180°C) by liquid nitrogen for 3-5 sec. The right and left tibiae of denervated and control rats were removed at 0, 1, 2, 3, 4 and 5 weeks after surgery. After fixation with a mixture of 1% glutaraldehyde, 1% formaldehyde and 0.05% CaCl2 in 0.1M sodium cacodylate buffer (pH. 7.3), the tibiae were demineralized in 0.1M disodium ethylenediaminetetraacetic acid (pH 7.3) for 6 weeks at 4oC, dehydrated through a graded ethanol series, and then embedded in paraffin. Longitudinal sections of 5µm thickness were cut using a microtome. Specimens were stained with the media of Azan or HE (haematoxylin-eosin). Quantitative analysis of microscopic observations was performed using a digital microscope (Coolscope, Nikon), which comprised a video monitor and a personal computer with image analysis software (Image-Pro Plus ver. 5.0).

Results: The sciatic denervation (by nerve freezing) resulted in a marked loss of trabecular bone mostly within first two weeks after denervation. Trabecular bone area gradually decreased ($p<0.01$) and recovered after 4 weeks, and returned to approximately 80% of the control levels (at 0 w) at 5 weeks after denervation. Both the thickness and length of trabecular bone were significantly ($p<0.01$) decreased after denervation. Trabecular thickness, number, and bone area at 4 and 5 weeks were significantly ($p<0.01$) greater than that at 3 weeks, but did not return to the control levels.

Discussion/Conclusion: These findings suggested that 1) the sciatic nerve freezing resulted in a marked loss of trabecular bone mostly within first two weeks after surgery; 2) the temporary denervation and subsequent reinnervation reversibly affects the trabecular bone architecture, especially trabecular thickness and trabecular number.

Reference:

Sakakima H et al Effects of short-term denervation and subsequent reinnervation on motor endplates and the soleus muscle in the rat. Arch Histol Cytol 2000; 63:495-506.

Tamaki H et al Effects of exercise training and etidronate treatment on bone mineral density and trabecular bone in ovariectomized rats. Bone 1998; 23:147-153.

INFLUENCE OF LOWER LEG ROTATION TO MTC EFFECT OF PATELLAR CARTILAGE DURING ISOMETRIC KNEE EXTENSION

Kudo, H., Mukai, N., Kuno, S., Miyanaga, Y., Miyakawa, S.

University of Tsukuba, Japan

Introduction

Magnetization transfer contrast (MTC) is an imaging method which creates tissue contrast in a different manner as T1 and T2 relaxation time by the exchange of magnetization between macromolecular protons and bulk water, via cross relaxation or chemical exchange. Therefore, it may be beneficial to evaluate articular cartilage using MTC because it has abundant macromolecules, and it's function

should be specified by macromolecular protons. The aim of this study was to evaluate the influence of knee rotation to the quantitative effect of MTC during isometric knee extension in patellar cartilage.

Methods

This study comprised five healthy volunteers and 10 knees. MR imaging was performed with a 0.2T MR imaging system with a knee coil. Gradient recalled echo (GRE) and GRE-MTC sequences to obtain transverse axial images of patellar cartilage were performed to all subjects for 18sec. GRE sequence was TR=100msec, TE=34msec, FA=30deg. The off-resonance sinc pulse was set at a frequency offset of 1.2KHz from the free proton resonance with a duration of 10msec and an amplitude of 12.7x10-6T as preparation for MTC images. GRE and GRE-MTC images were obtained before and during the courses of isometric knee extension. The volunteers performed 1kg loaded isometric knee extension under neutral and external rotation of lower leg for 2.5min. in the MR machine. The quantitative analysis of patellar cartilage was performed with Ms/Mo between neutral and external rotation of lower leg during knee extension. Ms/Mo was calculated as follows: Ms/Mo = SNR with MTC / SNR without MTC, where SNR is signal-to-noise ratio.

Results

Lateral facet of patellar cartilage with neutral and external lower leg rotation had mean Ms/Mo of 0.72+/-0.03 and 0.75+/-0.05, respectively, before knee extension. The Ms/Mo of lateral facet during knee extension with neutral rotation (0&2min) and rest after knee extension (0,4&6min) changed by 0.73+/-0.06, 0.78+/-0.10, 0.77+/-0.01, 0.73+/-0.05, 0.71+/-0.07. On lateral facet in knee extension with rotation, the Ms/Mo also changed by 0.76+/-0.07, 0.80+/-0.01, 0.81+/-0.08, 0.77+/-0.07, 0.74+/-0.04. On medial facet, there was no apparent difference between knee extension with and without lower leg rotation. However, these changes were not significant ($p>0.05$).

Discussion/Conclusion

We investigated the quantitative effect of MTC in patellar cartilage to evaluate the influence of lower leg rotation during isometric knee extension. On external rotation of lower leg, the Ms/Mo in lateral facet fluctuated more greatly than neutral lower leg position. This result suggests that lateral facet has suffered much large mechanical stress than medial facet by external rotation of lower leg during knee extension. The MTC technique would be a promising method to elucidate the effect of exercise on articular cartilage.

COMPARISON OF METHODS TO IDENTIFY LACTATE THRESHOLD DURING LEG PRESS EXERCISE

Puga, G.M., Barros, C.L., De Agostini, G.G., Simões, H.G., Garcia, E.S., Baltissera, V.

Catholic University of Brasilia, Brazil

Lactate threshold (LT) identification during activities such as running, cycling, rowing, and swimming has been the subject of a number of studies for the past several decades. However, little is known about the LT during resistance exercises (RE). PURPOSE: The purpose of this study was to compare five different methods to identify LT in RE during leg-press (LP) exercise for both trained (TR) and untrained (UN) individuals subjects. METHODS: 20 male subjects were divided in 2 groups of 10 subjects: LP-TR (23.3 ± 4.7 yrs, 84.65 ± 12.52 kg) and LP-UN (24.6 ± 3.8 yrs, 72.24 ± 5.92 kg). The subject 1RM load was determined prior to the LT tests. The initial load for the incremental RE tests was 10% of 1RM and it was increased by 10% for each consecutive 1-min trial. Blood collection was performed during the 2-min interval between the exercise trials. The cadence was established at 20 repetitions per minute. The methods used were: 1) the breakpoint of blood lactate (BL); 2) the lactate quotient (LQ) which was found by the blood lactate and workload ratio ([lac] • workload-1) at each stage; 3) LQ modeled through a second grade polynomial function by using all the stages (AS) of maximal incremental test; 4) five fixed stages (5S); 5) three stages, one below, one at and one above the LQ (3S). The one way ANOVA test for repeated measures with Scheffe post hoc was used to compare the different methods in each group. The level of significance was $p < 0.05$. RESULTS: The results of all subjects are shown as percent of their 1-RM test. In LP-TR were 35.5 ± 4.6, 40.9 ± 6.5, 35.9 ± 6.9, 38.0 ± 13.9, and 28.0 ± 6.3 % of 1RM for 5S, AS, 3S, BL and LQ methods respectively and in LP-UN were 37.0 ± 3.1, 40.2 ± 3.8, 34.9 ± 8.1, 40.0 ± 6.7, and 34.0 ± 6.9 % of 1RM for 5S, AS, 3S, BL and LQ methods respectively. The statistical analysis showed no differences ($p<0.05$) between the five different methods to identify LT in LP-TR group, but there was a difference ($p<0.05$) between AS and QL in LP-UN. CONCLUSION: The results suggest that it's possible to access the LT for RE in TR and UN subjects in LP exercise. Modeling of the LQ through a second grade polynomial function using 3S appears to be better than the others methods using more series to precisely identify the LT load for LP exercise. The physiological meaning of LT determination on RE need to be better investigated.

COMPARISON OF METHODS TO IDENTIFY LACTATE THRESHOLD ON RESISTANCE EXERCISE DURING ELBOW FLEXION

Puga, G.M., Barros, C.L., De Agostini, G.G., Simões, H.G., Garcia, E.S., Baltissera, V.

Catholic University of Brasilia, Brazil

Lactate threshold (LT) determination during activities such as running, cycling, rowing, and swimming has been the subject of a number of studies for the past several decades. However, little is known about the LT during resistance exercises (RE). PURPOSE: The purpose of this study was to compare five different methods to identify LT in RE during elbow flexion (EF) exercise for both trained (TR) and untrained (UN) individual subjects. METHODS: 20 male subjects were divided in 2 groups of 10 subjects: EF-TR (25.1 ± 5.7 yrs, 81.40 ± 9.22 kg) and EF-UN (23.8 ± 4.0 yrs, 72.55 ± 6.37 kg). The subject 1RM load was determined prior to the LT tests. The initial load for the incremental RE tests was 10% of 1RM and it was increased by 10% for each consecutive 1-min trial. Blood collection was performed during the 2-min interval between the exercise trials. The cadence was established at 20 repetitions per minute. The methods used were: 1) the breakpoint of blood lactate (BL); 2) the lactate quotient (LQ) which was found by the blood lactate and workload ratio ([lac] • workload-1) at each stage; 3) LQ modeled through a second grade polynomial function by using all the stages (AS) of maximal incremental test; 4) five fixed stages (5S); 5) three stages, one below, one at and one above the LQ (3S). The one way ANOVA test for repeated measures with Scheffe post hoc was used to compare the different methods in each group. The level of significance was $p < 0.05$. RESULTS: The results of all subjects are shown as percent of their 1-RM test. In EF-TR were 38.4 ± 2.0, 39.8 ± 3.9, 36.9 ± 8.2, 33.0 ± 8.2, and 34.0 ± 8.4 % of 1RM for 5S, AS, 3S, BL and LQ methods respectively, and in EF-UN were 37.4 ± 2.4, 39.0 ± 3.4, 34.6 ± 7.0, 26.0 ± 7.0 and 31.0 ± 7.4 % of 1RM for 5S, AS, 3S, BL and LQ methods respectively. The statistical analysis showed no differences ($p<0.05$) between the five different methods to identify LT in EF-TR group, however there were differences between 5S and BL; AS and BL; and AS and QL in EF-UN. CONCLUSION: The results suggest that it's possible to access the LT for RE in TR and UN subjects in EF exercise. Modeling of the LQ through a second grade polynomial function using 3S appears to be better than the others methods using more series to precisely identify the LT load in RE during elbow flexion especially in UN subjects. However, the physiological meaning of LT determination on RE need to be better investigated.

PREVALENCE OF CARDIOVASCULAR DISEASES AMONG MOUNTAINEERS

Faulhaber, M., Flatz, M., Burtscher, M.

University Innsbruck, Austria

In recent years mountain sports have become very popular. In the Alps, the number of tourists visiting altitudes above 2000 m is estimated at about 40 million people per year [1]. Although the percentage of elderly, often suffering from cardiovascular diseases (CVDs), seems to be high [2,3], little information is available about the real frequency of CVDs among mountaineers. Therefore the goal of this study was to provide data - collected in a representative population - about the prevalence of CVDs among mountaineers at moderate altitudes.

We interviewed a representative population of 937 ski mountaineers, 1525 hikers and 1062 alpine skiers / snowboarders (skiers) using a standardised questionnaire. We recorded personal data (age, sex etc) and if the persons had known CVDs such as a prior myocardial infarction (MI), coronary artery disease without infarction (CAD), hypertension, arrhythmias, and other CVDs. Data were statistically analysed by SPSS (version 13.0). Comparison of variables were performed by students' t-test, by chi-square-test or fisher's exact test as adequate. P-Values less than 0.05 were considered to indicate statistical significance. Values are presented as means±SD or frequencies (95% CI).

Data of 934 ski mountaineers, 1431 hikers and 1043 skiers were included into the analyses. The skiers (36.0±18.1 years) were younger than the hikers (41.8±16.1 years) and the ski mountaineers (42.4±12.7 years, $p<0.01$). Gender distribution was different in all the three sports. The prevalence of the cardiovascular diseases is clearly age dependent. The frequency of persons with one ore more cardiovascular disease is increased in hikers (12.7 (11.0-14.4) %) and skiers (11.2 (9.3-13.1) %) when compared to ski mountaineers (5.8 (4.3-7.3) %, $p<0.01$). A prior MI was reported by 0.7 (0.2-1.2) % of the ski mountaineers, 1.1 (0.6-1.6) % of the hikers and 1.0 (0.4-1.6) % of the skiers. Hypertension was the most frequent cardiovascular disease.

Because our data are based on the information given by the interviewed persons, cases of CVDs that are not reported or unknown are not included in our calculations. Although our data can not be uncritically generalized to other regions and altitudes, we assume a high number of mountaineers with CVDs in the Alps. Scientific research should focus on cardiovascular and metabolic responses during mountaineering to provide the data for scientifically based recommendations to persons with CVDs.

1 Burtscher M et al. Das Todfallrisiko beim alpinen Schilauf und Präventivmaßnahmen. In: Jenny E et al (eds). Jahrbuch 97. Österreichische Gesellschaft für Alpin- und Höhenmedizin 1997:155-172

2 Honigman B et al. Acute Mountain Sickness in a General Tourist Population at Moderate Altitude. Ann Intern Med 1993;118:587-592

3 Elveback L, Lie JT. Continued high incidence of coronary artery disease at autopsy in Olmstead County, Minnesota, 1950-1979. Circulation 1984;70;345-349.

STRUGGLE AGAINST DOPING IN OLYMPIC SPORTS:WAYS OUT OF CRISIS

Platonov, V.

National University of Ukraine on Physical Education and Sport, Ukraine

The whole history of the Olympic movement, its reputation and attraction for the world commonwealth are related to the moral-ethic values accumulated in the Olympism ideals including fair play, unity of human spirit, body and mentality etc. Thus such values can develop only on the basis of an education system of humanistic direction that could be referred to all the Olympic sports problems including doping. And to grow up these values is impossible by means of common distrust, total control, threats, sanctions, violation of human rights, and suppression of athletes' interests including those connected with their health care. Unfortunately the World Anti-Doping Agency took that very defective way to fight against doping.

There is a need in principally another methodology without subjectivism that is based on reliable scientific knowledge including wide educational programs that contain respect to an athlete personality, his rights, views, ethical principles, moral values.

The following directions can be emphasized as the main activities capable to normalize situation with doping use, to delete contradictions between anti-doping bodies and different structures of the international Olympic system (IOC, NOC, sports federations):

- cardinal revision of WADA Code on the base of methodology grounded on achievements of advanced sports and medical sciences, general international laws;
- conduct of wide scale scientific researches of elaboration of a system of allowed ergogene means and methods, minimization of a quantity of banned ones, creation of a distinct border between allowed and banned means taking into account the specifics of various kinds of sport;
- placing an opportunity to use all modern medicine achievements at athletes' disposal; not to limit them in usage of the most efficient medicinal means for treatment;
- establishment of alternative laboratories and centers for anti-doping control based on various methodology of solving the doping problem in sport;
- granting the ISF the right to invite for service of the competitions and kinds of sport those anti-doping laboratories and centers whose activities meet the specificity of a particular sport to the utmost extent;
- democratization of anti-doping struggle on the side of the IOC – support of alternative approaches of struggle against doping, assistance to the activities of anti-doping laboratories, shift of the accent in struggle against doping into the sphere of SF activities.

The work in these directions does not exclude the necessity to struggle against use of doping in sport. Its goal is identification of ways out of deadlock where this problem was driven by modern practice and existing laws in this sphere.

RELATIONSHIP BETWEEN THE PRESENCE OF GENU VARUS AND THE CROSS-SECTIONAL AREA OF LEG MUSCLES

Sogabe, A., Mukai, N., Miyakawa, S., Mesaki, N.

Konan University, Japan

[Objective] It has been proposed that the ratio of the cross-sectional areas of the four parts of the quadriceps femoris muscle may be related to development of PFP (patellofemoral pain) and AKP (anterior knee pain). In particular, the vastus medialis (VM) is thought to play an important role in pulling the patella medially, whereas the vastus lateralis (VL) acts by pulling the patella laterally. Furthermore, the presence of genu varus may result in differences in the power output of the VM and the VL, even when the knee is extended. Variation in knee alignment may lead to differences in the relative cross-sectional areas of the four muscles, and in this study we examined if genu

varus has an effect on these cross-sectional areas. [Methods] The subjects were 12 healthy adult males, including 6 with normal knees (FTA: 176.0° ± 0.9°) and 6 with genu varus (FTA: 180.2° ± 0.8°). The left thigh bones and left shin bones of the subjects were imaged in the supine position, using an AIRIS Mate 0.2T (Hitachi Medical Corporation, Japan) to obtain T1-weighted images. Cross-sectional areas of the adductor (Add), rectus femoris (RF), vastus lateralis (VL), and vastus medialis (VM) were measured at positions located 70% (Add), 50% (RF and VL) and 30% (VM) of the distance from the distal end of the femur. Cross-sectional areas of the gastrocnemius (GAS) and soleus muscle (SOL) were measured at the point of the biggest circumference around the lower legs, and the percentage of each muscle at the measurement point was also determined. The VM/VL ratio was calculated by dividing the VM cross-sectional area by that of the VL. [Results] The VM cross-sectional area expressed as a percentage of the total cross-sectional area of all the muscles was 25.1% and 30.7% in the normal knee group and the genu varus group, respectively. These data differed significantly ($p<0.025$); however, no significant differences were found for other muscles. The VM/VL ratio was significantly higher ($p=0.046$) in the genu varus group (1.56 ± 0.30) compared to the normal knee group (1.22 ± 0.23). [Discussion] The presence of genu varus may result in the patella being pulled more powerfully in a medial direction, and this may result in greater hypertrophy of the VM relative to the VL. The causes of knee pain include muscle weakness of the VM, along with patella misalignment and ageing, and the vastus medialis plays a more important role when genu varus is present, compared to the situation in normal patellae. Hence, we conclude that careful attention should be paid to VM muscle weakness.

ASSESSING THE RELATIONSHIP OF OXYGEN DESATURATION AND ISOKINETIC FORCE PRODUCTION USING NIRS

Ziesing, A. 1, Banzer, W. 1, Gibson, M. 2, Vogt, L. 1

1Johann Wolfgang Goethe-University Frankfurt, 2 University of Wisconsin, USA, Germany

Near-infrared spectroscopy (NIRS), based on differential absorption of oxygenated (Hb/MbO2) and deoxygenated forms of hemoglobin/myoglobin (Hb/Mb) in the near-infrared range, is a non-invasive method which allows continuous monitoring of the dynamics of tissue deoxygenation during exercise. The present study determines the relationship between the time course of Hb/MbO2 desaturation and isokinetic torque.

METHODS: Twelve healthy male subjects (age 52.9 ± 12 years, height 174.5 ± 9.4cm, weight 81.6 ± 9kg) performed 30 standardized repetitions at 120°/s of wrist extension/flexion isokinetic movements. NIRS signals were obtained by a commercially available unit (InSpectra Tissue Spectrometer 325, Hutchinson Technology, Netherlands). The NIRS probe was placed over the forearm flexor-group during the test. Subjects were verbally encouraged to produce their individual maximum contractions after 5, 15 and 25 repetitions. Oxyhemoglobin and deoxyhemoglobin values at a depth of up to 25 mm were recorded continuously with 4 specific wavelengths (680nm, 720nm, 760nm and 800nm). The temporal relationship between average Hb/MbO2 desaturation and flexor torque production were assessed using Pearson Product-moment correlation coefficients.

RESULTS: Findings demonstrated a significant negative correlation ($r = -.766$, $p<0.05$) between Hb/MbO2 desaturation and maximal isokinetic flexor torque values. Hb/MbO2 desaturation values increased from 45% to 80% of desaturation after 7 repetitions and then plateaued. Maximal torque increased from 6nm up to 7nm and then passed into a steady torque production. The maximal torque and the Hb/MbO2 values showed the greatest difference after 7 repetitions. Divided into three time intervals (0-40sec, 40-80sec, 80-120sec), it was found that the desaturation Hb/MbO2/torque relationship became more pronounced when exercise time increased. The third time interval showed the highest significance between Hb/MbO2 desaturation and maximum torque ($r = .824$, $p<0.001$).

CONCLUSION: The results demonstrate the temporal interrelation between Hb/MbO2 desaturation and force production at a constant angular velocity. Muscle deoxygenation measured by NIRS seems to be of increasing importance in the understanding of the mechanisms of local muscle metabolism during exercise. Future studies should evaluate the influences of muscle fatigue in more detail.

SINGLE AND/OR REPEATED EXERCISE AND THE AMPHETAMINE-INDUCED RELEASE OF DOPAMINE IN THE STRIATUM

Fontes Ribeiro, C.A., Marques, E., Pereira, F., Remedios, I., Morgadinho, T., Macedo, T.R.

University of Coimbra, Portugal, Egas Moniz Superior Health School

There is little information about the relationship between the effects of repeated exercise and the synthesis, release and action of neurotransmitters in the central nervous system. Moreover, in spite of the existence of many studies about amphetamines (AMPH) and the frequent use of these substances as doping, there is only a few ones about the influence of AMPH on neurotransmitter changes induced by exercise.

Being dopaminergic neurons essential in the motor system, this study aimed to verify the influence of exercise, acute and/or repeated, on the release of striatal dopamine (DA) induced by a single administration of AMPH.

Eight groups of male Sprague-Dawley rats (n=5-7) were used (no acute or repeated exercise; acute exercise after repeated exercise; only acute exercise; only repeated exercise; the same groups but after AMPH). Exercise was performed in a treadmill, being the training (of increasing intensity) performed for 8 weeks. Rats were anaesthetized with pentobarbital, placed into a stereotaxic frame and an intracerebral guide cannula was implanted into the caudate-putamen (CPu). On the day of the tests, a dialysis probe was slowly inserted through the guide cannula into the CPu. The probes were perfused with and artificial cerebrospinal fluid. Microdialysis in vivo in these freely moving rats was performed in a campanula and in the treadmill, being AMPH (5mg/Kg) or a saline solution injected intraperitonially. HPLC with electrochemical detection was used to quantify the DA present in the samples, collected for 6 hours.

Exercise, either acute and/or repeated, in the absence of AMPH did not increase extracellular DA concentrations above our limit of quantification for this amine. However, AMPH strongly increased the DA release. Regarding the maximal DA levels in the samples collected by microdialysis in the rats treated with AMPH, there was no significant differences (two tailed ANOVA) between the different groups treated with AMPH. However, analysing the behaviour of DA release along time, in the group with acute exercise after repeated exercise data show that there is a higher release of DA (for six hours, whereas in the group without acute and repeated exercise this release was for four hours). There is the possibility that a sensitization of these animals may occur towards the stimuli they were exposed during the training, being their response more intense to that same stimuli. In trained animals but without acute exercise, there appears to be a prolongation for half an hour of the effect of AMPH on the release of DA. Both types of exercise (acute or repeated) seem to delay the increase of extracellular DA release induced by AMPH. If drug abuse is related to DA reinforcing mechanisms, as has been demonstrated, repeated exercise may replace drugs of abuse. However, more studies are needed, at least with other doses of AMPH.

(Supported by POCI/DES/60227/2004, FCT, Portugal).

EXERCISE-INDUCED ANGIOGENESIS IS MISSING IN HETEROZYGOUS MNSOD-KNOCKOUT MICE

Brixius, K., Richters, L., Lange, N., Scharffetter-Kochanek, K., Treiber, N., Schwinger, R.H., Ghanem, A., Tiemann K., Bloch, W.

Institute of Cardiology and Sport Medicine, Germany

Only recently, a heterozygous mouse model has been described with a reduced expression of mangan superoxide dismutase 2. The MnSOD knockout mice (MnSOD_KNO) are characterised by an increased oxidative stress in the heart. It has been proposed that this model is suitable to investigate age-dependent alterations in heart failure (Strassburger et al. 2005).

Therefore, we investigated the influence of physical exercise on cardiac function in male MnSOD2_KNO (MnSOD_KNO_EXER, n=11) and wildtype mice (WT_EXER, n=6). Animals were trained for 8 weeks on a running wheel 1 h a day (15 m/min, 5 days/week, at an angle of 5°). Controls were untrained age-matched animals (WT_CON, n=7; MnSOD_KNO_CON; n=9). After the training period, an echocardiogram was taken from the animals. Heart frequency was measured in trained and untrained animals under conditions of acute physical exercise (running wheel, 10 min, 15 m/min, 5°) and 10 min after recovery. In addition, we measured heart-body weight ratio and the density of the cardiac capillaries.

Heart- and heart-body weight ratio was significantly increased in MnSOD-KNO independently from physical exercise. Left ventricular enddiastolic volume was ony increased in MnSOD_KNO_EXER. Under baseline conditions, heart frequency was similar in all groups. In the hearts of WT_EXER, a significant increase in capillary density was observed, whereas no alterations in capillary density were observed in MnSOD_KNO_EXER.

Conclusions: Physical exercise is able to induce a dilative cardiac phenotype under conditions of increased oxidative stress in the heart. Increased exposure to radicals seems to decrease exercise-induced angiogenesis.

IDENTIFICATION OF SATELLITE CELLS AND MYONUCLEI

Oka, K., Tayama, T., Morita, S., Takayanagi, S., Sakamoto, M., Muro, M.

Toho University School of Medicine, Japan

Introduction

Satellite cells are the stem cells of skeletal muscle and play an important role in the regeneration process. The satellite cells are located between the sarcolemma and the basal lamina of the muscle fiber. The cytoplasm of the satellite cell is extremely small and, therefore, the identification of the satellite cell and myonucleus is impossible using a light microscope. Immunological markers, antibodies, are used to identify satellite cells but to date, there is no consensus concerning the antibodies on what should be used for the marker (1). Presently, clear identification of satellite cells can only be achieved using a transmission electron microscope (TEM). However, it is difficult for TEM to handle satellite cells quantitatively because the observation area of the TEM specimen is small. The goal of this study is to identify satellite cells using a scanning electron microscope (SEM) and a paraffin section which is the most widely used technique for light microscope specimens.

Materials and methods

The gastrocnemius muscles of 3-week-old female ICR mice were used in this study. The excised gastrocnemius muscles were fixed in acetone for 3 hours at 5°C and embedded in paraffin in the usual manner. Longitudinal serial sections were made at 8 μm and the paraffin was removed from sections with toluene. After sputter coating with Pt-Pd, the specimens were observed with a Hitachi S-3500N scanning electron microscope at an accelerating voltage of 15 kV.

Results

 In this experiment, the cells in the interstitium were omitted from the subjects of study. Namely, the cells and nuclei surrounded by the basal lamina of muscle fiber were observed. All of the cells or nuclei surrounded by the basal lamina of the muscle fiber were divided into 2 groups. The structure with a double membrane is the satellite cell and that with a single membrane is the myonucleus. That is, in satellite cells, the outside membrane is the cell membrane of the satellite cell and the inside membrane is the nuclear membrane of the satellite cell. On the other hand, myonucleus has a single, nuclear membrane. Regarding the interior structure of the nucleus, that of myonuclei is simple compared to the nuclei of satellite cells.

Discussion

In this study, identification of satellite cells and myonuclei was achieved using SEM and a paraffin section. The paraffin section is the most widely used technique and it is easily made. The size of the paraffin section is large in comparison with the TEM specimen, and therefore, the technique in this paper is more appropriate for handling satellite cells quantitatively. Furthermore, the movement of the satellite cells is pursued regardless of the cell stages (quiescent, activated, proliferated, differentiated) because this technique is unrelated to immunological markers.

Reference

1) Thornell LE, Lindstrom M, Renault V, Mouly V, Butler-Browne GS. (2003). Scand J Med Sci Sports. 13(1): 48-55.

IMMEDIATE EFFECTS OF LASERNEEDLE STIMULATION ON MICROVASCULAR BLOOD FLOW MEASURED BY LASER DOPPLER SPECTROSCOPY

Hübscher, M., Banzer, W., Seib, M., Vogt, L.

J. W. Goethe-University Frankfurt/Main, Germany, Germany

Introduction

Biostimulatory effects of low level laser light therapy (LLLT) have been extensively reported. In clinical settings, LLLT has been proposed as a potential treatment in the management of musculoskeletal disorders and pain (Basford 2000). Furthermore, it has been shown that the application of low level laser light induces vascular relaxation leading to an improved microcirculation and oxygen supply (Litscher 2003, Maegawa et al. 2000). This is relevant since adequate blood provision is an important factor in the treatment of pain syndromes in sports medicine. Thus, the aim of the present study was to evaluate immediate effects of a standardised laserneedle stimulation over a defined acupuncture point on the microvascular blood flow in a randomised, double blinded, placebo controlled trial.

Methods

33 healthy non-smoking males were randomly assigned to a control group (n=15) with no laser irradiation and to a intervention group (n=18) for which laserneedle irradiation was performed on the right forearm at acupuncture point Pe6. Non-invasive blood flow meas-

urements (laser Doppler spectroscopy; LDS) were performed before, during and after intervention (depth of measurement approx. 1 and 8 mm) on the right forearm.

Results

Repeated measures MANOVA demonstrated a statistically significant interaction between time and group (p=0,034, partial eta squared=0,39) indicating that peripheral blood flow was influenced by laserneedle application. Simple contrast analysis showed that during intervention, average skin blood flow increased by 7,3% in the experimental group whereas in the placebo group, a decrease of 16,1% was demonstrated. After laser application skin blood flow increased by 8,1% in experimental group and decreased by 21,8% in the placebo group. In the deeper tissue, the perfusion increased by 2,7% in the experimental group whereas the perfusion was reduced by 13,0% in the placebo group after exposure to laser light, respectively.

Discussion/Conclusion

It has been demonstrated that laserneedle stimulation may improve peripheral microcirculation under standardized conditions. Further research is required to determine the influence of various parameter settings and irradiation treatments on the peripheral microcirculation. Anymore, different acupuncture points should be investigated in order to appraise the clinical effectiveness of laserneedle stimulation.

References

Basford, J.R., Sheffield, C.G., and Cieslak, K.R. (2000). Laser Therapy: A Randomized, Controlled Trial of the Effects of Low Intensity ND:YAG Laser Irradiation on Lateral Epicondylitis. Arch. Phys. Med. Rehabil. 81, 1504-1510.

Litscher, G., (2003). Cerebral and peripheral effects of laserneedle-stimulation. Neurol. Res. 25 (7), 722-728.

Maegawa, Y., Itoh, T., Hosokawa, T., Yaegashi, K., and Nishi, M. (2000). Effects of Near-Infrared Low-Level Laser Irradiation on Microcirculation. Lasers Surg. Med. 27, 427-437.

PLASMA HSP72 IN RUNNERS SUFFERING FROM EXERTIONAL HEAT ILLNESS

Ruell, P.A. 1, Thompson, M.W. 1, Hoffman, K.M. 1, Brotherhood, J.R. 1, Richards, D.A. 2

1 The University of Sydney, 2 Westmead Private Hospital, Australia

Exertional heat illness is a potentially fatal disorder that primarily affects fit young men. Plasma Hsp72 may be important in the aetiology of this disorder, acting as a danger signal to the organism and leading to an inflammatory response. The aim of this study was to determine whether patients with exertional heat illness following a 14 km fun run show a difference in their plasma Hsp72 concentration compared with control subjects who completed the event without incident. Patients (n=22) and controls (n=7) were all male. The patients were subdivided into 2 groups, one of which exhibited more serious symptoms indicating neurological impairment such as confusion (n=13) (CNS) while the other group exhibited mild symptoms (MILD) (n=9). The CNS group had a higher rectal temperature (Trec) compared with the control group (41.0±0.3°C versus 39.8±0.2°C, P<0.05). Immediately after the run plasma Hsp72 was significantly higher in the CNS group compared with controls and patients with mild symptoms (37.9, 17.0 and 20.9 ng/ml respectively) (P<0.01). There was a significant correlation between plasma Hsp72 and Trec measured immediately after the race (r=0.597, P<0.001, n=29). However, core temperature was not the only factor leading to increased plasma Hsp72 immediately post race. Plasma Hsp72 was still significantly higher in CNS patients compared with the control group (P<0.05) when Trec was included as a covariate. Plasma Hsp72 may be important in differentiating those patients most at risk of developing more serious clinical signs of heatstroke.

MONITORING MUSCLE OXYGENATION KINETICS AFTER EXERCISE-INDUCED MUSCLE SORENESS

Ahmadi, S., Sinclair, P., Foroughi, N., Davis, G.M.

The University of Sydney, Sport Knowledge Australia, Australia

Background: Delayed onset muscle soreness (DOMS) and impaired muscle function are common consequences of vigorous eccentric exercise (EE).The structural alterations or increased intramuscular pressures observed within muscle after EE may restrict local blood flow, and increase the diffusion distance of oxygen to muscle fibres (1). Near infrared spectroscopy (NIRS), is a simple and non-invasive method to monitor oxygen saturation within skeletal muscle. Hypothesis: We proposed that strenuous EE might impair muscle oxygenation and muscle blood flow in healthy adults. It was also hypothesised that biochemical, anthropometric and functional markers of DOMS might be closely time-associated with changes of muscle oxygenation assessed by NIRS. Methods: This study utilised a 7-day prospective time-series design. Ten healthy males, aged 18-35 yr, performed 2 bouts of 70 maximal elbow flexion eccentric contractions 6 days apart. Before and after EE on day 1 and over the next 6 days, maximum voluntary contraction (MVC), plasma creatinine kinase concentration (CK), elbow joint range of motion (ROM), subjects' perception of muscle soreness (SOR), arm circumference (CIR), and muscle oxygenation kinetics within biceps brachii were assessed. Muscle oxygen saturation, total haemoglobin, oxyhaemoglobin, deoxyhaemoglobin, muscle blood flow and muscle oxygen consumption were measured at rest on each day. In addition, muscle oxygen desaturation and re-saturation kinetics and volume during isometric contractions at 50 and 80 percent of MVC, as well as during arterial occlusion were quantified to investigate the hypotheses. Results: Repeated measures ANOVA revealed that MVC and ROM decreased while CIR, SOR and CK increased significantly (p<0.05) after acute EE. These changes were consistent with EE's effectiveness to evoke DOMS. Resting muscle oxygen saturation, total haemoglobin and oxyhaemoglobin increased, and deoxyhaemoglobin decreased after acute EE on both days 1 and 7. During super-systolic arterial occlusion, oxygen desaturation kinetics and volume increased significantly after EE on days 1 and 7, but the changes in re-saturation kinetics were not significant. Similar significant changes in desaturation and re-saturation kinetics/volume were observed during 50% isometric MVC. The changes in desaturation and re-saturation kinetics and volume during 50 and 80 percent MVC muscle contractions remained significantly different from the first day over the following days. In contrast, resting values of muscle oxygenation recovered towards pre-EE values over the six days after exercise. Conclusion: Although the volume and kinetics of desaturation and re-saturation during isometric contractions changed significantly after EE and these changes were present for several days, the alteration in muscle oxygenation kinetics did not always reflect an expected impaired oxygen delivery within arm muscles affected by DOMS. (1) Walsh, et al. (2001). Med Sci Sport Exer 33: 436-41.

ELECTROMYOGRAPHIC ACTIVITY IN BICEPS BRACHII AFTER ECCENTRIC EXERCISE-INDUCED MUSCLE SORENESS

Ahmadi, S., Sinclair, P., Foroughi, N., Davis, G.M.

The University of Sydney, Sport Knowledge Australia, Australia

Background: It is well known that strenuous eccentric exercise (EE) may result in delayed onset muscle soreness (DOMS). Although, the analysis of surface electromyographic signals (sEMG) had been used to characterise changes in the myoelectric behaviour of a muscle that could be associated with DOMS (1), there is a large controversy over the usefulness of sEMG signals in detecting DOMS. Hypothesis: We proposed that vigorous eccentric exercise would impair myoelectric activity of the biceps brachii in healthy adults, and that characteristic changes of sEMG might last several days afterwards. It was also hypothesised that biochemical, anthropometric and functional markers of DOMS would be closely time-associated with sEMG changes. Methods: This study utilised a 7-day prospective time-series design. Ten healthy males, aged 18-35 yr, performed two sessions of 70 maximal EE elbow flexion contractions, 6 days apart. Analysis of EMG activity was performed on the signals recorded during isometric contractions at 50% (IC50) and 80% (IC80) of maximum voluntary isometric contraction (MVC), deriving RMS and MDF as synthetic sEMG parameters. Linear regression of the RMS and MDF time-series (20 s sustained IC50 and IC80) was used to extract intercepts and slopes of these signals on each day. Plasma creatine kinase activity (CK), MVC, arm circumference (CIR), each subject's perception of soreness (SOR) and elbow joint range of motion (ROM) were measured to assess effectiveness of EE to evoke DOMS. Results: Plasma CK concentration increased over resting values until day 5 after EE (almost 7 times higher than the initial value), and remained significantly ($p<0.05$) elevated even on day 7. In contrast, MVC force had decreased to 50% of its initial value by day 2 after EE, and remained significantly depressed for the following days. Similar increases in SOR and CIR, and decrements in ROM supported the viewpoint that EE was highly effective to evoke DOMS. At IC50 and IC80, both MDF and RMS were significantly altered after acute EE on the first and seventh days. A significant shift (comprising a 15-20% decrease) of MDF intercept towards lower frequencies at IC50 was observed after EE in the exercised arm, and these values remained depressed over the next days. Both RMS slope and intercept during IC50 and IC80 were altered after EE, but showed an inconsistent pattern. Somewhat surprising was that RMS changes were present in the control arm as well as in the EE exercised limb. Conclusion: A prolonged reduction in MDF slope and intercept was a concomitant sign of DOMS, but this was not closely associated with biochemical, anthropometric or functional markers of DOMS. The downward shift of MDF slope and intercept could be related to lower recruitment of fast twitch muscle fibres after DOMS. Compared to RMS, MDF was a more reliable measure to reflect changes in sEMG after vigorous eccentric exercise.

(1) Felici et al. (1997). J Electromyogr Kines 7(3): 193-202.

IMCIDENCE AND DETERMINANTS OF RUNNING INJURIES IN LONG DISTANCE RUNNERS: A SYSTEMATIC REVIEW

Koes, B.W., van Gent, R.N., Siem, D., van Os, A.G., van Middelkoop, M., Bierma-Zeinstra, S.M.

ErasmusMC, Netherlands

Objective: to present a systematic overview of the literature on the incidence of lower extremity injuries in long distance runners and to identify rik factors associated with these injuries.

Methods: Medline data-base was search extensively for relevant studies meeting pre-determined inclusion criteria. Two reviewers assessed the quality of the included studies independently of each other. A best evidence synthesis was used in order to summarize the available data.

Results: 12 prospective and 4 retrospective cohort studies were included. Four of which were considered to be of lower quality. The incidence of lower extremity running injuries ranged from 19.4% to 51.5%. The most predominant site of these injuries was the knee. For many potential determinants only limited or conflicting evidence was found for an association with running injuries. Strong evidence was found for an association between a long training distance per week in male runners and running injuries. Also a history of previous injury is associated.

Conclusions: This systematic reviews presents a clear overview of the current state-of-science on the incidence of running injuries and its determinants in long distance runners. These injuries are not rare given the high incidence rates reported in the literature. For many determinants the association with the occurence of running injuries is yet unclear.

PREVALENCE AND INCIDENCE OF LOWER EXTREMITY INJURIES IN THE ROTTERDAM MARATHON

van Middelkoop, M., Kolkman, J., van Ochten, J., Bierma-Zeinstra, S.M., Koes, B.W.

Erasmus MC - University Medical Center Rotterdam, Netherlands

Objectives: The aim of this study was to describe the prevalence and incidence of lower extremity injuries of recreational runners running a marathon.

Methods: A cohort study was set up of recreational participants in the 2005 Rotterdam marathon. Out of 10000 recreational athletes who signed in for the Rotterdam marathon a random sample of 1500 athletes was made. One month before the start, demographic data and information on previous occurred injuries were obtained from a baseline questionnaire. Information on injuries sustained shortly before or during the marathon was obtained from a post-race questionnaire directly after the marathon.

Results: Of the 1500 random selected participants, 726 (48.4%) returned the baseline questionnaire. The one-year prevalence of running injuries was 54.8%. In the post-race questionnaire, 15.5% of all respondents reported at least one new lower extremity injury in the month preceding the Rotterdam marathon. The most frequent site was the knee (29.6%). The incidence of lower extremity injuries occurring during the marathon was 18.2% (n=118). Most of these injuries occurred in the calf, knee or thigh. However, the median score of pain intensity in rest (on a scale from 0-10) immediately after the marathon was 2 points and the median score of pain intensity during physical exercise was 5-points and the Interquartile Range was 4. Of all injured runners in the Rotterdam marathon 86.4% were able tot do all their work tasks within one week after the marathon. Also 88.1% of all injured runners were able to carry out their usual Activities of Daily Living within one week.

Conclusions: Running injuries are very common in recreational marathon runners. However, the pain severity and consequences for work tasks and Activities of Daily Living seems to be quite low one week after the marathon.

TRIAL FOR DEVELOPING A NEW INDICATOR FOR PREVENTING OVERUSE KNEE EXTENSOR MECHANISM DISORDERS IN ADOLESCENT ATHLETES USING A TISSUE STIFFNESS METER: RESULTS OF ONE YEAR PROSPECTIVE STUDY

Kinoshita, H., Miyakawa, S., Mukai, N., Kono, I.

University of Tsukuba, Japan

Introduction:

Overuse knee extensor mechanism disorders, such as Osgood-Schlatter's disease, in adolescent athletes are said to be related to increased tension in the knee extensor mechanism, which is elongated by rapid skeletal growth during the growth spurt period. Although it is important to check the tension of the elongated knee extensor mechanism for the prevention of overuse knee injuries, a simple and quantitative measurement has yet to be established. In a previous study, we found that elongation of the knee extensor mechanism can be evaluated using a tissue stiffness meter. In the current study, in order to develop a new indicator for preventing disorders in adolescent athletes, we investigated the relationship between knee extensor mechanism tissue stiffness and the incidence of knee disorders.

Methods:

A total of 190 legs of 95 adolescent male soccer players (9 to 17 years old, including the growth spurt period; mean age: 13.1 ± 2.6 years) were examined in the study. In the initial medical check-up we calculated the tissue stiffness of each knee extensor mechanism, and prospectively observed the occurrence of overuse knee extensor mechanism disorders for a period of one year. Each leg was measured for tissue stiffness at the knee extensor mechanism (the midpoint of the length from the anterior inferior iliac spine to the tibial tuberosity in the anterior thigh) in both supine and knee extended positions using a tissue stiffness meter, the Muscle Meter PEK-1 (Imoto Machinery Co. Ltd.: arbitrary unit).

Results:

During the observation period, knee extensor mechanism disorders occurred in a total of six legs from four players, including Osgood-Schlatter's disease (five legs of three players) and jumper's knee (one leg of one player). The mean value ± SD of tissue stiffness at the knee extensor mechanism in legs in which knee extensor mechanism disorders had occurred was 57.3 ± 2.5 (N=6), which is significantly higher (p＜0.05) than the value in legs in which no disorder had occurred, which was 54.8 ± 3.0 (N=184).

Discussion/Conclusion:

In a previous study, we found a positive correlation between elongation of the knee extensor mechanism and tissue stiffness, yielding tissue stiffness as an indicator for evaluating tension within the knee extensor mechanism. In the current study, tissue stiffness at the knee extensor mechanism was significantly higher among the legs in which knee extensor mechanism disorders occurred than that of the legs in which no disorder had occurred. In conclusion, evaluating tissue stiffness at the knee extensor mechanism can be used as a predictive index for the occurrence of overuse knee extensor mechanism disorders in adolescent athletes.

References:

Micheli LJ (1983). Orthop Clin North Am 14:337-360.

Kinoshita H et al. (2004). JPN J Clin Sports Med 12:278-282.

ANTHROPOMETRICAL CHARACTERISTICS OF THE CHILDREN AND ADOLESCENTS SELECTED AT THE HIGH PERFORMANCE COLOMBIAN TENNIS ACADEMY OF BOGOTA

Radut, D.S., Hernandez, A.

University El Bosque, Colombia

To assess the anthropometric characteristics, 60 children and adolescents between 6 and 14 years old have been studied, 36 male and 24 female, aspiring to enter the high performance Colombian Tennis Academy of Bogota. The shape was looked for according to the Heath-Carter methodology, the body composition using a Huang equation for Latin children and the proportionality with the Ross-Wilson method. The parameters found have been correlated with sexual development and training level. The statistical analysis was made with SPSS V13 program. Central measures of median, standard deviation, minimum and maximum values, averages comparison by T Student method, variances by the Levene test and correlation by Spearman test have been realized. 73% of the subjects previously participated in tennis trainings and 27% entered for the first time. The somatotype was located near meso - ectomorphy for men and near endo - ectomorphy for women. The fat mass and its percentage were found greater in women. The lean mass has been found greater in men. The proportionality revealed low weight and high fat percentage, especially at women. Not significant difference was found between old and new subjects, neither between the studied sample and the general population of Bogota of the same age, whose somatotype has been found closer to that recommended for tennis players. An inadequate caloric intake was concluded. The sportsmen selection criteria had a more economic quantitative tendency than a sports medical scientific qualitative one, inopportune for high performance tennis optimal selection.

FOUR YEARS OF UNIVERSAL PREVENTION IN PRIMARY SCHOOLS - EFFECTS ON BMI AND MOTOR ABILITIES IN CHILDHOOD

Graf, C., Koch, B., Dordel, S., Falkowski, G., Staudenmaier, K., Christ, H., Tokarski, W., Predel, H.-G.

German Sport University; University of Cologne, Germany

Objectives: Obesity in childhood is increasing worldwide. To combat overweight and obesity in childhood, the school-based CHILT project combines health education and physical activity. This paper examines the effect of intervention on the body mass index (BMI) and motor abilities after nearly 4 years in 12 randomly selected primary schools compared with 5 randomly selected control schools.

Methods: The anthropometric data were taken, BMI was calculated. Gross motor development was determined by a body coordination test (KTK) and endurance performance by a 6-minute run.

Results: No difference in the prevalence of overweight and obesity was found between the intervention (IS) and control schools (CS) either at baseline or final data (each p>0.05). There was no difference between the result of the endurance performance and the complete KTK, but the performance in lateral jumping and balancing backwards was better in the IS than in the CS (p=0.005; p=0.007), adjusted for age and test result of the entrance examination, gender and BMI-classification at final examination. Overweight and obese children produced significantly lower scores in all tasks than their counterparts (each p<0.05).

Conclusions: Preventive intervention in primary schools offers an effective means to improve coordinative skills in children, but overweight and obese children always produce significantly lower results. To improve motor skills in overweight and obese children and to prevent overweight and obesity, selective family- and school-based measures are necessary and parents should be included.

THE STUDY ON PREVALENCE OF MUSCULAR-SKELETON INJURIES IN ROCK CLIMBERS

Ahanjan, S.

Razi unhversity, Iran

The propose of this study was consider to prevalence of muscular - skeleton injuries in rock climbing, and determination of some individual - performance factors such as maximum grade of climbing, skillful hand and common type of climbing on existence and circumstance of the injuries . In February to September 2005 previous or present injuries among 50 young climbers via clinical examination was assess in fingers, palm, wrist, forearm, elbow, arm and shoulder girdle. After data gathering and statistical analyses to find these results about amount of muscular - skeleton injuries prevalence:

About half of injuries were in fingers and others approximately were divided equally between elbow - forearm and shoulder girdle. Most injury prevalence consist of collateral ligament strain of PIP joint, FDS and FDP muscle strain, rotator Cuff muscles strain and A2 annular pulley strain. Injury prevalence rate on the base of appearing in fingers orderly consist of ring, long, index and small finger. In subsequent process, inferential statistics results show that among mentioned factors, there was significant difference in the mean of climbing maximum grade between climbers group that sustain injuries and climbers group without injuries.($p=0.000$, $t=4.72$) In the same way there was significant positive correlation between maximum grade of climbing and intensity of A2 annular pulley injuries ($p=0.042$, $r=72.5$).

THE EFFECTS OF STRENGTH TRAINING ON MUSCLE MASS IN TYPE 2 DIABETES MELLITUS PATIENTS DETERMINED BY COMPUTER TOMOGRAPHY

Strasser, B., Cauza, E., Metz-Schimmerl, S., Leeb, G., Haber, P.

Medical University Vienna, Austria

Objective: This study was designed to evaluate the effects of a 4 month strength training (ST) on muscle mass and fat mass in diabetes mellitus type 2 (DM2) patients, measured by comutertomography (CT) and to relate these changes to changes in metabolic and anthropometric parameters.

Methods: Twenty-three DM 2 participants were included in a 4 months ST program. Muscle and fatt cross-section was estimated in 20 ST participants by CT volumetry with a Tomoscan AV before and immediately after the training of the quadriceps muscle. In all patients, laboratory data of blood glucose, hba1c, insulin resistance (IR) and lipid-parameters (total cholesterol, HDL-C, LDL-C, and triglycerides) as well as body mass index (BMI), fatt mass (skin fold measurements) and lean body mass were determined before and after the ST.

Results: We found significant increases in muscle CSA, as well as in muscle strength, while fatt mass and lean body mass were significantly reduced. A tendency towards a positive correlation between muscle CSA and changes in total body surface ($r=0.3$, $p<0.08$), and a correlation between left muscle CSA and improvements in systolic BP ($r=0.3$, $p<0.09$ left) were observed. Additionally, a trend towards a negative correlation between FBG and changes in % BF was found. We also found a trend in the correlation between left muscle CSA and increase in muscle strength, ie. bench press ($r=0.3$, $p<0.07$). A strong correlation between the change in left muscle CSA and the changes in pull sitting was observed ($r = 0.4$, $p<0.04$).

Conclusion: The ST in our diabetic patients was successful. However, the observed changes in muscle mass did not correlate significantly with the changes in metabolic parameters, probably due to the small sample size. Nevertheless, the CT evaluation of the training effect is safe, effective and highly available and therfore provides a suitable method for future investigations.

References:

Cauza Edmund, Hanusch-Enserer Ursula, Strasser Barbara, Ludvik Bernhard, Metz-Schimmerl Sylvia, Pacini Giovanni, Wagner Oswald, Georg Petra, Prager Rudolf, Kostner Karam, Dunky Attila, Haber Paul. The relative benefits of endurance and strength training on metabolic factors and muscle function of people with type 2 diabetes mellitus. Archives of Physical Medicine and Rehabilitation (2005) 86: 1527-1533.

Cauza Edmund, Hanusch-Enserer Ursula, Strasser Barbara, Kostner Karam, Dunky Attila, Haber Paul. Strength and endurance training lead to different post exercise glucose profiles in diabetic participants using a continuous subcutaneous glucose monitoring system. Eur J Clin Invest (2005) 35: 745-751.

COURSE AND PREDICTING FACTORS OF LOWER-EXTREMITY INJURIES AFTER RUNNING A MARATHON

van Middelkoop, M., Kolkman, J., van Ochten, J., Bierma-Zeinstra, S.M., Koes, B.W.

Erasmus MC - University Medical Center Rotterdam, Netherlands

Objectives: The aim of this study was to investigate the 3-months prognosis and medical consumption of running injuries of recreational runners occurred shortly before or during a marathon. Also, possible prognostic factors for persistent complaints were evaluated.

Background: Previous studies have reported incidence rates of lower-extremity injuries for runners ranging from 19-75%. However, the medical consumption and prognosis of such running injuries is unknown. Also factors predicting the course of running injuries are unknown.

Methods: A cohort study was set up of 1500 random selected recreational participants of the 2005 Rotterdam marathon. Demographic data and information on previous occurred injuries were obtained from a baseline questionnaire one month before the start of the marathon. Immediately after the Rotterdam Marathon a second questionnaire was sent to all respondents. A third questionnaire was sent to all runners who reported a new running injury occurred in the month before or during the marathon. Baseline assessments included demographic characteristics, training factors, race events, lifestyle pre-race factors and history of running injuries. The main outcome measure was whether the injured recreational runners had persistent complaints or not at 3-months follow-up. Potential prognostic factors for persistent complaints were analysed by multivariate logistic regression.

Results: The third questionnaire was sent to 181 injured runners and was replied by 165 (91.2%) runners. At 3-months follow-up 25.5% of the runners reported persistent complaints. Thus about 75% were recovered after 3 months. The injured runners reported nearly no pain at rest while they reported little pain at exercise at 3-months follow-up. Of all 165 runners, 27 (16.4%) visited a general practitioner as a

result of their running injury. A total of 40 runners (24.2%) visited the physiotherapist, 218 times in total. Persistent complaints after 3 months were associated with non-musculoskeletal co-morbidities such as disorders on the nervous system, gastrointestinal tract and cardiac diseases (OR 3.89, CI 1.39-10.94) and calf injuries (OR 0.33, CI 0.11-0.99). Subgroup analyses showed that persistent complaints of knee injuries were associated with training on unimproved underground (OR 19.07, CI 2.10 – 173.25). There were no prognostic factors associated with persistent complaints of calf injuries.
Conclusions: In this cohort study, one quarter of the runners had persistent complaints of their initial running injury at 3 months follow-up. Persistent complaints were related to non-musculoskeletal co-morbidities at baseline. Calf injuries predict good outcome at 3-months compared to injuries at other locations.

Poster presentation (PP)

PP3-05 Biomechanics 1-3 - "Exhibition Hall"

INFLUENCE OF THE CONTACT TIME ON THE COUPLING TIME AND A SIMPLE METHOD TO MEASURE COUPLING TIME

Zameziati, K.F., Morin, J.B., Deiuri, E., Telonio, A., Belli, A., di Prampero, P.E.

Université Jean Monnet Saint-Etienne, France, France

The enhancement of performance in stretch shortening cycle exercises (SSC) has been attributed to the recoil of elastic energy stored during the stretching phase and depends on the duration of the coupling time (Tcoupling) (Thys et al. 1975; Bosco et al. 1981). However, instead of Tcoupling, the contact time (Tcontact) i.e., the sum of Tcoupling plus the duration of the stretching and shortening phases that precede and follow Tcoupling, is more easily and often measured. The aim of this study was to investigate Tcoupling changes within a large range of Tcontact, in order to put forward a possible relationship between Tcoupling and Tcontact, thus allowing accurate measures of Tcoupling only from tachometer and force data obtained classically in vertical jumps, jumps on sledge apparatus and running on force treadmills. 11 subjects performed SSC exercises on a sledge apparatus with a large range of Tcontact (400, 700, 1000, 1500, 2000 and 2500 ms).
Tcoupling and Tcontact were measured individually, from force platform recordings and the velocity of the carriage seat obtained by a tachometer. Though subjects were asked to maintain a static position, v was not exactly nil during this phase. As a consequence, we tested 4 velocity thresholds (10, 5, 1 and 3 % of maximal velocity (vmax) during upward and downwards motions of the sledge). As velocity was obviously not nil within the 10 % and 5 % thresholds and as the 1 % threshold did not allow very short (≤ 1 ms) Tcoupling determinations, we retained the 3 % of vmax threshold as the most accurate to determine both shortest and highest Tcoupling.
For the longest Tcontact (i.e., from 850 to 2500 ms), we observed a significant linear relationship between Tcontact and Tcoupling. This transition between Tcontact shorter or longer than about 850 ms seems to be important and to correspond to Tcoupling close to 300 ms. This limit could be explained physiologically due to a possible limit of the cross-bridges lifetime during an isometric contraction (Curtin et al. 1974). Furthermore, for Tcontact shorter than 850 ms, the clear linear relationship between Tcoupling and Tcontact values was not observed any more, and as a consequence, this point obviously does not allow us to speculate on any direct assessment of Tcoupling from Tcontact in a discriminating manner for these short Tcontact conditions.
In conclusion the results of the present study show that, for Tcontact longer than about 850 ms, Tcoupling can be accurately measured from force and velocity data.

CHANGES IN SPRING-MASS CHARACTERISTICS OF THE RUNNER IN FATIGUE CONDITIONS DURING REPEATED SPRINTS

Morin, J.B., Romeyer, F., Chevallier, B., Jeannin, T., Belli, A.

UR Physiologie et Physiopathologie de l'Exercice et Hanicap (PPEH), France

Many sport events such as team sports include sprint repetitions, and the ability to withstand fatigue in these conditions may be considered a key factor of performance. We investigated mechanical determinants of performance in fatigue conditions during field repeated 100m sprints through the spring-mass model (Blickhan, 1989). Indeed, a recently developed computation method (Morin et al., 2005) makes possible to measure spring-mass characteristics of the lower limbs during field running without resorting to dynamometers. The aim of this study was to measure changes in these spring-mass characteristics induced by four all-out 100m sprints. 8 males non-specialists performed four 100m separated by 2min of passive rest. Spring-mass characteristics of the lower limbs: maximal vertical ground reaction force (Fmax in N), vertical downward displacement of the center of mass (Delta y in m) and leg length change (Delta L in m) were calculated for each contact phase using the method cited earlier. These computations are based on flight and contact times measured at 400Hz by footswitches (FSR, Intelrink, UK), horizontal velocity measured at 35Hz by radar (Stalker ATS, Radar Sales, Mineapolis, USA), mass and leg length of the subjects. Then, vertical and leg stiffness (Kvert and Kleg respectively) were calculated as Kvert = Fmax/Delta y and Kleg = Fmax/Delta L and expressed in kN/kg. An ANOVA was used, and percentage changes calculated to study variations in mechanical parameters between the first and the fourth sprint. Leg stiffness, maximal vertical ground reaction force and leg length change did not show any significant variation with sprint induced fatigue, though the mean 100m velocity decreased significantly by 7.30±5.23 %. Vertical stiffness decreased significantly by 20.6±7.9 %, and this corresponded to a significant 21.2 % increase in the vertical downward displacement of the CoM, and not to a decrease in maximal force. From these results, it seems that the decrease in sprint velocity with fatigue coincides with a decrease in Kvert, Kleg remaining constant. Further, changes in Kvert were due to an increase in Delta y rather than a decrease in Fmax during contact. This latter point is not in line with the results of Weyand et al. (2001) that showed a significant relationship between Fmax and maximal running velocity, within a much larger range of velocities. This range of maximal velocities was much narrower in the present study, maybe explaining why Fmax did not change significantly whereas maximal velocity did. Further experiments may indicate whether fatigue induces a decrease in maximal velocity and consequently in Kvert, or whether these factors both depend on other parameters (neuromuscular activation, metabolical muscular fatigue, or else).
Blickhan R (1989) J Biomech 22(11-12): 1217-27
Morin JB et al. (2005) J Appl Biomech 21(2): 167-80
Weyand PG et al. (2000) J Appl Physiol 89(5): 1991-9.

THE EVALUATION OF SIMULATED JUMP USING A FORCE PLATE

Tsunoda, K., Sasaki, T., Hoshino, H., Minouchi, Y., Ono, M.

Hokusei Gakuen University, Japan

INTRODUCTION: In ski jumping, athletes need to move their center of mass towards their intended direction. Athletes perform simulated jumping repeatedly to master intended direction. This training aims to stabilize crouching at approach, generation of maximum power and optimal movement of the center of mass at take-off. It is important to measure the forces that athletes exert during take-off. The values of Force impulse, power and center of pressure are mechanical quantities used to evaluate jump movements. These values can be calculated from simulated jumping using a force plate. The purpose of this study is to clarify the process of learning take-off motion by longitudinal measurements using a force plate.

PURPOSE: A world-cup class Japanese ski jump athlete voluntarily participated in this study. Measurement was taken three times about every 6 months from Dec. 2004. Reaction forces were measured using a force plate (AMTI co.). These data were digitized at 1kHz. And same time, simulated jump motions were recorded using a video camera (Photoron co.) at 120 fps.

RESULTS AND DISSCUSSION: Comparing the 1st and 3rd measurements, maximum force of vertical direction increased from 1258.1N to 139.0N. Maximum force of horizontal direction decreased from 278.1N to 253.0N. Force impulse of vertical direction changed from 137.9N•s to 160.7 N•s. Also Force impulse of horizontal direction changed from 90.7N•s to 72.3 N•s. The COP (Center of Pressure) at beginning take-off motion moved backward. After that COP moved forward again. The maximum displacement of COP was defined as the distance from toe to COP that had moved most forward. At the 1st measurement, the maximum displacement of COP appeared -0.246s, and the value was 17.5cm. At the 3rd measurement, -0.320 and 18.7cm. The displacement of COP became larger, and its appearance came earlier. It is important that the jumper not change the angle of the shank at take-off motion. We gave instruction on this point to the athlete. In dynamics theory, the force generated at the trunk and thighs applies to the shanks through the knee joints. If the applied force is directed parallel to the shank segment, the shank will not undergo rotation. Finally, the force is directed to calcaneus bone. Due to the progression of take-off motion, the point of reaction force appears and stays for a long time near by calcaneus bone at beginning of take-off motion.

CONCLUSION: In this study, these results suggest the following conclusions:

1. The inhibition of movement of the shank during take-off motion increased vertical force. 2. The inhibition of movement of the shank at take-off motion increased vertical Force impulse. 3. Due to the progression of take-off motion, the point of action of force moves backward at the beginning of take-off motion. 4. It is possible to evaluate take-off motion by the measurement of the point of reaction force.

AERODYNAMIC BEHAVIOR DURING THE FLIGHT PHASE IN SKI JUMPING

Sasaki, T., Tsunoda, K., Hoshino, H., Minouchi, Y., Ono, M.

Hokusei Gakuen University, Japan

Introduction: In ski jumping, jump athletes stay in the air after take-off. The longer jumpers stay in the air, the better prize they can get. The jumper cannot ignore the aerodynamic forces. Therefore, it is important to know how aerodynamic force affects the jumper during the flight phase. Sasaki (2000) pointed out that the aerodynamic forces affected jumpers with some periodicity. Vortex made periodicity of the airflow in the air (Gerlach, C. (1970)). Therefore, it is important to know the behavior of the aerodynamic force acting on a jumper during the flight phase. The purpose of this paper is to reveal the periodicity of the aerodynamic force during the flight phase.

Methodology: Measurements of acceleration during ski jumps were carried out by voluntary participants of 7 jumpers at the Hakuba in the year of 2001 Summer. Two dimensional accelerometer ("Trygal" , US Announce Co.) was set on the back position. The x-direction was defined as a parallel to the anteroposterior axis of the body and the y-direction to the longitudinal axis. The acceleration data were stored in the digital memory by 84Hz.

Results: The time at the edge of the take off platform was defined as the origin. The mean acceleration of the first period of a second and the fourth period of a second was as follows: the data for the first period of a second was 4.4m/s/s in the x-direction, and was -0.173m/s/s in the y-direction. The data for the fourth period of a second was 6.601m/s/s in x-direction and was 0.023m/s/s in y-direction. Aerodynamic forces were clearly larger in the x-direction than in the y-direction. The mean acceleration in the x-direction increased with time. The maximum frequency for each jumper during flight phase was analyzed by FFT. The mean values for peak power spectrum in both directions developed at almost the same frequency (9.16Hz:x-direction, 9.26Hz:y-direction).

Discussion: Perhaps resulting from the vortexes, The acceleration occurs in a periodic fashion. The acceleration of the x-direction increased with time course. It can be considered that jumpers' direction of motion progressively changes from a horizontal to a vertical direction. Therefore, jumpers should receive a large deceleration from air. From FFT analyses, the large power spectrums were shown to be approximately 9.0Hz. This can be considered as evidence that aerodynamic force acts on a jumper with 9.0Hz frequency.

Conclusion: In this study, the following conclusions concerning aerodynamic behavior on ski jumpers were: 1. Acceleration of the direction of the anteroposterior axis of the body increases during flight. 2. Aerodynamic force affects ski jumpers with some periodicity.

References: Sasaki, T., et.al., Aerodynamic force during flight phase in ski jumping, Sci. & Skiing II, (Ed,E.Muller),2001,p.115-128.

Gerlach, C.R. and F.T. Dodge., An Engineering Approach to Tube Flow-Induced Vibration,. in Conference on Flow-Induced Vibrations in Reactor System Components. 1970: ANL.

EFFECTS OF AGING ON THE CONTROL ABILITY OF THE ECCENTRIC CONTRACTION IN KNEE BENDING AND STRETCHING EXERCISES

Chihiro, E., Tomoyuki, I., Takeshi, M., Masayuki, K.

Kurashiki University of Science and the Arts, Japan

Introduction

When the elderly are requested to do eccentric contraction, such as descending stairs or sitting down on a chair, many elderly may feel uneasiness or even fear. However, there is no easy method to measure the ability to control muscle-tension during eccentric contraction. The first purpose of this study was to clarify the influences of aging on the ability to control muscle-tension during concentric and eccentric contractions. The second purpose was to establish the simple and easy method to measure the ability to control muscle-tension in elderly females.

Methods

Subjects were 126 elderly females (67.3 ± 9.2 yr old) and 8 young adults (21.3 ± 1.3 yr old) with no known neuromuscular deficits. They performed knee bending and stretching exercises on a force-plate while synchronizing the movement of the center of gravity (COG) with the movement of light emitting diode (LED) sign (sine wave, amplitude was 15 ~ 19.5cm (we adjusted the amplitude to the subject's height), the period was set 2.5sec) as good as possible. Time-series data of the vertical ground reaction force (GRF) were considered as a change of the vertical acceleration of COG movement. The vertical GRF was compared with the acceleration of LED movement. Three measures of the ability to control muscle-tension were studied; these were the cross correlation coefficient (CCC), the concentric contraction control ability (CCCA), and the eccentric contraction control ability (ECCA). CCC is a cross correlation coefficient of the vertical GRF to the acceleration of LED movement. CCCA is a correlation coefficient of the vertical GRF to the acceleration of LED movement while stretching the knees (concentric contraction). ECCA is a correlation coefficient of the vertical GRF to the acceleration of LED movement while bending the knees (eccentric contraction).

Results and conclusion

The following results were obtained: 1) CCC, CCCA, and ECCA were decreased with age. 2) Remarkable decreases in CCC, CCCA, and ECCA were seen in elderly females over 70 years old. 3) ECCA, especially, showed the functional decrease in elderly females over 70 years old. 4) In the eccentric contraction the drastic decrease of the ability to control muscle-tension was seen in females from around the age of 70. It implied that the age of 70 was a critical point to influence the ability to control muscle-tension during knee bending and stretching exercises. In conclusion, our study suggests that knee bending and stretching exercises are valid, simple, and also an easy method to measure the ability to control muscle-tension in the elderly female.

NEUROMUSCULAR BEHAVIOR IN OPEN KINEMATICS CHAIN IN ISOKINETIC AND ISOTONIC METHODS IN SOCCER PLAYERS

Garcia, L., Liotta, G., Argemi, R., Ortega Gallo, P.

Club Atletico Boca Juniors, Argentina

Objectives: The objective of the present study was to compare force, power and misbalances (relation of agonist/antagonist and dominant non dominant leg) in open kinetics chain, form quadriceps and hamstring muscle groups of soccer players of the Athletic Club Boca Juniors with isokinetic (IC) and isotonic (IT) devices.

Methods: Nineteen (19) youth soccer players of the Athletic Club Boca Juniors performed, in random order in two different days 2 maximal strength tests; the IC at 60, 180 and 300 grades per second of velocity, and IT with progressive load until exhaustion.

We evaluated knee extensors and flexors, in order to compare peak power and the relation of both muscle groups. we also compared the relation between dominant and non dominant leg, and the relation with a one leg countermovement and squat jump evaluation.

Results: The correlation, between IC and IT, of peak power was between 0.5 and 0.6 in the extensor of the dominant leg, and the extensor and flexor of the non dominant leg. In the flexors of the dominant leg it was less than 0.3.

We didn't observe a correlation between misbalances. In IT, but not in the IC, the flexor muscle group had 5 % more peak power in the dominant compared with the non dominant leg ($p < 0.05$) which correlates positively with the CMJ of the dominant leg.

Conclusions: IT shows that the dominant leg of soccer players have 5 % more power than the non dominant leg, probably produced for the adaptation to keep stability in driving the leg in the air during soccer play. The IC didn't show the ability to discriminate between dominant and non dominant leg.

LEVEL OF JUMPING ABILITY AT GIRLS PRACTISING RHYTHMIC GYMNASTICS

Polishchuk, T., Poliszczuk, D.

The Jozef Pilsudski Academy of Physical Education in Warsaw, Poland, Poland

Rhythmic gymnastics is one of the most difficult, and at the same time one of the most spectacular sport disciplines. One of the most significant motor properties that determine sport results achieved in artistic gymnastics is the jumping ability. The conducted study was aimed at finding an answer to the question: how does the dynamometric structure of jumping ability change with age, does it depend on the degree of fitness coordination of the subjects, and do changes take place in the level of jumping ability endurance in the ontogenesis.

The study comprised 32 gymnasts, who were divided into two groups, each with 16 subjects. The first group was consisted of gymnasts aged 9-12 years (training period experience 3 to 5 years). The second group was compose of girls aged 13-16 years (training experience – from 6 to 10 years).

Tests of the level of the jumping ability was performed using the tensodynamographic method, which is used to evaluate parameters that characterize strength and speed capabilities of the human motor system on the basis of a vertical leap off on a dynamometric platform. The tested persons performed 3 tests: leap off with sweeping arm motion, leap off without sweeping arm motion, performing a series of ten single vertical leap offs – without sweeping arm motion with an interval of 3 seconds between the jumps. The course of component force of base reaction was used to calculate the following: height of body mass centre elevation – height of upward leap off, maximum strength, maximum speed, maximum and average power, range of sweeping arm motion, force drive and performed work.

The obtained results have shown that values of particular parameters: maximum and average power and maximum strength and force drive depend on the age of gymnasts at the significance level of $p<0.05$. The obtained correlation indices demonstrated rather significant relations ($r = 0.83$) between the level of jumping ability, and coordination abilities of the subjects. Considerable differences between groups were recorded also in an executed leap off series. In gymnasts of the older age group a high level and stabilization of values of particular indices (including also the height of jumps) during performance of a series of 10 jumps was observed, while gymnasts from the younger group were characterized by a trend of decreasing values of the tested parameters.

PEAK VERTICAL GROUND REACTION FORCE IN STEP EXERCISE

Machado, M. 1, Santos-Rocha, R. 1+2, Veloso, A. 1

1 Faculty Human Movement-Technical Univ. Lisbon, 2 Sport School RioMaior-Pol. Inst. Santarém, Portugal, Portugal

Physical activities such as Step Exercise involve large weight bearing impacts on the feet. The rate and magnitude of skeletal loading, can improve the osteogenic potential of physical activity. The foot ground reaction force is affected by the mechanical properties of three bodies: the foot, the footwear, the ground and the sports equipment such as the Step bench. The assessment of biomechanical loading is quite important for exercise prescription and injury prevention in the scope of Exercise Biomechanics. Therefore, it is important to de-

termine if the differences on the mechanical characteristics of this system have any influence on the mechanical load applied on the musculoskeletal system. The study of ground reaction forces helps to understand the magnitude and pattern of loading experienced by the body while in contact with the ground. The purposes of this study were to analyse selected components of ground reaction forces (GRF) and to investigate the differences that exist between four stepping rate conditions (125, 130, 135 and 140 beats per minute - bpm) and between four Step patterns (basic step, knee lift, run step and knee hop), performed with right and left leading legs, in terms of vertical 1st peak (FZ), normalised to bodyweight (BW); vertical loading rate (LRZ), normalised to BW/s; and time to vertical peak (TFZ), in a group of 18 experienced females. These parameters were explored concerning ascending and descending phases. Concerning ascending phase, mean FZ ranged from 1.2 BW (basic step & knee lift) to 1.8 BW (knee hop) and 2.3 BW (run step); mean LRZ ranged from 4.9 BW/s (knee lift) to 10.2 BW/s (run step); mean TFZ ranged from 0.2 to 0.3 s. Concerning descending phase, mean FZ ranged from 1.6 BW to 1.8 BW; mean LRZ ranged from 7.4 to 8.5 BW/s; mean TFZ was 0.2 s. ANOVA repeated measures showed significant differences between conditions, from 125 to 140 bpm and between Step patterns, in FZ and LRZ, but not in TFZ. The results indicate that lower extremity external loading can be effectively controlled by varying stepping rate during Step classes. Assuming that walking or running are "safe" activities to be included in Exercise and rehabilitation programs, controlled stepping exercise appear relatively safe with respect to the magnitude of loading. The present investigation provides normative data of GRF parameters on the external forces of Step movements.

THE EFFECTS OF EXTENDED PITCHING ON BALL VELOCITY AND MOTION CHANGES IN BASEBALL PITCHERS

Miyazaki, M., Tsukada, M., Tanaka, S., Tsunoda, N.

Obirin University, Japan

The success of a pitcher over the course of a game is based on his ability to maintain his pitching motion as the innings progress. There were no reports to explain possible correlations between ball velocity, joint torques and motion changes. Therefore, the purpose of this study was to clarify kinetic and kinematic changes as a result of extended play in baseball pitching.

Six male baseball pitchers with no injury on the throwing arm voluntarily participated in this study. Mean age, baseball experience, height and weight were 22.2±3.5 (SD) yr, 12.3±1.0 yr, 175.9±7.6 cm and 66.3±10.1kg, respectively. Each subject pitched 140 times consisting of 7 sets of 20 pitches each. The velocity of each throw at the distances of 18.44m (Pitched ball velocity: PBV) was measured by Radargun (Mizuno). The relative velocity（VR）in each set was compared to the first set and the coefficient of variation (CV) in each set were calculated. The pitching motion was filmed by two high-speed video cameras (Digimo). The cameras were set at a nominal frame rate of 250 frames/s and at an exposure time of 1/2000s. Six landmarks (Ball, Wrist, Elbow, Shoulder, Pelvis and Knee) were manually digitized from video data. The analyzed phase was from stride foot contact to ball release in the pitching motion. Isokinetic shoulder internal-rotation (IR), knee extension (KE) and knee flexion (KF) torque at 140 of 20 times 7sets repetitive maximal contractions with velocity of 180deg/sec were measured using Isokinetic dynamometer (Biodex). The relative peak torque in each set compared to the first set was calculated in all the pitchers.

The following results were obtained: The PBV decreased from the first set to the final set. The VR of the final set had significantly lower values than the second, third and fourth sets ($p<0.05$). The Torque of IR and KF decreased from the first（IR: 32.8±7.3Nm, KF: 81.5Nm）to the final set (IR: 29.8±6.8Nm, KF: 73.8±16.4N-m). Acceleration of each joint decreased from the first to the final set. Acceleration on elbow joint in final set was significantly lower than the first set. The differences of time to maximal movement velocity in all the joints of upper extremity were shorter from the first set to the final set for the subjects who recorded decreased pitched ball velocity.

Decreases in the ball velocity from the first set to the final set were noted. Torque of IR and KF and acceleration of each joint decreased from the first to the final set. From these results, it was indicated that decreases in torque and acceleration of joint movements possibly influence a decrement of ball velocity. The differences of time to maximal movement velocity in all the joints of upper extremity were shorter from the first set to the final set for the subjects who recorded decreased pitched ball velocity.

INFLUENCES OF THE BUOYANCY AND THE VISCOUS RESISTANCE ON GAIT PATTERNS DURING THE TREADMILL WALKING IN THE WATER

Miyakawa, T., Onodera, S.

Kawasaki University of Medical Welfare, Japan

It has not been clarified how gait patterns change in the water yet. Therefore, the purpose of this study was to investigate the influences of the buoyancy and the viscous resistance on gait patterns during the treadmill walking in the water.

Two males and four females volunteered to this study. They walked on the treadmill in the following three conditions; these were on a land (LAND), in the water (WATER), and in the viscous water (VISCOUS). The duration and speed were set for 15 minutes and at 40m/min, respectively. The water depth set at the greater trochanter level. The viscousity of water was 1% solution of the carboxymethl cellulose (viscous coefficient : 470cps). The walking motions were videotaped using a high speed video camera(200Hz).

The step lengths on LAND, in WATER, and in VISCOUS were 42.8±3.6cm, 53.7±5.8cm,?and 53.8 ±4.6cm, respectively. The step lengths in WATER and that in VISCOUS were significantly longer than that on LAND ($p<0.05$). The flexion angles of the knee-joint on LAND, in WATER, and in VISCOUS were 65.2±4.9 degrees, 75.8±4.7 degrees, and 79.1±6.4degrees, respectively. There was a significant difference between LAND and WATER. A significant difference was also seen between LAND and VISCOUS. The angular velocities of the knee-joint during flexion on LAND, in WATER, and in VISCOUS were 123.2±12.7degrees/sec, 120.6±19.3degrees/sec, and 150.5±11.7degrees/sec, respectively. The angular velocity of the knee-joint in VISCOUS was significantlly larger than the other conditions. On the other hand, the angular velocities of the knee-joint during the extention on LAND, in WATER, in VISCOUS were 188.9±13.5degrees/sec, 148.1±21.7degrees/sec, and 124.5±22.5 degrees/sec, respectively. A significant differrence was observed in each condition. The flexion angles of the hip-joint on LAND, in WATER, and in VISCOUS were 24.5±5.3degrees, 32.5±5.3degrees, and 37.5±3.7degrees, respectively. There was a significant differrnce between LAND and WATER. A significant difference was also seen between LAND and VISCOUS. The angular velocities of the hip-joint during the flexion on LAND, in WATER, and in VISCOUS were 72.9±13.9degrees/sec, 74.5±11.5degrees/sec, and 84.6±15.4degrees/sec, respectively. There was a significant difference between VISCOUS and the other conditions.

We consider that the buoyancy may influence the step length, and the viscous resistance may influence the angular velocity of the joints while walking in the water. Furthermore, based upon our study, we believe that a human tend to use more hip reflexors while walking in the water as compared to land. It is, especially, obvious when the viscousity of water is high. The reason why is because the hip flexors

can generate more force than the knee extensors. In short, a human tends to use a body part in which one is able to exert the greater force in order to perform efficiently and effectively in the water.

DISCRIMINANT ANALYSIS OF MORPHOLOGICAL CHARACTERISTICS IN ELITE FEMALE ATHLETES OF THREE TEAM SPORTS

Noutsos, K., Rousanoglou, E., Bolatoglou, T., Bergeles, N., Bayios, I.

National & Kapodistrian University of Athens, Greece

Introduction: The morphological characteristics of athletes affect performance and reflect optimum sport-specific somatotype in each sport. The aim of this study was to identify the variables of body dimensions, body composition and somatotype that best differentiated elite female volleyball, basketball and handball players.

Methods: The characteristics of body height, body mass, the skinfolds of biceps, triceps, subscapular, suprailiac and the circumferences of mid-upper-arm and calf were measured according to the guidelines of Heyward & Stolarczyk (1996), in 79 volleyball (25.7±5.1 yrs), 70 basketball (23.6±4.6 yrs) and 101 handball players (23.2±5.3 yrs), all members of the first Greek National League. The body mass index (BMI) and the height to weight ratio (HWR) were calculated (Heyward & Stolarczyk, 1996). Body density was determined using the equation of Durnin & Womersley (1974) and body fat (%) entering the measurements of four skinfold into the equation of Siri (1956). Somatotype was determined according to Carter & Heath method (1990). Discriminant Function Analysis (DFA) was performed to ascertain the linear combination of anthropometric, body composition and somatotype variables that best differentiated the three groups. Wilks' lambda, percentage of correctly classified players and explained variance, as well as standardized coefficient, among other parameters, were calculated.

Results: DFA was conducted entering body dimension variables, body composition indicators and somatotype components. After validation, the analysis showed that 82.4% of the athletes were correctly classified in their respective sports. The DFA yielded two significant ($p<.001$) discriminant functions. The first discriminant function explained 73.5% of the total variance, mainly described the differences between handball and volleyball players and the highest standardized coefficients were shown for BMI (8.741), ectomorphy (4.951) and fat free mass (-2.593). The second discriminant function explained 26.5% of the total variance, mainly described the differences of basketball players from both the volleyball and the handball players and the highest standardized coefficient were those of BMI (10.410), ectomorphy (8.266) and body mass (-6.219).

Discussion: The main finding was that elite female volleyball, basketball and handball players are primarily discriminated by BMI and secondly by ectomorphy, as shown by their high standardized coefficients. This is in agreement with findings that lower BMI and high ectomorphy favour athletic performance (Carter & Heath, 1990). The discriminant model confirms that the morphological characterists do distinguish elite female athletes of team sports.

References

Durnin JV, Womersley J (1974). Br J Nutr 32:77-92

Carter JEL & Heath BH (1990). Somatotyping – development and application

Heyward V, Stolarczyk L (1996). Applied body composition assessment

Siri WE (1956). Adv Biol Med Phys 4:239-280.

DYNAMIC ASYMMETRY AND DIMORPHISM AT CHILDREN IN AGE 8-13 YEARS

Witkowski, K. 1, Stefaniak, A. 2, Migasiewicz, J.1, Kedzierski, J. 2

1 University School of Physical Education in Wroclaw, 2 Primary School No 94 in Wroclaw, Poland

Introduction

The girls differ from boys as far as construction of body (sexual dimorphism) and physical fitness are concerned. Many scientists indicate for differences present at both sexes in the field of morphological and functional asymmetry. At the same time, the evaluation

of dynamic asymmetry at representatives of the same as well as the opposite sex is still an open issue. The authors focus their attention on evaluation of dynamic asymmetry between girls and boys in the range of age 8 - 13 years in such areas as coordination and fitness.

Material and the methods of investigation

Among 105 investigated children, there were 52 girls and 53 boys. Both sexes were represented by almost equal number of representatives, which was a favorable situation

in the light of comparison between two sexes. For measurement of dynamic asymmetry, a set of 8 tests was prepared. Asymmetry of coordinative ability was examined by tests used for evaluation of movement accuracy and speed of the lower and upper limbs. Different kinds of asymmetry was measured by various acknowledged types of tests.

Results and their interpretation

On the basis of conducted investigations it was confirmed, that the examined children were characterized by greater physical efficiency of the right side of body than left.

In exceptional cases, some tests among girls proved superiority of the left side over the right. In the group of investigated children, statistically relevant dynamic asymmetry was present

in case of almost all examined motor abilities. The only ability, not diversified as far as the investigated asymmetry was concerned, was dynamic endurance of lower limbs. Among girls, the largest differences were exposed in movement speed as well as muscles strength of upper limbs. Among boys, the most essential differences concerned accuracy of movements

of lower limbs and - like at girls - speed of movements and muscles strength of upper limbs. When taking into consideration dimorphism within the range of estimated dynamic asymmetry, it indicates for lack of statistically relevant differences between sexes. Only within particular age groups, essential differences were shown.

Conclusions

1. The examined children are characterized by a high level of dynamic asymmetry within the range of investigated motor features.

2. At the examined children, significant superiority of the right side of body over the left was noted as far as the level of investigated motor features was concerned.

3. The examined girls do not essentially differ from boys by the level of dynamic asymmetry in the range of investigated motor features.

COMPARATIVE ANALYSIS OF DELPHIN KICKS AT THE UNDERWATER SWIMMING

Zahalka, F., Kuzvard, T.

Charles University, Czech Republic

The main task of this study was evaluating swimming technique of swimmers with the different swimming specialization. Working of lower limbs are the main driving force for the performance this swimming technique. The general movement of lower limbs is divided to several phases. One movement cycle consists of the lower limb's movement nose-up to the water surface (upbeat) and the lower limb's movement down from the water surface (downbeat). We consider the bottom dead center of the lower limbs as the beginning of the movement phase. This moment is the end of the previous phase and the muscles are released and lower limbs are inactive at this time. Next movement starts with the flexion at the hips joints. Lower limbs are stretched and their movements are in the direction up to the water surface until they reach the highest vertical position. The next phase is starting at this time. Downbeat is starting with the flexion at the hips joints and lower limbs are bending at the knee joints. Propulsive forces are created by fast dynamic extension at knee joints (Maglischo 2003).

We observed the group of four swimmers. One woman SW1 and one man SW2 are swimmers specialists, one man SW3 is triathlon specialist and one man SW4 is swimmer with flippers specialist. For the evaluation of the movement we used 3D kinematics analysis. The movements were recorded under the water by 3 digital video cameras with 50 Hz frame rate. In the centre of the swimming pool there were the calibration cubes and calibrating space was 1 x 1 x 4 m. The displayed space was 6 m long. For the calculation of the space coordinates DLT algorithm was used. For the trace a score of the selected points we used software TEMA Bio 2.3. We choose the significant point on the body of the swimmers: ankle, knee, hip, shoulder, elbow, wrist, and head. The swimmers had task to perform the selected technique with the maximal respect of performance regardless of the speed of swimming.

The results the trajectory and velocity of the ankle show that all swimmers reach the higher values of the velocity during the downbeat. Swimmer SW4 had the highest values of velocity during the both phases (downbeat, upbeat). Swimmers SW2 and SW3 had the longest time of ankle displacement from top dead centre to bottom dead centre (more than 1.1 s). The results of the velocity of the hip joints during the cycles showed big differences SW1(1.1 – 1.3 m/s); SW3 (0.5 – 1.1 m/s). This oscillation (SW3) could be considered as the wrong performance of the technique. We found the swimmers specialists with the high level of competition performance had not intraindividual stability of every cycle. Swimmer SW1 performed three cycles in sequence with the high stability of velocity (0.2 m/s) but with the different trajectories of the ankles, knees, hips and trunk. We can give reason for it by ability of swimmer to solve particular kick according the aqueous media.

THE EFFECT OF FOOT POSITION ON PEDAL SURFACE ON ANKLE, KNEE, AND HIP JOINT MOMENTS FOR TRIATHLETES

Hoshikawa, H., Takahashi, K., Ohashi, K., Tamaki, K.

Musashigaoka College, Japan

The settings of bicycle positions have a great influence on cycling performance. Although some studies examined the effect of foot position on heart rates, muscle moments and EMG activities (Ericson et al., 1985,1986, Mandroukas, 1990), those studies were limited to normal healthy subjects at low pedaling cadences from 50 to 60 rpm. No research on foot position has been performed for subjects trained in pedaling exercise at high pedaling cadences from 90 to 100 rpm. PURPOSE This study investigated the effect of foot position on ankle, knee and hip joint moments at widely changing pedaling rates for regularly pedaling-trained subjects. METHODS Four male university triathletes cycled with their feet in the anterior position (AP) and the posterior position (PP) on the pedal surface at four pedaling rates (40, 60, 90, 120 rpm) at a constant power output of 200 W. The AP was defined as the position that the center of the pedal was in contact with the metatarsal head of the great toe and the PP was defined as the 10 cm backward from the AP (Ericson et al., 1985). The bicycle ergometer equipped with force sensors on the both pedals was used in this experiment. The displacements of the crank axis, ankle, knee, and hip were recorded by a video camera. From those video data the motion analyzer was employed to extract necessary data points. The lower extremity was modeled as a planar, three-segment, and rigid body system. Based on a standard inverse dynamics method, the equations of motion for the three segments were solved using the pedal force and position data to calculate the moments of ankle, knee and hip joint. RESULTS & DISCUSSION Few ankle dorsiflexor moments were exhibited at all experimental conditions. The mean ankle plantar flexor moments in the PP were significantly lower than those in the AP at every pedaling rate ($p<0.05$). The differences in the mean ankle plantar flexor moments between the AP and the PP (d-Map) decreased as pedaling rate increased. There were no significant differences between two foot positions in the mean knee extensor and flexor moments at every pedaling rate. The PP showed significantly higher mean hip extensor moments at 40, 90 and 120 rpm compared to the AP ($p<0.05$). This result suggests that hip extensor would compensate the d-Map. Furthermore, the mean hip extensor moments in the AP decreased until 90 rpm as pedaling rates increased, whereas the values in the PP tended to increase above 60 rpm. The differences in the hip extensor moments between the AP and the PP (d-Mhe) were no statistically significance at every pedaling rate. As the result that the d-Mhe did not decrease in spite that the d-Map decreased as pedaling rates increased, hip extensor muscles at the PP would be overloaded at higher pedaling rates．These observations suggest that by effectively utilizing ankle movement, triathletes would decrease hip joint moments and reduce muscle fatigue in the lower extremity at higher pedaling rates.

THE EFFECTS OF ELEVATED FOREFOOT WALKING SHOES ON POSTURE, GROUND REACTION FORCE AND FOOT-PRESSURE DURING WALKING

Yi, K.-O., Kwon, B.Y., Lee, S., Lim, H., Lee, Y.

Ewha Womans University, Korea, South

Purpose

The purpose of this study was to analyze the effects of elevated forefoot walking shoes on posture, ground reaction force, and foot-pressure

Methods

Twenty female college students volunteered as subjects for the seven-week study. The structure of the shoes is analogous to the anatomical structure of the foot, with a distinct heel, arch, and ball of the foot. The forefoot of these shoes elevated the foot to an angle of 35 degrees, while positioning the toes at 50 degrees above the ground. In the sagittal plane, neck, hip, knee and ankle angle were all measured. Ground reaction force was measured via the Kistler force platform. Foot pressure was measured through the Insole (Novel). The paired-T test was used for statistical analysis.

Results

There was a statistically significant difference in the sagittal plane for the neck & knee angle. As with normal walking shoes, subjects experienced no impact with the elevated forefoot shoes. However, the active loading rate (both vertically and laterally) was two times greater with the elevated forefoot shoes. As expected, wearers of the elevated forefoot shoes placed pressure on their midfoot and heel for a longer time than wearers of normal walking shoes. In addition the maximum average pressure was less than normal walking shoes.

Conclusion

Bad posture places increased stress on the body and the constant repetitive action of walking can exacerbate existing problems. Elevated forefoot shoes can help counteract some of these negative factors. In the sagittal plane the posture of all test subjects improved in the neck & knee. The redistribution of weight on both the heel and the midfoot emphasized active stretching in the posterior of the leg. In contrast, in the front of the leg were accentuated with the elevated forefoot walking shoes. Furthermore, this redistribution of weight limited the range of movement during midfoot and heel striking. First, wearers of the shoes were unable to lean forward in order to walk. Secondly, wearers experienced active dorsi flexion during heel and midfoot contact, so they can not transfer ground reaction force into forward momentum. In order to compensate, wearers were required to move their center of gravity upwards in order to walk, utilizing greater active muscle force with each step. This can be seen in an active loading rate which is twice that of normal walking shoes. Thus, with increased contraction and stretching, blood circulation increases in the legs.

References

Emily, A. Keshner., John, H.J. Allum(1990). Muscle Activation Patterns Coordinating Postural Stability from Head to Foot. Multiple Muscle Systems: Biomechanics and Movement Organization J.M. Winters and S.L-Y. Woo(eds.), Springer-Verlag.481-497.

David, A. Winter., Gordon, K. Ruder., and Colum, D. Mackinnon(1990). Control of Balance of Upper Body During Gait. Multiple Muscle Systems: Biomechanics and Movement Organization. J.M. Winters and S.L-Y. Woo(eds.), Springer-Verlag. 534-549.

COMPARISON BETWEEN TREADMILL AND LEVEL WALKING -FOCUSING ON THE COMPLEXITY OF THE WALKING CYCLE-

Tomoyuki, I., Chihiro, E., Takeshi, M., Sho, O.

Kawasaki Univercity of Medical Welfare, Japan

Introduction

Walking is the most fundamental periodic movement. However, the complexity of the walking cycle is not clearly understood even though time series data has come to be quantified. Entropy is a concept which quantifies the complexity of the cycle of a system, and it has been used in various fields including physiology. To apply this concept to walking, it can be possible to clarify the complexity of the walking cycle. Furthermore, measurements of walking ability and gait training are done on a treadmill as well as on a level floor by many researchers. However, a lot of differences, such as body functions during walking, are observed in these different situations. Therefore, the purposes of this study is to examine whether walking on a treadmill and a level floor influences the complexity of the walking cycle by using Approximate Entropy (ApEn).

Methods

Thirty young healthy males and females volunteered as subjects for this study. Subjects walked on a motor driven treadmill and level a floor. The head fluctuation of the right-and-left direction during a walk was measured by using an accelerometer. Subjects walked on the treadmill with a walking velocity of 20m/min, 40m/min, 60m/min, 80m/min, 100m/min and 120m/min. Subjects walked for 3 minutes each in both conditions. While walking, subjects were instructed to look at the target, which was situated 3m ahead. In level walking, subjects walked 40 m, and they were instructed to walk "slowly", "a little slowly", "usual velocity", "a little fast" and "fast" depending on their subjectivities. The walking velocity was also measured. In addition, the complexity of the head fluctuation of the right-and-left direction cycle in the treadmill and level floor walking was calculated by utilizing ApEn. After the value of ApEn in both walking conditions was standardized at the walking velocity (20, 40, 60, 80, 100, 120 and 140m/min), these were compared.

Results and Discussion

The value of ApEn in the treadmill and level floor walking decreased with the increases in the walking velocity. This was remarkable until the walking velocity reached 100m/min. Nevertheless, the value of ApEn increased from the walking velocity a little faster than 100m/min in both walking conditions. The value of ApEn in the treadmill walking was significantly higher than that of level floor walking at 20, 40 and 60m/min. However, its value showed significantly lower than that of level floor walking at 120m/min ($P<0.05$). From our results, it is assumed that there are no differences in the complexity of the walking cycle at the free walking or a little faster than free walking velocity while walking on the treadmill and level floor. This is because walking affects nerves including the control of posture, which is optimized at the free walking velocity. In conclusion, it is clear that walking on the treadmill and level floor have influence on the complexity of the walking cycle.

WHY DOES POWER OUTPUT DECREASE AT HIGH PEDALLING RATES DURING SPRINT CYCLING?

Samozino, P., Morin, J.B., Hintzy, F.

UR Physiologie et Physiopathologie de l'Exercice et Handicap, Saint-Etienne , France

During sprint cycling, the power output-pedalling rate relationship is parabolic and presents a maximal power output (Pmax) and an optimal pedalling rate (PRopt). Using a dynamics modelling simulation, Van Soest and Casius (2000) explained these PRopt values from two factors influencing power output in opposite ways when pedalling rate increased. On the one hand, the potential for power production, as defined by intrinsic muscle mechanical properties, increased with pedalling rate and reached a maximum around 200 rpm. On the other hand, activation dynamics had a detrimental effect on increasing power production with pedalling rate. The aim of this study was to investigate the concrete expression of this detrimental effect to understand the decrease in power output beyond PRopt.

Eleven male cyclists performed four randomised 8s sprints against friction loads ranging from 0.5 to 0.9 N.kg-1 body mass. The friction-loaded cycle ergometer (Monark type 818 E, Stockholm, Sweden) used was equipped with an optical encoder for measurement of flywheel displacement and with a strain gauge for measurement of frictional force. Instantaneous crank angle and pedalling rate were obtained from flywheel displacement and velocity. Power output was the product of external force (sum of frictional and inertial forces) and flywheel velocity. Power output and pedalling rate were averaged over each pedal downstroke and related by 2nd order polynomial regression. Pmax and PRopt were determined by the first mathematical derivation of the relevant regression equation. During each

downstroke, crank angles corresponding to minimal (CAPmin) and maximal (CAPmax) instantaneous power output values were determined. Pedalling rate effect was tested with analyse of variance and Newman-Keuls post-hoc tests.

Mean Pmax and PRopt values were 9.55 ± 0.99 W.kg-1 and 120 ± 9.86 rpm, respectively. CAPmin and CAPmax ranged from -7.27 ± 4.26 ° to 17.7 ± 11.0 ° and from 80.8 ± 6.41 ° to 107 ± 15.2 °, respectively (0° corresponding to the top dead centre). CAPmin and CAPmax were significantly higher at pedalling rates higher than 130 rpm than at low ones ($P<0.05$).

To be efficient, power must be produced between 70 and 110°, i.e. at angles optimizing pedal effectiveness (Ericson at al. 1988). At low pedalling rates (<130 rpm), peak power production appeared at these optimal crank angles. However, with increasing pedalling rate, the beginning (CAPmin) and peak (CAPmax) of power production appeared at higher crank angles. Hence, power was produced later in the crank cycle, and therefore at less efficient crank angles. Consequently, even if muscle power applied to the pedals would increase (Van Soest and Casius 2000), power output decreased beyond PRopt.

Ericson MO, Nissel R (1988). Efficiency of pedal forces during ergometer cycling. Int. J. Sports Med. 9: 118-122

Van Soest AJ, Casius LJR (2000). Which factors determine the optimal pedaling rate in sprint cycling? Med. Sci. Sports Exerc. 32.

OPTIMAL SLOPE FOR MINIMIZING ENERGY COST OF LOCOMOTION: INDIRECT ASSESSMENT BY HIGH ACCURACY GPS

Terrier, P., Wearing, S., Hills, A.P.., Schutz, Y.

University of Lausanne, Switzerland / Queensland University of Technology, Australia., Switzerland

The energy cost of human locomotion is significantly influenced by the slope of the terrain. The relationship of energy cost to slope may be expressed as a J-shaped curve with a minimum at about -10% slope. The underlying mechanics that explains such a relationship include: 1) the differential efficiency of the muscles used as force and brake generators 2) the residual positive mechanical work against gravity that occurs during downhill walking, as well as residual negative work during uphill walking.

Although uphill and downhill walking has been studied over decades in the gait laboratory, there is a lack of data concerning the effect of grade on the energetics of outdoor free walking. The objective of the present report, therefore, was to ascertain the slope at which the energy cost of locomotion was minimized under free walking conditions.

A high accuracy Global Positioning System (<1cm) was used to continuously monitor the vertical oscillation of the head in 25 young healthy non-obese women while walking along a 2.5km outdoor circuit, exhibiting a wide range of grades (-20% to +20%). The head oscillation was assumed to represent trunk oscillation. The step frequency, walking speed and vertical oscillation were subsequently used to estimate the energy cost of walking at various grades.

The observed vertical body oscillation (positive and negative, expressed per step) was +6.5/-6.5cm at 0% slope, +3.6cm/-10.6cm at -10% slope and +11cm/-4.0cm at +10% slope. The mechanical power induced by these oscillations was expressed as transport cost per unit body mass (i.e. the energy to transport 1kg mass over 1m). The physiological cost of walking was computed taking into account the theoretical well known difference in efficiency of eccentric/negative work (0.25) and concentric/positive work (1.25). By pooling the individual data sets (about 10hour walking) we found a J-shaped curve pattern with a theoretical minimal energy cost of locomotion at a decline of 10.4%.

Despite the use of a simplified model and the application of a new technology (GPS) which is still at its infancy, we confirm in our free-living conditions the literature results in the lab based on the analysis of treadmill walking over short duration. This highlights the utility of high accuracy GPS in monitoring outdoor walking under free living conditions.

FATIGUE EFFECTS IN GROUND REACTION FORCES DURING LANDING IN MALES AND FEMALES

Kouvelioti, V., Kellis, E.

Aristotle University of Thessaloniki, Greece

Jumping and landing are frequent movements in various sports. Foot impact with the ground during such activities can impose extreme loads on the musculoskeletal system [1,], which may lead to musculoskeletal injury. Muscle fatigue may also be of particular importance to injury [2]. This is supported by epediomiological and expirimental sudies which indicate that fatigue combined with extreme loads, may lead to injury[3].

The objective of this study was to investigate the effects of knee extension fatigue, on ground reaction force characteristics during landing, in males and females. Twenty healthy subjects, 10 males and 10females, (mean age 23.9±1.37years, height 174.8±10.3 cm, and mass 68.95±12.09 kg), performed 2 sets of repeated maximal concentric efforts of the knee extensors at 120º /sec, until they could no longer consistenly produce 50% of maximum torque. Αll subjects were asked to perform three single –leg landings from 30cm drop height on a force plate, before, in the middle and after the knee extensors' test.

The maximum GRF ,the mean GRF during the first 100ms after touch down and the mean GRF during 100-200ms after touch down, were determined before, during and after fatigue. The effects of gender and fatigue on GRF parameters were analysed using a two-way analysis of variance (2x3). The results indicated that the mean values of maximum GRF, the mean GRF during the first 100ms after touch down and the mean GRF during 100-200ms after touch down , did not significantly change with fatigue (all $p> 0.05$). Males and females landed with similar GRFs and all variables did not differ significantly (all $p>0.05$).

All variables after touch down did not change cignificantly. These finding suggest that a typical fatigue protocol of knee extension did not decline ground reaction forces. Further, no gender effect was observed whichs agrees with previous studies [4]. Further investigation is recommended in order to learn how does fatigue affects ground reaction forces during landing in males and females.

References

1.Madigan , L., Pidcoe, E., (2003) .Journal of Electromyography and Kinesiology 13 491–498

2.Christina, K. A.,White, S. C., Gilchrist, L. A.,(2001). Human Movement Science

3.Urabe, Y., Kobayashi. R., Sumida, S., Tanaka, K., Yoshida, N., Nishiwaki, G. A., Tsutsumi, E., Ochi, M.(2005).The Knee 12: 129-134

4.Decker M. J., Torry M. R., Wyland D. J., Sterett W. I., Steadman R. J., (2003). Clinical Biomechanics 18:662-669.

A COMPARATIVE KINEMATICS STUDY OF THE KARATE PUNCHING MOVEMENT (CHOKU-ZUKI) PERFORMED WITH TWO DIFFERENT STRATEGIES

Vences Brito, A. 1, Pezarat-Correia, P. 1, Pascoal, A. 2, Fernandes, O. 2

1 Sports Sciences School of Rio Maior P. I. S., 2 Faculty of Human Kinetics T. U. L. Portugal, Portugal

The study compares the upper limb kinematics on two different conditions of karate punching movement (choku-zuki): with (WI) and without impact (NI) against a makiwara (karate training instrument). The WI condition was performed with the maximal impact and the NI condition involves a voluntary interruption of the punch on the contact moment.

Ten male athletes of the Portuguese Karate National Team (age=25 +3yr, height=174,8 +0,062cm, weight=71,13+9,4kg, arm length=78,4+3,1cm, body fat %=14,07+3,6), performed choku-zuki to a makiwara from a karate stance of Hachiji-dachi. Each subject repeated 10 times the punch with the right side in the two conditions. The thorax, upper arm and forearm kinematics data were recorded with a six degree-of-freedom electromagnetic tracking device, Flock of Birds System (Ascension Technology Inc., Burlington, Vermont, USA). Was used a set-up of three sensors located on thorax over T1 process, on the humerus in the lateral face of the middle upper arm and in the dorsal face of distal forearm. A four sensor was mounted on the makiwara. Differences between conditions were tested by One-Way Anova. To statistical processing we use the SPSS 13.0 for a significance level of 0.5.

The choku-zuki WI condition movement sequence was: forearm pronation, arm flexion, arm abduction, thorax left rotation, arm internal rotation and forearm extension. The total punch sequence average duration was of 300+70ms. The choku-zuki NI, presented a short duration (288+79ms) and the movement sequence was: arm flexion, thorax left rotation, forearm pronation, arm internal rotation, arm abduction and forearm extension. This temporal different sequence between conditions reflects several significant differences on segments movements. In NI condition we found a significant ($p<0.02$) increase in movement amplitude (WI=57+14,9o; NI=77+13,8o) and a decrease ($p<0.001$) on maximum peak velocity (WI=3,57+1,51rad-1; NI=1,42+0,91rad-1) of arm flexion, significant ($p<0.000$) increase in the time interval between the instant of peak velocity and the instant of the impact (WI=11+10ms; NI=41+16ms) and in the movement amplitude (WI=5,54o+3,28o; NI=20,9o+5,89o) in the arm internal rotation, significant ($p<0,000$) increase in movement amplitude (WI=47,8o+21,17o; NI=69,62o+17,17o) on forearm extension, significant ($p<0.02$) decrease in the duration (WI=300+70ms, NI=210+90ms) and maximal peak of angular velocity (WI=2,17+0,95rad-1; NI=3,83+1,88rad-1) on forearm pronation.

Significant differences were found between conditions on kinematics of choku-zuki execution. The main differences were found on NI condition including a different sequential order of movements, longer movement amplitude and time anticipation on acceleration and velocity maximum peak in arm flexion, arm internal rotation and elbow extension. On further processing of this study, these kinematics differences will be related with the neuromuscular patterns of shoulder and elbow muscles, recorded by EMG.

THE VALUES OF SELECTED BIOMECHANICAL PARAMETERS OF SPRINTERS' LOWER LIMBS MUSCLES

Gabrys, T., Staszkiewicz, R., Ozimek, M.

Academy of Physical Education Cracov, Academi of Physical Education Warsaw, Poland

Introduction. The 100-metre sprint race belongs to sport discipline where a competitor's success depends on the level of speed abilities. The final result is conditioned also by a range of other parameters: body constitution, muscle fibres composition, muscles' strength and power output, race technique and the level of physical fitness. The functional condition of muscles of lower limbs influence on the abilities of increasing the speed during the race (Staszkiewicz et al. 2002). The aim of the researches was the measurement of selected biomechanical parameters describing the muscles of sprinters and the definition of connection of these parameters with the sport level of examined competitors.

Material and methods. Conducted researches involved the group of 10 sprinters specialized in 100-meter race. Among the examined sportsmen were competitors of international champion's class (MM), champion's class (M) and first sport class (I). In the isometric condition there were determined: maximal (Tmax) and relative (Trel) knee extensors muscle torque and the maximal rate of muscle's force development (F'max). In counter movement jump on dynamographic platform, the average (P) and relative (Prel) mechanical power output developed by muscles were calculated.

Results. The highest values of Tmax and Trel were noted in MM group (253 Nm and 3,43 Nm/kg, respectively). Maximal knee extensor's muscle torque in M group was 16% lower, while relative value – 25% lower. Sprinters from the weakest group (I) achieved the lowest values of Tmax and Trel (198 Nm and 2,77 Nm/kg). The differences between the parameters describing the muscles' strength of left and right limbs do not exceeded 4% for every sportsman. The value of maximal rates of muscle strength increasing (F'max) for M group was equal to 8236 N/s and 8392 N/s – for MM group; F'max in I group was equal to 7862 N/s. The rate of muscle force development in left and right knee extensors were similar for all the sprinters. The best examined athletes (MM) during counter movement jump achieved the highest values of power output in absolute formulation (P) as well as in relative formulation (Prel): P in this group was equal to 1740 W, while Prel – 23,6 W/kg. These variables in other groups of sprinters were: 1607 W and 20,6 W/kg (M group); 1401 W and 19,5 W/kg (I), respectively.

Conclusions. The values of biomechanical parameters describing muscles' force, speed and mechanical power output are increasing with improving of sport level of sprinters. The largest differences between the competitors from MM and M group refer to the relative muscle force (Trel), so it appears that it is necessary to aim at optimization of this parameter value during training process. Sprinters' training process is favorable to equalizing the values of variables describing the strength and speed abilities of left and right limb muscles.

Reference

Staszkiewicz R. et al. (2002) Diagnostika Pohyboveho Systemu: 149-152, Olomouc.

TRAINING PROCESS INFLUENCE ON STRENGTH AND SPEED ABILITIES OF YOUNG FOOTBALL PLAYERS' MUSCLES

Szmatlan-Gabrys, U., Staszkiewicz, R., Ozimek, M.

Academy of Physical Education Cracov, Academi of Physical Education Warsaw, Poland

Introduction. The modern football makes high demands for competitors that make possible to reach the best results. The training process begins at more and more early ages and is assisted and controlled by professional scientific researches. As well as in all kinds of team games the result in football is determined by individual features of sportsmen (Komi 2000) and team factor. The aim of researches was the definition of the influence of many-years football training process on the level of strength and speed abilities describing the knee extensors of young football-players.

Material and methods. The mentioned researches involved 118 football-players at the age of 12-18 years. The aim of the measures was the determination of maximum muscle torque of knee extensors (Tmax) and the rate of muscle force increase (F'max). All tests were carried out under maximum isometric contraction in standard measuring positions. Strength parameters were also expressed in relative formulations (Trel).

Results. The lowest value of Tmax were characteristic for the youngest football-players (about 114 Nm), the highest one for 17 age competitors (196 Nm). The biggest annual increase (10-20%) was noted for competitors between 12 and 15 years old. In the analyzed age period (12-18 years old) the maximum moment of force increased about 70%, while Trel increased about 15%. The differences between force parameters values describing the muscles of left and right lower limbs do not exceed 7% and are not statistically significant. The maximal derivative of force (F'max) reaches the lowest value in the group of the youngest competitors (about 4900 N/s), while the highest one (about 6700 N/s) in the group of competitors aged 18. The difference of F'max value between aged 12 and aged 18 is about 37%. The registered Tmax values (sufficiently higher than for non-training boys of the same age) prove that the influence of training process on muscle strength of young football- players is more essential than it is considered. All the more so as in this process the strength aspect is not prevailing because the specificity of mentioned sport discipline does not demand the generating of maximal muscles' strength. In view of increasing of F'max value with the age of football-players, the oldest group of competitors develops the muscle strength of the maximal value that can be achieved with the highest speed.

Conclusions

1. Maximal and relative knee extensor's muscle torque are increasing up to the age of 17, while the value of Tmax increases in larger range.

2. The level of speed abilities (F'max) of examined muscles of football–players are increasing during the whole period of ontogenesis (12-18 years old).3Maximal annual knee extensor's strength increase and the rate of muscle force development increase are noted before the age of 15.

References

1. Komi P.V. [2000] Journal of Biomechanics (33): 1197-1206.

ASSESSING TECHNICAL LEVEL IN THE EXECUTION OF THE OVERARM THROW: IMPLICATIONS FOR THE STUDY OF MOTOR DEVELOPMENT

Marqués-Bruna, P., Lees, A., Scott, M.

Edge Hill College of Higher Education, United Kingdom

Introduction

The study of motor development has traditionally consisted of the description and categorisation of the different movement patterns observed in children (Stage Theory - e.g. Roberton, 1978). However, more recently Newell's (1986) constraints model postulates that individual, environmental and task constraints interact to encourage certain movement patterns. Thus, to study the technical adaptations associated with motor development, assessment of technical level, and not simply technique description, may be more meaningful. The term technical level is rarely used in the biomechanics literature, despite being suggestive of technical supremacy regardless of performance outcome. This study aimed to define, and study the development of, technical level in the execution of the overarm throw for a group of children.

Methods

A group of 187 children (106 males and 81 females; aged 5-11 years; mean age = 8.5, SD = 1.9 years) and a control group of 31 adults (20 males and 11 females; mean age = 21.5, SD = 5.9 years) were asked to perform the overarm throw for maximum distance; which was recorded on videotape. The technical level of the subjects in the execution of the throw was established using qualitative video analysis and hierarchical models developed for the purpose (Marqués-Bruna, 2005). Children were allocated to three age groups and two-tailed Chi square tests ($p < 0.05$) were used to infer an association between technical level and age of the children. Gender differences in technical level were examined.

Results

Generally, male children showed a higher technical level across the age range than female children. Male children showed also a faster rate of development of technical level (higher Chi square values) than female children (males: Chi square = 34.67, df = 6, sig. = 0.001 (significant); females: Chi square = 7.84, df = 6, sig. = 0.250). Compared to female adults, male adults displayed a higher technical level in the execution of the throw.

Discussion/Conclusion

Previous research on motor development (e.g., Roberton, 1978) has described how the movements of children increase in complexity with age of the children. However, the present study allowed the assessment of technical level in a group of children when performing the overarm throw. Some of the younger children displayed a high technical level, while some of the older children and adult subjects displayed low technical levels. This adds supports to Newell's (1986) constraints model. The findings have implications for future research into the technical adaptations associated with child development.

References

Marqués-Bruna (2005). The Development of Movement Effectiveness in Children: A Qualitative Analysis.

Newell (1986). In Wade and Whiting. Motor Development in Children: Aspects of Co-ordination and Control.

Roberton (1978). J Human Movement Studies. 4: 167-175.

THE INFLUENCE OF UPPER BODY POSITION ON PELVIC AND LIMB KINEMATICS AND LEG MUSCLE RECRUITMENT DURING CYCLING IN NOVICE AND HIGHLY TRAINED CYCLISTS

Chapman, A.R., Vicenzino, B., Blanch, P., Hodges, P.W.

The University of Queensland, Australia

Trained cyclists are better able than novice cyclists to maintain cycling efficiency when shifting between riding positions, which involve different orientations of the upper body. Most notably, the decrease in cycling efficiency of novice cyclists is greater than that of highly trained cyclists when shifting from an upright riding position (i.e. grasping brake hoods) to the aerodynamic riding position (grasping drop bars or aerobars)[1]. Factors associated with less efficient cycling by novices in the aerodynamic riding position have not been investigated. We suggest that changes in pelvic and limb kinematics and muscle recruitment may be one mechanism by which upper body

position influences cycling efficiency. This study compared pelvic and lower limb kinematics and electromyographic (EMG) activity of tibialis anterior (TA), tibialis posterior (TP), peroneus longus (PL), gastrocnemius lateralis (GL) and soleus (SOL) muscles during cycling between upright and aerodynamic riding positions, in novice and highly trained cyclists. The aerodynamic riding position was associated with greater anterior tilt (sagittal plane pelvic position) of the pelvis and greater hip flexion in both novice and highly trained cyclists (but not greater ranges of motion) and a greater range of oblique motion (i.e. frontal plane motion) of the pelvis in novice cyclists, but no other kinematic changes. The aerodynamic riding position was also associated with increased variability of recruitment of three of the five tested muscles in highly trained cyclists. Riding position did not influence variability of leg muscle recruitment in novice cyclists and had no effect on other parameters of muscle recruitment (i.e. timing and amplitude) in either group. These results show that orientation of the upper body alters pelvic and hip kinematics, and therefore most likely the length of thigh muscles, which may influence cycling efficiency. Increased range of frontal plane pelvic motion may be associated with less efficient cycling by novices in the aerodynamic riding position. However, trained cyclists were less able to maintain a consistent level of variability of muscle recruitment between upright and aerodynamic riding positions, which may influence their cycling efficiency.

1. Petrone, N, M Bertoldini, et al. Intergrated analysis of bicycle posture for the optimization of cycling efficiency. Proceedings of the XIXth Congress of the International Society of Biomechanics. Dunedin, New Zealand, p. 317, 2003.

GEOMETRY OF RUNNING

Romanov, N., Pyanzin, A.

Romanov Academy of Sports Science, United States

Introduction

Muscular contraction is considered to be the main force moving and accelerating the runner on support. This assumption doesn't explain the so called "extensor paradox" (1), when the extensor muscles of the leg are off immediately after the runner passes the vertical position on support (midstance). This contradiction can be resolved, if we assume that gravity is the main moving and accelerating force in running. The role of muscles then is reduced to regulating the direction of gravity's action on the body, having one degree of connection with support and being in the state of unstable balance.

Methods

The movement of the runner on support, after it passes the midstance is nothing else, but tipping the body, rotating around the point of support. This type of movement can be described using the model of a falling rod. We modeled the process of falling of the rod from its vertical position on support, with a graphic analysis of the dynamics of vectors of forces participating in this movement (gravity, ground reaction, resultant forces) and their components.

Results

When the angle of deviation of the rod changed from its vertical position to its complete fall, the values of horizontal components of ground reaction and resultant force between gravity and ground reaction changed in the form of a bell-like curve from zero at its vertical position to maximum at 45° angle and went back down to zero at 0° angle. The dynamics of vertical components of the same vectors completely different with a constant increase from minimum at the vertical position to maximum at 0 ° degrees for the resultant vector of gravity and ground reaction and the same mirror-like symmetrical increase of the vector of ground reaction. Of most interest was the dynamics of correlation between the horizontal and vertical components of resultant vector between gravity and ground reaction, for every angle of deviation. The maximal prevalence of the horizontal component occurs at 22.5 ° angle, after which the vertical component starts dominating.

Discussion/Conclusion

The forward displacement of the runner's body is determined by the geometry of the falling body on support. The horizontal movement (acceleration) of the body is a function of the angle of deviation of the body from its vertical position that is a function of the vector of gravity and ground reaction force. Our analysis of the geometric relations of force vectors confirms our hypothesis of the leading role of gravity in the movement of the runner forward, and explains why support in running ceases at a certain angle of deviation of the body from its vertical position. On support the muscles do not work to push the body forward, they work to transform the gravity-force downward movement into a horizontal one.

References

1. McClay I.S., M. J. Lake, P. R. Cavanagh. The Extensor Paradox Experiment. Biomechanics of Distance Running. Editor P. Cavanagh, Human Kinetics Books, 1990, &#108.

BIOMECHANICS OF PROPHYLACTIC ANKLE TAPING DURING THE FEINTS: ANKLE KINEMATICS BEFORE AND AFTER TRAINING

Meana Riera, M., Alegre Durán, L.M., López Elvira, J.L., Aguado Jódar, X.

Universidad Católica San Antonio; Universidad de Castilla-La Mancha, Spain

INTRODUCTION

Feints are associated with ankle sprains mechanism of injury.

METHODS

The effectiveness of preventive ankle taping in the limitation of ankle supination and extension during a feint and the degree of loss of restriction after 30 minutes training was analysed.

The results of passive measures were compared with dynamic ones during a feint, using 3D digital video system (125 Hz).

The influence of individual characteristics on initial restriction and on loss of restriction was analysed in order to evaluate particular necessities of replacement.

RESULTS

Significant initial restrictions on passive supination and extension movements have been reported (64.45% and 59.07% respectively), while dynamic measures only show a significant restriction of 13.53% on landing supination, so taping provides no significant restriction during the feint on healthy subjects.

Although significant loss of restriction has been found after exercise on passive supination and extension (49.29% and 47.64% respectively) the feint showed no significant losses.

About the influence of anthropometrical characteristics, taller subjects suffered higher losses of extension restriction (r=0.590). Related with foot dimensions, subjects with pes cavus (r=0.679), narrow middle foot (r=0.614) and wide inner arch (r=0.643), suffered more important losses of restriction on supination and extension movements, so taping should be replaced more frequently.

CONCLUSIONS

The results show the importance of considering individual characteristics on taping construction and reposition, the useless of preventive taping on healthy subjects as well as importance of a fitted strength and co-ordination program.

COMPARISON OF THE MUSCLE-TENDON COMPLEX BEHAVIOR IN THE GASTROCNEMIUS DURING DIFFERENT HUMAN VERTICAL JUMPING MOVEMENTS IN VIVO

Fukashiro, S.

University of Tokyo, Japan

Behavior of fascicles and tendinous structures of the m. gastrocnemius medialis was quantitatively compared during several human vertical jumping movements in vivo. Eight male subjects performed maximal-effort 1: squat jumping (SQJ) from the squat position without countermovement, 2: counter movement jumping (CMJ) from the standing position, 3: ankle plantarflexion jumping (AJ) from the standing position without countermovement, and 4: straight legged drop jumping (DJ) from a height of 0.20 m. Kinematic and kinetic data were obtained using a high-speed camera and a force platform system. Selected parameters such as angular velocity, torque and power were calculated for the hip, knee and ankle joints. Furthermore, behavior of fascicles and tendinous structures were determined using ultrasonography and electromyography. The length of the muscle-tendon complex as estimated by the kinematic data consisted of fascicle and tendinous structures. Ultrasound data were used to calculate fascicle length and pennation angle. The tendon force was estimated by the ankle joint torque divided by ankle moment arm. The gastrocnemius medialis tendon force was determined by using the ratio of the physiological cross sectional area (PCSA) of triceps surae muscle group to the PCSA of the gastrocnemius medialis.

Vertical displacements of the body center of gravity from the standing position were 0.43m, 0.44m, 0.16m and 0.33m in SQJ, CMJ, AJ and DJ, respectively. During the latter take-off phase, there was no stretching of the fascicles of the m. gastrocnemius medialis in all jumping motions, including CMJ and DJ with countermovement. In SQJ and AJ without countermovement, on the other hand, the fascicles of the m. gastrocnemius medialis shortened in the early take-off phase. As a result, the elastic energy of 4.9J, 6.6J, 2.2J and 7.6J in the tendinous structures of the m. gastrocnemius medialis were stored, and 4.4J (86% of total muscle-tendon complex work in push-off phase), 3.8J (79%), 2.1J (47%) and 5.8J (75%) of the energy were reutilized during the push-off phase in SQJ, CMJ, AJ and DJ, respectively. The results quantitatively indicate that there was a large advantage from elastic energy use in human vertical jumping. The behavior of the muscle-tendon complex of the m. gastrocnemius medialis was also examined in terms of force-length and force-velocity relations. The fascicles of the m. gastrocnemius medialis operated within the optimal range of the sarcomere force-length relationship during jumping. Also, the fascicles worked in the relatively low shortening velocity region of the instantaneous force-velocity relationship in all jumping motions.

1: Kurokawa, S., T. Fukunaga and S. Fukashiro: J. Appl. Physiol. 90(4):1349-58, 2001.

2: Kurokawa, S., T. Fukunaga, A. Nagano and S. Fukashiro: J Appl Physiol. 95(6):2306-14, 2003.

3: Fukashiro, S., Kurokawa, S., D. C. Hay and A. Nagano: Int. J. Sport Health Sci. 3:253-263, 2005.

EQUILIBRIUM REGULATION BY ATHLETES'

Booban, W., Sadowski, J., Niznikowski, T., Mastalerz, A., Niznikowska, E.

Józef Pisudski Academy of Physical Education in Warsaw, Poland

Performance of many exercises by youth acrobats and athletes during training and competition required equilibrium regulation. Some results indicate slight effect of visual condition on the postural sway and describing effect of maintaining body equilibrium during hand stance. The human body is not rigid and its center of gravity and base of support can change with limb movements. Humans can thus control their stability by changing their stance and body position. The aim of the study was to describe the mechanism of equilibrium control by youth acrobats during three types of exercises. All exercises were performed on the Kistler force platform and recorded by JVC video recorder. Center of pressure and center of mass were selected for two planes: sagital - Y and frontal - X. Base of support, acceleration of COP, external work and time of equilibrium stability were also analyzed. 9 highly skilled athletes (height 170cm, ± 4.0cm, body mass 72.4kg ± 3.6kg, age 20.4years, ±1.7years) and 30 children (height 116 ±5cm, body mass 25kg, ±2kg, 7 years old) took part in the research. Individual manner of equilibrium regulation for selected exercises was affirmed. Most of our acrobats controlled their body position by trunk motion in sagital plane (37%) during all exercises. Quality of sway holding was the best for children who got it by micro fluctuations in hip joints. Expert opinions for first exercises were 36.9 % higher for children which got stability by micro fluctuations in hip joints. Similar notes for this regulation were obtained for second (39%) and third (38.9%) exercises.

BIOMECHANICS ANALYSIS EXECUTION OF DOUBLE BACKWARD STRETCHED SALTO WITH DIFFERENT TOUCHDOWN ELEMENTS

Sadowski, J., Boloban, W., Mastalerz, A., Winiowski, W., Niznikowski, T.

Józef Pisudski Academy of Physical Education in Warsaw, Poland

Based on the key components theory the aim of the study was to compare factors describing technique differences of double backward stretched salto with different touchdown elements. One 60 Hz (JVC GR-DVL 9800 NTSC) camera and APAS 2000 cinematographic analysis systems were used. One highly skilled acrobats – jumper (height 170cm, ± 4.0cm, body mass 72.4kg ± 3.6kg, age 20.4years, ±1.7years), champion of Poland in acrobatics jumps attended to this project. The studies were conducted on a standard acrobatic path (type PTS 2000). Two sequences with the following elements were analyzed: round-off - double salto backward stretched (A) and round-off - double salto backward stretched - tempo salto (B). The highest differences between the key components describing performance of presented exercises exist for joint angles during launching and landing posture, and resultant velocities during touchdown. Correct performance of double backward stretched salto is not depended on the sequence elements and its complexity.

Poster presentation (PP)

PP3-06 Psychology 1-3 - "Exhibition Hall"

THE MOTOR, FUNCTIONAL AND PSYCHOLOGICAL STATUS OF SELECTED JUDOISTS

Bratic, M., Nurkic, M., Mitic, D., Milojevic, A.

The Faculty of Physical Eduaction Nis, The Faculty of Physical Education, Leposavic, Serbia and Montenegro

Success in judo represents the result of the functioning of various components which are intertwined into a single activity, that is, a sum of anthropometric, motoric, functional, cognitive, connative and other factors. The determination of the motor, functional and cognitive dimensions is an important factor in the sport selection process and the creation of a model on the basis of which the training process of judoists is programmed. A high level of basic motor, cognitive and functional abilities is considered to be the basic requirement for the effective learning of motor structures, their improvement and successful application. Within the training process, the dominant aim has to do with the transformations of basic motor abilities and certain morphological characteristics. Yet, considering the fact that all basic motor abilities cannot be altered to the same extent, and besides that, are deeply rooted in the organized system of other anthropological dimensions, it is very difficult to alter them independently and individually in the desired direction. Due to that, there is no universal system of exercise by means of which it is possible to ensure such a level of basic motor abilities which would suit all the possible forms of movement. The purpose of this research is to determine the motor, functional and psychological status of selected judoists. The sample of subjects encompassed 40 selected judoists, aged 15 – 17. All the subjects had their names on the long list for the national team on the basis of their standing in the State Finals. For the purpose of evaluating motor abilities, 12 motor tests were used. To describe the structure of the judioists' personalities, the HSPQ personality test was used, and to evaluate competitive anxiety, the Martens questionnaire, SCAT (Sports Competition Anxiety Test). The results of the research have indicated that the measured motor abilities of the selected judoists are of a significantly higher value than those found among members of the general public of the same age. The results have also shown that the shortlisted selected judoists scored higher values in relation to the judoists on the long list. Due to continuous strain, where an alteration between the aerobic and anaerobic mechanisms of judoists occurs, functional abilities are also significantly higher in the case of selected judoists. An analysis of the results for the psychological status indicates that the majority of judoists have a balanced personality profile with a normally developed personal disposition. Most of the judoists are at the optimum level of sport-competitive anxiety, while a smaller number of them are characterized by an increased level of pre-competitive tension in the form of somatic and cognitive anxiety.

MOOD MONITORING WITH YOUNG ELITE SOCCER PLAYERS

Steinbacher, A., Kleinert, J.

Institute of Psychology, Germany

Introduction

Mood monitoring gives indices for stress states in individuals and teams, and therefore also for current injury dispositions. Despite this, continuous measuring of physical and psychological states (mood monitoring) is less investigated in sport injury research and prevention.

The purpose of the present study (founded by the Federal Institute of Sport Science, Germany) is to find out the applicability of handheld-assisted monitoring of perceived physical states with three different scale versions. Firstly, to survey, whether mood monitoring in young elite soccer players identifies injury dispositions. Secondly, whether the quality of healing process is traced in case of injury. Thirdly, whether information is received about the optimal date of re-entry into practice for the convalescent player. Furthermore it is to be verified, whether strains of the soccer season are reflected in mood processes.

Methods

Participants are 39 young male elite soccer players of the highest German league level regarding their age (15-17). During the season 2004/2005 38 measuring points took place. Usually once a week the perceived physical state (perceived activation, perceived fitness, perceived flexibility and perceived health) were measured using special software (moodmeter ®, module Bodyfinder) installed on handhelds (Acer N 10). Bodyfinder-items were taken from the questionnaire Perceived Physical State (PEPS, Kleinert, 2004). Three scale versions were used: (1) a typical six point Likert-scale, (2) a visual-analogue scale (VAS) with seven growing bars and (3) a special scale called "cognitive-dilemma-scale" (CoDi).

Results

The physical processes of the examined group reflected the strains of the season. Different results became obvious in closer examination of individual mood processes (perceived physical states). Perceived physical and psychological states decreased before an injury occurred. Furthermore the phase of healing and indices for an optimal re-entry after rehabilitation were recognisable. The different scale versions didn't have any significant influence on the data.

Discussion

Handheld-assisted monitoring of perceived physical and psychological states seems to be applicable in sport-psychological care of team sport athletes. Mood monitoring can give evidence of potential psychological injury dispositions in individual cases and injury prevention interventions seem to be possible by an early discovery of these dispositions.

PSYCHOLOGICAL PREDICTORS FOR BEHAVIORAL CHANGE - BASELINE VALUES OF READINESS TO CHANGE AND SELF-EFFICACY AS PREDICTORS OF ADHERENCE TO PHYSICAL ACTIVITY AFTER EXERCISE ON PRESCRIPTION

Bredahl, T.G., Roessler, K.K., Ibsen, B., Puggaard, L.

University of Southern Denmark, Denmark

Introduction

Studies have demonstrated that a sedentary lifestyle is related to increased risk of lifestyle diseases (1). Research emphasizes the importance and the difficulty of keeping the individual in a physical active lifestyle after intervention and establishes the fact that behavior change is anchored in a psychological and social context as well as physiological (2). Exercise on Prescription (EoP) is used to initiate

physical activity among sedentary individuals in risk of lifestyle diseases due to physical inactivity. After intervention, adherence to physical activity is crucial to the success of EoP. EoP is in the County of Funen and municipality of Frederiksberg divided into two central areas. a) A Treating Perspective (TP) aimed towards individuals with specific lifestyle diseases. The intervention involves physical activity counseling (baseline, and after 2, 4 and 10 month) and 4 month of supervised group training. The participants in the TP are referred to EoP by their general practitioner. b) A Preventive Perspective (PP) directed towards healthy citizens in risk of lifestyle diseases due to physical inactivity. The PP only involves physical activity counseling (baseline and after 2, 4 and 10 month). The participants in the PP are primarily included after self initiated contact to the physical activity adviser.

The aim of this study is to describe the baseline psychological values for the participants in the TP and the PP, respectively. The hypothesis is that participants in the PP will rate their Self-Efficacy (SE), their psychological Readiness to Change (RC), Self Reported Health (SRH), Self Reported Physical Condition (SRPC) and Self Reported Physical Activity (SRPA) higher than participants of the TP.

Methods

Subjects were 31 women and 10 men (age 51.2±14.8, BMI 32.8±6.2). RC, SE, SRH, SRPA, SRPC and BMI were assessed by a questionnaire. Mean values were compared using an independent-samples t-test. Data are presented as mean ± SD.

Results

The participants in the PP are younger than the participants in the TP (46.5±13.7 vs. 56.2±14.7, p=0.035). The participants in the PP scored higher in SRH (3.8±0.8 vs. 3.2±0.6, p=0.007) and SRPC (4.1±0.9 vs. 3.5±0.8, p=0.027). The participants in the PP scored lower in SE (50±13 vs. 68±19, p=0.003). No difference was found in RC, SRPA and BMI.

Conclusion

Psychological factors are very important to keep the EoP participants in a physical active lifestyle after intervention. At baseline the TP and PP group separates by age, SRH, SRPC and SE. Surprisingly no differences were found for RC and SRPA. A larger number of participants may be able to document potential important psychological differences of the PP and TP.

References

1 Sluijs, E. (2004): Effectiveness of physical activity promotion: The case of general practice. Ponsen & Looijen B.V., Wageningen, NL.

2 Uexküll, T. V. (1996): Psychosomatische Medizin. München: Urban & Schwarzenberg.

FROM BUILDING TO REBUILDING:AN ELITE BODYBUILDERS REFLECTIONS ON CAREER ENDING INJURY

Batey, J., Sparkes, A.C.

University of Winchester, United Kingdom

This work draws on the life history of an elite, black, male bodybuilder to explore how career ending injury has impacted upon his life. Following guidelines from Glesne and Peshkin (1992) and adopting an interpretive methodology, six in-depth interviews each lasting between 1.5 and 3 hours were conducted. The data was analysed using narrative analysis outlined by Maykut and Morehouse (1994). Numerous themes emerged from the data of which four will be discussed here. Using the theoretical lenses of Athens (1995), Charmaz (1983, 1987, 1995), and Frank (1991, 1995) attention is given to themes of bodily betrayal and negative pain and anger as they pertain to the psychological complexities of restorying the self after such a biographical disruption. Reflections on the process of being a life history subject are also provided.

Athens, L., (1995) Dramatic Self Change. The Sociological Quarterly, 36, 3, 571-586.

Charmaz, K., (1983) Loss of Self: A Fundamental Form of Suffering in the Chronically Ill. Sociology of Health and Illness, 5, 2, 168-195.

Charmaz, K., (1987) Struggling for a Self: Identity Levels of the Chronically Ill. Research in the Sociology of Health Care, 6, 283-321.

Charmaz, K., (1995) Identity Dilemma's of Chronically Ill Men. In Sabo, D., & Gordon, D., (Eds). Men's Health and Illness. Gender, Power and the Body, 266-289.

Frank, A., (1991) At the Will of the Body: Reflections on Illness. Houghton Mifflin Co. USA.

Frank, A., (1995) The Wounded Storyteller. The University of Chicago Press, USA.

Glesne, C., & Peshkin, A., (1992) Becoming Qualitative Researchers: An Introduction, Longman, USA.

Maykut, P., & Morehouse, R., (1994) Beginning Qualitative Research: A Philosophic and Practical Guide. The Falmer Press, Great Britain.

ADAPTED PHYSICAL ACTIVITY IN OUTPATIENTS WITH ANOREXIA NERVOSA. PRELIMINARY RESULTS

Tolomio, S., Ferrara, S., Favaro, S., Travain, G., Zaccaria, M.

University of Padova, Italy

INTRODUCTION

Anorexia Nervosa (AN) is an eating disorder mainly affecting young women. With the purpose of losing weight these patients drastically reduce food intake and enhance energy expenditure by increasing physical activity. Most psychotherapists forbid exercise per se, instead of trying to correct its pathological features linked to the excess of physical activity, but whether to promote or withhold exercise is still controversial. To our knowledge a few studies reported the effects of individual exercise programs on inpatients with AN (Duesund L, 2003; Tokumura M, 2003) and only one study in outpatients (Thien V, 2000). No available data exist about group exercise programmes in anorexic outpatients.

AIM

To evaluate, in AN outpatients, the effects of an adapted group activity program, using exercises with low energy expenditure profile, combined with psychotherapy.

METHODS

5 young females (age range 17-31yr) with diagnosis of AN (DSM-IV) gave their informed consent to participate in this study, consisting of a 6-month adapted physical and psychotherapy program. To date, we completed only the basal and 3-month evaluations, using the tests specified below.

Anthropometric parameters: BMI and body composition by bioimpedance analysis (BIA).

Functional evaluations: maximal oxygen consumption (VO2 max) using a treadmill test, lower and upper limb maximal strength by leg-extension (LMS) and handgrip (UMS), respectively.

Psychological/psychiatric conditions: Body Attitudes Test (BAT), Eating Disorder Inventory (EDI), Rosenberg Self Esteem Test (RSE), Mackenzie Group Climate Questionnaire (GCQ).

RESULTS

After 3 months 4 subjects repeated the evaluations; one subject dropped out because of moving to a different town.

3 subjects increased while one decreased their BMI; Body Cellular Mass (BCM) increased in all patients. All functional parameters (LMS +61.1%, UMS +24.7%, VO2 max +16.7%), as well as several psychological/psychiatric items (self-esteem, body image, group climate, etc.) suggested a general improvement.

CONCLUSIONS

These preliminary results suggest that the association of adapted physical activity and psychotherapy programs, may contribute to enhance functional and psychological condition in outpatient anorexic females. Furthermore, they suggest that an exercise group activity could be a component of the existing therapeutic approaches to Anorexia Nervosa.

REFERENCES

Duesund L, Skarderud F. Use the body and forget the body: Treating anorexia nervosa with Adapted Physical Activity. Clin. child psychol. Psychiatry. 2003 vol 8(1):53-72.

Tokumura M, Yoshiba S, Tanaka T, Nanri S, Watanabe H. Prescribed exercise training improves exercise capacity of convalescent children and adolescents with anorexia nervosa. Eur J Pediatr. 2003 Jun;162(6):430-1.

Thien V, Thomas A, Markin D, Birmingham CL. Pilot study of a graded exercise program for the treatment of anorexia nervosa. Int J Eat Disord. 2000 Jul;28(1):101-6.

INVESTIGATION INTO THE SOCIOECONOMIC STATUS AND PHYSICAL ACTIVITY OF TEENAGERS: A CASE STUDY IN HUNGARY

Soós, I. 1, Hamar, P. 2, Biddle, S. 3, Murdey, I. 3

1 University of Sunderland, UK, 2 Semeilweis University, Budapest, Hungary, 3 Loughborough University, UK, United Kingdom

Introduction: The prevalence of teenagers' physical activity is influenced by the socioeconomic status (SES) of the family. SES is associated with parents' occupation, the number of rooms in the house and household electronic, entertaining and technical devices. In many developed countries, teenagers in the lower SES groups have the highest level of overweight and the lowest level of physical fitness. In contrast with developing countries, young people from higher SES groups have the greatest level of overweight and obesity, and are more likely to live sedentary lives. The aim of our study was to investigate physical activity and SES in Hungarian teenagers, thus investigating an important developmental transition period, and a country in "development".

Method: A free-time diary was used as the principal data collection instrument. The diary was broken down into two main sections, in order to collect demographic data (including personal details, family background, pubertal status of students, home environment and socioeconomic status) and time sample data (including the weather conditions and dietary habits). Students (n=114), 13-16 years of age, were asked to report their activities on three weekdays and one weekend day. Activities were recorded in 15-minute time slots, outside of school time, by answering the questions "what students were doing", "where they were", and "who they were with". Data were analyzed by SPSS 13.0.

Results: The current study showed no significant difference between SES groups (based on parents' occupation) for TV viewing, using the computer, playing computer games, active transport or sport and exercise. However, fathers' occupation was significantly associated with the number of TV sets in the home ($p<0.04$), number of video machines in the home ($p<0.034$), and number of internet computers in the home ($p<0.009$). Significant differences were found between both fathers' and mothers' occupation and the number of music stereos in students' bedrooms ($p<0.014$) as well as having their own skateboard or microscooter ($p<0.016$).

Conclusions: Time spent on electronic entertainment activities can be related to the number of TV sets, electronic devices and computers in the home, and especially if they are located in the bedroom, it may lead to an inactive and sedentary lifestyle. Nevertheless, in many cases, students do exercise and sports directly after school, and watch TV or use computer in the evening, consequently the interrelationship between sedentary and active behaviours requires further investigation.

THE POTENTIAL RELATIONSHIP BETWEEN ACHIEVEMENT GOAL ORIENTATIONS AND SPORTS ATTITUDES AMONG PORTUGUESE YOUNG ATHLETES

Gonçalves, C.E., Coelho e Silva, M., Cruz, J.

University of Coimbra, Portugal

Introduction

For the athlete, attitudes represent an effective and instrumental evaluation of the best behavior to addopt in a sport setting, without external interventions. For coaches and other significant adults achievement goal orientations would represent the link between individuals' attitudes and the ecological environment. The goal of this study is to examine the relationship between the dimensions extracted from the Task and Ego Orientation in Sport Questionnaire-TEOSQ [1] and those extracted from the Sports Attitudes Questionnaire-SAQ [5], among portuguese athletes aged 13-16 years old.

Methods

The sample is composed of 482 athletes (mean age: 14.1 years, 248 boys, 234 girls). Respondents fulfilled the Portuguese versions of the TEOSQp [2] and of the SAQp [4].In previous studies [3] [4], 2 dimensions of the TEOSQ, task and ego, and 4 dimensions of the SAQ: convention, commitment, cheating and gamesmanship, were identified. Both studies used exploratory and confirmatory factor analysis. Descriptive statistics for the 6 identified dimensions are presented. The bivariate coefficient of correlation is then determined using the SPSS, version 12.0.

Results

Task- and ego- orientations are uncorrelated (r=+.0.05, n.s.). Among the SAQ dimensions, two significant correlations were found between cheating and gamesmanship (r=+0.67, p≤.01) as well as between convention and commitment (r=+0.27, p≤.01). Ego orientation appears to be positively correlated with cheating (r=+0.30, p≤.01) and gamesmanship (r=+0.33, p≤.01), and negatively with convention (r=-0.16, p≤.01). Positive correlations between task- orientation and convention (r=+0.29, p≤.01) and commitment (r=+0.40, p≤.01) were also found.

Discussion/Conclusion

The present study suggests a bipolar link between ego- orientation and the antisocial dimensions of SAQ, cheating and gamesmansip, while task- orientation seems to be related to prosocial attitudes, as convention and commitment. Therefore, the research of the causal

effect of achievement goal orientations on the expression of sports attitudes would be of interest, using structural equations to confirm a hypothetic model.

References

[1]Chi L, Duda JL (1995). Research Quarterly for Exercise and Sport. Vol. 66 (2): 91-98

[2]Fonseca AM (1999). PhD. University of Oporto.

[3]Gonçalves et al.(2005)Proceedings of the 10th Congress of the European College of Sport Science. Belgrade, SCG.

[4]Gonçalves et al. (2006) Revista Portuguesa de Ciências do Desporto.In press.

[5]Lee MJ, Whitehead J (1999). The effect of values, achievement goals and perceived ability on moral attitudes in youth sport. Report provided to the Economic and Social Research Council, Swindon, England.

A SITUATED ANALYSIS OF THE DECISION-MAKING ACTIVITY IN BASKETBALL

Hauw, D., Renault, G.

JE 2416 GP3S, University of Montpellier 1, France

Research in the domain of decision-making actually promotes an extensive use of video-based simulation of game situations (e.g., Caserta, Singer, Coombes, 2005). As suggested the situated cognition theory (Clancey, 1998 ; Greeno, 1998), this protocol reduced the complexity of the decision-making process. For example, it did not allow the study of meaningful teambuilding situations or the dynamics of the developing coupling between actions and situations. The aim of this study was to analyse the activity that consisted to create meaningful situations during decision-making.

Method

18 players, in groups of two, volunteered to participate in a specific task well-known in basketball: the screen play. Two offensive players had to be organised collectively in order to attack the basket, confronted with four defensive organisations that were performed twice by two defensive players. Each of the eight trials was recorded on video, then self-confrontation interviews were conducted with each offensive player. The course of action was analysed using the methodology of the theory of the course of action (e.g., Hauw, Berthelot & Durand, 2003)

Results

Four categories of action-situation coupling were identified: (a) action routines associated with familiar situations or referred to preceding situations experienced in the task, (b) waiting actions associated with uncomfortable or uncomprehending situations, (c) actions initiated without certitude associated with ill-known situations that players nevertheless decided to let unfold, (d) step-by-step orientating and building actions associated with situations that hold diverse possibilities. Four collective configurations of coupling were identified :(a) a deterministic mutualism organisation where the two players used the others' activities to reduce the non-deterministic nature of the situation, (b) a non-deterministic mutualism organisation where the two players' activity led to a new non-deterministic situation, (c) an individualism organisation where the two players' activity was independent of each other, (d) a waiting organisation where one player let the situation unfold in order to see what would happen and to reduce the non-deterministic nature of the situation.

Discussion

These results show that decision-making does not only process the input that is in context. By using possibilities of play, players develop the solution online. These actions are based on the determined or undetermined properties of the situation and manage differently the possibilities of interaction with the other players. These types of action-situation coupling are the processes that players display to organise themselves in such an environment. Decision-making is a situated process that should be analysed by taking into account the dynamics of this process of creating meaningful situations through action and using a large temporal horizon (Ward, Williams et Ericcson, 2005).

JUDGING BIAS IN AESTHETIC SPORTS: OPEN FEEDBACK LEADS TO NONPERFORMANCE-BASED CONFORMITY

Boen, F., Vanden Auweele, Y., De Geest, A., Feys, J., Claes, E., De Cuyper, B.

K.U. Leuven, Belgium

Introduction

Two experiments were designed to determine whether the open feedback system used in many aesthetic sports (i.e., the judges hear and see each others' scores after having rated each performance) leads to unwanted (i.e., nonperformance-based) conformity in the scoring of judges.

Methods

In Study 1, twenty judges in synchronized swimming were randomly divided into four panels of five judges. These judges had to rate 60 performances of the same imposed figure, the barracuda twirl: 30 performances in phase 1 and 30 performances in phase 2. Two independent variables were orthogonally manipulated: feedback (or none) during phase 1 and feedback (or none) during phase 2.

In Study 2, twenty-seven difficulty judges in rope skipping were randomly divided into panels of maximum five judges. These panels had to rate the same 30 videotaped individual performances: 15 in phase 1 and 15 in phase 1. Again, feedback (or none) during phase 1 and feedback (or none) during phase 2 were orthogonally manipulated.

Results

With respect to Study 1, the variation of the scores given in phase 1 was significantly smaller when the judges had received feedback than when judges had not received feedback. Moreover, the variation of the scores given in phase 2 remained significantly smaller among the judges who had received feedback in phase 1 but not in phase 2, compared with judges who had not received feedback in either phase.

With respect to Study 2, the results revealed that there was more score-conformity among those panels that were given feedback in phase 1 compared with panels that were not given feedback in this phase However, in contrast with Study 2, this conformity did not last when feedback opportunities were removed in phase 2.

Discussion/Conclusion

The results of Study 1 indicate that the scoring of judges in synchronized swimming is strongly and lastingly influenced by immediate feedback. Moreover, these findings suggest that normative rather than informational influences caused the observed conformity among judges in synchronized swimming. The results of Study 2 revealed that the scoring of judges in rope skipping was also influenced by immediate feedback. However, in contrast with Study 1, this conformity did not last when feedback opportunities were removed, suggest-

ing that informational rather than normative influences caused the observed conformity among judges in rope skipping. The implications for panel judging in aesthetic sports will be discussed.

References

Vanden Auweele Y, Boen F, De Geest A, Feys J (2004). Judging bias in synchronized swimming: The effects of open feedback on non-performance based conformity J Sport Exercise Psychology, 26, 561-571

Boen F, Vanden Auweele Y, Claes E, Feys J, De Cuyper B (2006). The impact of open feedback on conformity in rope skipping. Psychology of Sport & Exercise, manuscript in press.

ANGER RUMINATION AND SELF-REPORTED AGGRESSION AMONGST BRITISH AND HONG KONG CHINESE ATHLETES

Maxwell, J.P.

University of Hong Kong, Hong Kong

Previous work has determined positive relationships between provocation, anger rumination, and aggression in British athletes (Maxwell, 2004); however, the reliability of these findings and their generality across diverse cultures has not been examined. Eastern cultures typically discourage the overt expression of angry feelings (Bishop & Quah, 1998; Chen et al., 2005); therefore weaker relationships amongst provocation, anger rumination, and aggression might be expected. A comparison of British and Hong Kong (HK) Chinese athletes' propensity for rumination and aggression was undertaken to test this prediction. A total of 308 participants from Hong Kong and 376 from Britain completed a self report questionnaire detailing frequency of aggressive acts and provocation whilst participating in competitive sport. In addition, participants completed the Anger Rumination Scale (Sukhodolsky, Golub, & Cromwell, 2001), a 19 item measure of repetitive thoughts involving past anger invoking experiences. The ARS consists of four subscales that measure the content of ruminative thoughts (thoughts of revenge, angry afterthoughts, angry memories, and understanding of causes). Regression analyses suggested that provocation and thoughts of revenge were significantly associated with the self-reported aggression of both British and Hong Kong athletes. A multivariate analysis of variance demonstrated that mean frequency of aggression was similar across cultures except for a tendency for British male contact sport athletes to report greater frequency of aggressive behaviour. HK Chinese athletes tended to report higher frequencies of thoughts relating to understanding the causes of anger and higher incidence of perceived provocation. It was concluded that the pattern of aggressive behaviour was similar across the two cultures when opportunities for aggression are infrequent, but that HK Chinese athletes may inhibit aggressive responding even when opportunities are frequent.

Bishop, G.D. & Quah, S.H. (1998). Reliability and validity of measures of anger/hostility in Singapore: Cook & Medley Ho Scale, STAXI and Buss-Durkee Hostility Inventory. Personality and Individual Differences, 24, 867-878.

Chen, S.X., Cheung, F.M., Bond, M.H., & Leung, J.P. (2005). Decomposing the construct of ambivalence over emotional expression in a Chinese cultural context. European Journal of Personality, 19, 185-204.

Maxwell, J.P. (2004). Anger rumination: an antecedent of athlete aggression? Psychology of Sport and Exercise, 5, 279-289.

Sukhodolsky, D.G., Golub, A. & Cromwell, E.N. (2001). Development and validation of the anger rumination scale. Personality and Individual Differences, 31, 689-700.

STRUCTURAL AND PREDICTIVE VALIDITY OF THE BASIC PSYCHOLOGICAL NEEDS IN EXERCISE SCALE APPLIED TO COMMUNITY EXERCISE PROGRAMS

Vlachopoulos, S.P.

Aristotle University of Thessaloniki, Greece

The present study extended the use of the Basic Psychological Needs in Exercise Scale (BPNES: Vlachopoulos & Michailidou, in press) to community exercise programs and examined the structural and predictive validity of the scale's scores in this context. The BPNES assesses the extent to which the needs for autonomy, competence, and relatedness (Ryan & Deci, 2000) are satisfied in exercise. A total of 851 participants in community exercise programs provided data on the BPNES as well as on frequency of concentration during exercise, enjoyment, attitude toward exercise and intention for continued exercise involvement. The results supported the hypothesized dimensionality, internal consistency, and predictive validity of scale responses. The goodness-of-fit indexes of the 3-factor confirmatory factor analysis BPNES model revealed an excellent fit to the data: $X2 = 209.87$, $df = 51$, $p < .001$, NNFI = .97, CFI = .97, RMSEA = .06. The factor loadings ranged from .59 to .90. The alpha values (Cronbach, 1951) for each of the subscales were .84 for autonomy, .86 for competence, and .92 for relatedness. The predictive validity of the scale responses was supported through a number of structural equation models representing the prediction of concentration, enjoyment, attitude toward exercise, and intention from the three needs. All of the motivational consequences were predicted by the psychological needs. Overall, the results supported the structural and the predictive validity of BPNES responses of participants attending community exercise programs and extended the construct validity evidence of the scale into the community exercise context.

References

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. Psychometrika, 16, 297-334.

Ryan, R.M., & Deci, E.L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist, 55, 68-78.

Vlachopoulos, S.P., & Michailidou, S. (in press). Development and initial validation of a measure of autonomy, competence, and relatedness in exercise: The Basic Psychological Needs in Exercise Scale. Measurement in Physical Education and Exercise Science.

THE RELATIONSHIP BETWEEN COACHES LEADERSHIP STYLE & TEAM COHESION IN IRANIAN SUPER LEAGUE BASKETBALL CLUB

Moradichaleshtori, M., Jafari, A.

Tehran University, Iran

The purpose of this study was to investigate the relationship between leadership styles of coaches (according to multi-dimensional model in sport) and group cohesion in basketball teams present in Iranian premiere league. A number of 144 basketball players, therefore, responded to questionnaires, including Leadership Scale in Sport (LSS) (Chelladurai & Saleh 1980), and Group Environment Questionnaire (GEQ) (Caron, Widmeyer, and Brawly 1985). The two latter questionnaires were used to study players perception of coach leadership

styles and group cohesion in their own teams. For analyzing the collected data, descriptive and inferential statistics such as Pearson's correlation coefficient, independent T-test, and Factorial ANOVA were used. Results showed: 1) A significant direct relationship between leadership styles of instruction behavior, democratic, social support, and positive feedback as well as a sig. reverse relationship of autocratic leadership with social and task cohesion among players ($p<0.01$).

2) A sig. difference between leadership styles of coaches in successful teams and those in unsuccessful ones ($p<0.01$).

3) A sig. direct relationship between group cohesion and success of a team (i.e. win percentage of a team during the session) ($p<0.01$).

Based on the results it can be said that leadership style of coaches is one of the factors related to cohesion while cohesion itself is considered as a success factor of a team. In addition, those coaches using instruction behavior, democratic, social support, and positive feedback styles rather than autocratic behavior, will have more cohesive & finally more successful teams.

PERFORMANCE EVALUATION OF SELECTED IRANIAN COLLEGIATE SPORT ASSOCIATIONS

Salehi, S., Moradi, M.

azad university, Iran

The purpose of this study was to evaluate the performance of some selected Iranian collegiate sport associations, in terms of their effectiveness, from Viewpoints of stakeholder groups of these associations, including student-athletes as well as coaches of universities in Tehran, members of the selected associations, and experts of these selected sport types(i.e. Badminton, Football, Basketball, Wrestling, Handball, and Volleyball). A total of 546 respondents(270 student- athletes, 120 coaches,120 experts, and 36 members of associations) responded to two respective questionnaires developed for this study(one for students and another designed for other three groups). The collected data were analyzed by some statistical methods such as One-sample T-test, ANOVA, and Dunnett C as the following test of ANOVA . In Addition, for determining the consistency of questionnaires and normal distribution of collected data, Cronbach's alpha and Kolmogorov-Smirnov were used respectively. Results showed that student-athletes, coaches , and experts evaluated the performance of selected associations as weak(Means<3, p<0/05), as such did the members of wrestling association(Mean=2/78). Members of other associations, however, didn't evaluate it as weak (Means>3). There was also a significant difference between Viewpoints of members of associations and those of other groups in each sport type(p<0/05). Among the questions of 2nd part of all questionnaires, only items of 5 , 6, and 14 obtained acceptable means(Means>3), while they all are subscales of a total performance indicator(i.e. organizing intercollegiate games). Results indicate that from Viewpoints of all stakeholder groups, despite the sig. difference between members and other groups, performance of studied associations was not favorite.

THE RELATIONSHIP BETWEEN COACHES LEADERSHIP STYLE & TEAM COHESION

Moradi, M., Jafari, A., Salehi, S.

Tehran University, Iran

The purpose of this study was to investigate the relationship between leadership styles of coaches (according to multi-dimensional model in sport) and group cohesion in basketball teams present in Iranian premiere league. A number of 144 basketball players, therefore, responded to questionnaires, including Leadership Scale in Sport (LSS) (Chelladurai & Saleh 1980), and Group Environment Questionnaire (GEQ) (Caron, Widmeyer, and Brawly 1985). The two latter questionnaires were used to study players' perception of coach leadership styles and group cohesion in their own teams. For analyzing the collected data Pearson's correlation coefficient was used. Results showed: A significant direct relationship between leadership styles of instruction behavior, democratic, social support, and positive feedback as well as a sig. reverse relationship of autocratic leadership with social and task cohesion among players ($p<0.01$).

Based on the results it can be said that leadership style of coaches is one of the factors related to cohesion while cohesion itself is considered as a success factor of a team. In addition, those coaches using instruction behavior, democratic, social support, and positive feedback styles rather than autocratic behavior, will have more cohesive & finally more successful teams.

COPINGSTRATEGIES AS PREDICTORS FOR PSYCHOSOMATIC PATHOLOGY

Wippert, P.-M., Wippert, J.

TU Munich, Germany

Introduction: Experiencing a critical Life-Event entails coping behaviour adapted to the given situation. The problem posed in this study was whether the shown coping behaviour can influence the expression of psychosomatic pathology in the process of dealing with the event.

Method: The participants in the longitudinal study consisted of N= 19 athletes of the German national ski-team (Age= 20) who had to cope with an undesirable and unexpected career end. The participants were questioned once prior to the event onset and five times after the event onset (sampling times: 10 days/ 3 weeks/ 3 months/ 5,5 months/ 8 months after the event). Data collection for psychosomatic variables was carried out using Jenkins questionnaire on sleeping behaviour, Appels questionnaire on Vital Exhaustion (VE) and a modified Version of the Complaint List by Zerssen (B-L). The coping behaviour was measured 8 months after event onset using the German version of the World of Coping Checklist by Ferring and Filipp. The data was evaluated parametrically by regression analysis.

Results: The coping behaviour categorised as emotion-focussed coping displayed a medium significant influence on the scales for Vital Exhaustion ($ß = 3.09$, $p< .05$, $R2\ adj. = .17$, $R = .46$) and sleep ($ß = 1.80$, $p< .05$, $R2\ adj. = .23$, $R = .52$) 3 weeks after event onset. A further significant influence was found 5,5 months after event onset for the values in the Complaint List ($ß = 1.23$, $p< .05$, $R2\ adj. = .17$, $R = .47$), as well as after 8 months for Vital Exhaustion ($ß = 3.2$, $p< .05$, $R2\ adj. = .24$, $R = .53$). As the levels of emotion-focussed coping increased, so did the expression of psychosomatic disorders.

Discussion: Emotion-focussed coping, which the literature considers as being an unfavourable form of coping behaviour, indicates an increased expression of psychosomatic variables. However, due to the relatively small variance of maximally 24% and the small sample size these results are to be interpreted carefully.

Literature

Appels et al. (1987). Scores obtained by the nine-item Shortened Maastricht Exhaustion Questionnaire

Ferring, D. & Filipp, S.-H. (1989). Bewältigung kritischer Lebensereignisse.

A RESEARCH OF THE RUNNING ATHLETES IN COMPETITIONS

Laszlo, Z.

Universitiy of Pecs, Hungary

Introduction

The results of different studies in national and international levels give a comprehensive, multi-coloured view. Both previous and recent studies in the field of anxiety researh have made attempts to provide psychological and pedagogical review of anxiety and the reasons for reducing or, if possible, eliminating it. The interpretation and handling anxiety requires the understanding of physiological and psychological mechanism as well. For sport experts, one of the most important tasks is to determine and develop the most successful personality traits in competitive situations. The properly trired personalty can positively contribute to the management of anxiety before competition, and in the may influence the performance in it.

Methods

In the present paper, on the one hand, I studied the properties of the competitive performance anxiety of the middle-distance and the long-distance runners before and after the race, on the other hand, the related kinds of the competitive performance anxiety (cognitive anxiety, somatic anxiety, the degree of self-confidence of the achievement).

The metod of investigation is focused on psychological traits. This assessment was performed by the means of the Martens Competitive State Anxiety Inventory, CSAI-2 questionnaire and the reduced version of the Spielberger Competitive Performance Anxiety Test, PRQ1, PRQ2.

Redults

The averages and the scatterings of averages of the Martens (CSAI-2) indicators of the competition anxiety in different age groups showed that the somatic anxiety was higher in case of middle-distance and long-distance runners before the race both the cognitive anxiety and the self-confidence related to the result of the race showed lower values. The junior and adult age group stands out from the studied groups providing the highest averages, and in respect of self codfidence they can be characterized with higher values compared to the other two groups.

The averages and the scattering of values of the Sarason indicators (PRQ1, PRQ2) in the competitive performance anxiety yielded the following results, the reduction of lowest in the junior and adult groups before the race.

Conclusion

Since the previous investigations have not studied this, thus the anxiety level of competition performance of the middle-distance and long-distance runners can be approached from a new point of view in a given period of races.

I have received information about how far, before competition, the anxiety level of the sportsmen is infuenced by the types and personality traits of the problemetic sportsmen.

DETERMINING THE ROLE OF THE CLUB DEVELOPMENT OFFICERS, COACHES AND PARENTS IN PREPARING THE YOUNG ELITE PLAYER FOR A PROFESSIONAL CAREER IN THE AUSTRALIAN FOOTBALL LEAGUE

Gibson, B.

Edith Cowan University, Australia

With the expansion of Australian Rules Football into a national competition, and the development of the Australian Football League, the opportunity for players to undertake a full time professional career has become increasingly attractive. Sponsorship and television rights have provided the finance that is necessary for players to be contracted on a full time basis with attractive salary packages. This new structure has seen the introduction of the national drafting system and the competitive recruiting of the most promising young players across Australia. The intensity of the competition has led to players as young as 16-17 years of age becoming the targets of the recruiting agents. The outcome of being drafted by a club means a significant change to the life style and routines of these young players. In many instances it results in a change of location as the young recruits move interstate to take up the appointment with their new club. They also move from being part time athletes to full time professionals with significant salaries and major demands being made on their time. Inherent in these changes are numerous adjustments that must be made and these can result in both psychological and physical problems occurring with the young players. Therefore, the purpose of this study was twofold. Firstly, to identify the psychological and/or physical problems that continually arise with the young recruits, and secondly to investigate the role that the Development Officers, coaches and parents can undertake in assisting the young players in making the transition from the junior ranks to the full-time professional level. The sample that was interviewed for this study included twelve Development Officers and coaches from the AFL clubs and the parents of 30 players who had been drafted to AFL clubs. All were interviewed using the same standardised set of questions and interviews were tape recorded so as to permit an accurate post interview analysis to be performed. The problems that were identified were numerous and varied and in some instances would require additional professional assistance, for example, a medical practitioner, sports psychologist. However there were a significant number of common problems identified and this demonstrated the important role that the development officers, coaches and the parents should undertake. This role would change over time as the young player progressed through the ranks.Results have also shown that the administrators in the AFL clubs have a significant part to play in liaising between management and the families, thereby ensuring that all aspects are dealt with during this difficult transition period. Finally, the results of this study have enabled the author to establish a set of guidelines that are designed to assist administrators, clubs and parents in dealing with the psychological and physical problems that may prevent the young player from fulfilling his potential as a developing professional player.

THE MOTIVATIONAL PRIORITIES OF PARTICIPATION IN THE ELITE ATHLETICS OF KURDESTAN PROVINCE

Boroujerdi, S.S.

Kurdestan University, Iran

The purpose of this research was investigation the motivational priorities of participation in the elite athletics group sports of Kurdestan Province. This goals achieved through classification of motivational factors (development and improvement of skills , being with the friends , to gain success and to win , situational factors: (parents , close friends, coaches , equipment and facilities) get ride of energy , team spirit , to gain physical fitness, having hobby and recreation) with due attention to individuals characteristics of samples (age class , career – educational condition , record of taking participation in competitions , record of participation in sport , injury rate)

Statistical population include elite athletics assured of Kurdestan Province which their number were about 362 and 60 teenagers , 50 adolescents , 60 adults of theses were chosen according random sampling as the research samples.

The research method was based on description study. Data analysis includes descriptive statistics and ANOVA test.

The results of descriptive showed that: all the subjects addressed the motivational factor of gaining success and winning as the main factor in participation in sport and having team spirit having hobby recreation, situational factors as the least significant factors

Hypothesis test results showed in classification motive of:

Development and improvement of skills with due attention to career – educational condition, situational factors with attention to record of participation in sport having team spirit with attention to injury rate and record of participation in sport and having hobby and recreation with attention to age class and injury rate among subjects meaningful differences were observed.

1- Busby, G.J. (1997). Modeling participation motivation in soprt. Inj. kremer, k.Trew, & s. Ogle (Eds.), Young people involvement in sport (pp.178-210). London: Rout ledge.

2- Butt, D.S. (1987). Psychological motivation in sport, exercise and fitness. In 1. Dimont (Ed), Mind body maturity: Psychological. Approaches to sports, exercise and fitness (pp.213-225) New York: Hemisphere Publishing Corp.

PSYCHOLOGY HAS A LOT TO OFFER SPORT: THE USE OF HYPNOSIS AND HYPNOTHERAPY IN SPORT

Claasen, M.

Private Practice, South Africa

INTRODUCTION

The influence of the mind and mental preparation upon sports performance is widely acknowledges. More and more elite as well as recreational athletes, coaches and even officials, make use of mental skills to enhance their performances and to relieve emotional and physical stress.

Visualisation, relaxation and stress reduction are keys not only to reach goals and perform successfully but also to mental well-being and good physical health.

PURPOSE:

The utilisation of various hypnotic techniques and –phenomena can be of great value to enhance sport performance and gain inner strength, to mobilise energy, to optimise arousal levels, to speed –up recovery from injuries and to ease pain.

The use of hypnosis and ego-strengthening techniques can also alter the course of therapy (when necessary) in a very positive way. Hypnotic intervention and ego strengthening "has been shown to (1) shorten the course of therapy, (2) increase self-confidence, (3) enhance internal control and (4) produce a sense of mastery." (Phillips and Frederick, Stanton 1979, Hartland 1965,1971)

METHOD:

By making use of the various hypnotic techniques and by teaching the athletes self-hypnosis. Case studies to illustrate.

RESULTS:

Athletes experienced (1) increased confidence and self-belief, (2) enhancement of their general coping abilities, (3) reduction of fear, anxiety, worrying and muscle tension, (4) greater feelings of control and concentration and (5) increased ability to manage pain and fatigue.

CONCLUSION:

Hypnosis helps to prevent physical symptoms getting in the way of optimal performance. It can be amazingly effective to bring about improvements in physical performance and to strengthen mental well-being. It helps athletes to stay calm and in control under pressure and to establish a positive mind-set.

A STUDY ON GOAL ORIENTATION, PERCEIVED MOTIVATIONAL CLIMATE AND SOURCES OF SPORT CONFIDENCE IN PLAYERS OF JUNIOR VOLLEYBALL CHAMPIONSHIP OF IRAN

Bahram, Y., Poorya, Q.

Razi University, Iran

The purpose of this study was to investigate the relationship between Goal Orientation (Task-oriented goal vs. Ego-oriented goal) and Perceived Motivational Climate (Perceived Task-Climate vs. Perceived Ego-Climate) with Sources of Sport Confidence of volleyball players, competing in the 2004 Junior Champion Competition of Iran. Subjects of this study were 82 male volleyball players. For data gathering three questionnaires were used: Goal Orientation Questionnaire, Perceived Motivational Climate Questionnaire (PMCQ) and Sources of Sport Confidence Questionnaire. Prior the survey was administered; the researcher would explain the content of the inventories to the athletes. Researcher had informed the player that their responses were submitted anonymously. Significant findings were summarized as following: Among Sources of Sport Confidence, factors of Coach Leadership, Mastery and Demonstration of Ability had the highest average and athletes recorded higher score in Task-Orientation used more factors of Sources of Sport Confidence. According to this research the athletes who recorded higher scores in Task-Orientation selected Mastery and Social Support as factors to enhance their self-confidence. On the other hand the athletes who recorded higher scores in Ego-Orientation didn't mention those factors and selected Situational Favorableness as a factor to enhance self-confidence. Thus athletes who recorded higher scores in Perceived Task-Climate in their teams selected mastery as a factor to create self-confidence and who recorded higher scores in Perceived Ego-Climate selected Situational Favorableness and Physical Self-Presentation as factors to enhance their self-confidence.

References

1. Chi, 1.K. (1996). Stress management of athletes. National Physical Education Quarterly, 25(4), 51-57

2. Duda, L. J.(I 992).Motivation in sport settings : A goal perspective approach .In G.C.Roberts(Ed.) ,Motivation, and Sport and Exercise (pp.57-91). Champaign, Illinois: human Kinetics.

3. Gould. D. Hodge. K. Peterson. K. & Gianninti, J. (1998). An exporatory examination of strategies used by elite coaches to enhance self-efficacy in athletes. Journal of Sport & Exercise Psychology. 11. 128-140.

4. Huang. C. R, Kuo, H. Y.(l 999). The sources of athletes' sport confidence. The Chinese physical Education. 13 (3). 60-66.

5. Nicholls, J. G. (1984). Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance Psychological Review, 91, 328-346.

6. Petherick, C.M., & Weigand, D.A. (2002). The Relationship of Dispositional Goal Orientations and Perceived Motivational Climates on Indices of Motivation in Male and Female Swimmers. International Journal of Sport Psychology, 33, 2 18-237.

Poster presentation (PP)

PP3-07 Physical Education and Pedagogics 1-2 - "Exhibition Hall"

ATHLETES RETENTION OF COACH'S INSTRUCTION IN TYPICAL INSTRUCTIONAL CONTEXT IN SPORT SESSIONS

Rosado, A., Breia, E., Mesquita, I.

Faculty of Human Movement, Portugal

The aim of the present study was to analyze athletes' retention of coaches' instructional episodes (task presentation, feedback and session closing instructions). We observed 32 gymnastic training sessions and 200 instructional episodes. The independent variables were age, gender, school level and practice level. The dependant variables were the quantity of information on coach instructions and the nature of the information (according with several categorical systems of codification, one for each type of instructional episode), the information's reproduction by the athletes, both in a quantitative (extension, number of ideas, density) and qualitative (coherency) approach. The coaches instructions were audio and video recorded and immediately afterwards athletes were asked (by interview) to reproduce the coach's information. The information given by the coach and the athlete's answers were analyzed through quantitative and qualitative (content analysis) procedures, being the data compared and correlated.

Globally, athletes perceived coaches the instructions. The retention of the information was inversely related with the number of transmitted ideas and its extension. The type of the instructional episode does not affect the reproduction and the retention of the information.Results suggest that the retention of the information depends, generally, on its structure and not on the athletes personal characteristics. Some personal characteristics, however, were associated with retention in task presentation and instructional feedback.

COACHES' CONCEPTIONS AND VALUES ABOUT YOUTH SPORT COMPETITION. COMPARISON BETWEEN NOVICE INTERMEDIATE AND EXPERIENCED COACHES

Mesquita, I., Graça, A., Pereira, F., Marcelo, C.

Faculty of Sport, Portugal

The purpose of this study is to describe and compare the conceptions and values concerning competition in sport at ages of 10-12 and 14-16 sustained by Portuguese coaches by considering the type coaching experience (novice; intermediate and experienced).

A 43 items questionnaire in a 5-point likert-type scale was developed to disclose the coaches' appraisal about competitions at both of those ages. A sample ranging from 274 coaches from several sports filled the pair of questions at each item. Data underlying structure and psychometric properties of the questionnaire were sought by means of an exploratory factor analysis (principal components method) and a reliability analysis (Cronbach alpha).

Coaches' Professional experience is a discriminating factor for some elements of coaches' conceptions. More experienced coaches emphasise more the pedagogical value of competition, and its consequences for lifetime commitment. Experienced coaches of team sports reject more vehemently premature specialization at 10-12 ages, and stress higher the alignment of developmental and competitive objectives at 14-16 ages. Experienced coaches differ from novices by supporting the regulatory role of sport governing bodies over contents and processes of game play appropriate to 10-12 and 14-16 competitions.

DIFFERENTIATION OF THE RISK FACTORS IN AGREEMENT WITH THE LEVEL OF PHYSICAL ACTIVITY

Lima, W.A., Glaner, M.F.

Catholic University of Brasília, Brazil

Several risk factors are associated to the development of cardiovascular diseases as the excess of relative body fat (%F), the accumulated fat in the trunk (%F trunk), arterial hypertension, dyslipidemia, physical inactivity, among others (Grundy, 1998). However, the objective of this study was to verify the risk factors if they differentiate in agreement with the level of physical activity (LPA). The sample for this study was 80 male individuals. The LPA was estimated by the questionnaire of habitual physical activities, developed by Pate (1995), being the individuals classified in four categories: Group 1 (G1)= inactive, Group 2 (G2)= irregularly active, Group 3 (G3)= moderately active, Group 4 (G4)= very active. The other risk factors measured were: systolic blood pressure (SBP), diastolic blood pressure (DBP), abdomen perimeter (AP), enzymatic glucose (EG), total cholesterol (TC), high density lipoprotein (HDL), low density lipoprotein (LDL), triglycerides (TG), %F and %F trunk. These last two were estimated for the dual energy X-ray absorptiometry. The blood was taken after fasting for 12 h and the sanguine analysis was made by the enzymatic method. The groups, by LPA were compared through analysis of variance between groups and Scheffé's test ([a]p<=.05). The results obtained for G1, G2, G3 and G4 were: SBP= 133.0 +/- 12.7; 133.0 +/- 19.3; 130.9 +/- 18.2 and 128.5 +/- 19.6 mmHg; DBP = 90.0 +/- 10.5; 86.5 +/- 14.0; 83.3 +/- 14.0 and 84.1 +/- 17.1 mmHg; APa= 94.0a +/- 3.8; 89.3ab +/- 9.3; 87.9ab +/- 9.1 and 82.9b +/- 10.7 cm; %F= 25.6 +/- 3.7; 21.9 +/- 7.2; 19.7 +/- 7.8 and 17.8 +/- 9.2%; %F trunk= 29.7 +/- 4.9; 23.1 +/- 9.0; 22.5 +/- 9.4 and 19.9 +/- 10.6%; EG= 97.7 +/- 10.7; 93.6 +/- 15.7; 95.2 +/- 9.3 and 95.1 +/- 27.3 mg/dL; TC= 179.5 +/- 27.7; 159.8 +/- 39.0; 161.3 +/- 36.9 and 149.2 +/- 32.2 mg/dL; HDLa= 36.4 +/- 7.5; 41.5 +/- 11.7; 38.1 +/- 9.9 and 46.0 +/- 13.7 mg/dL; LDLa= 114.7 +/- 27.7; 92.5 +/- 35.4; 100.2 +/- 29.7 and 82.2 +/- 29.5 mg/dL; TG= 143 +/- 62.8; 134.1 +/- 59.6; 116.8 +/- 70.1 and 107.9 +/- 64.3 mg/dL, respectively. The individuals from the moderately and very active group apparently presented less expressive mean values for the factors of cardiovascular risk in all the variables, but, this difference was only shown significant for AP, HDL and LDL. However Scheffé's test evidenced differences between inactive and very active individuals in AP. In spite of limited questionnaires to estimate LPA, the obtained results are good indicators as how the physical activity can be beneficial to reduce and/or to control the risk factors for the cardiovascular diseases.

Grundy, SM (1998). Am J Clin Nutr. v.67(suppl):p.563S-72S.

Pate (1995). Quest. v. 47, p.304-310.

GENERAL DIRECTIONS OF DEVELOPMENT OF OLYMPIC EDUCATION SYSTEM IN UKRAINE

Bulatova, M., Platonov, V.

National University of Ukraine on Physical Education and Sport, Olympic Academy of Ukraine, Ukraine

Expansion of knowledge about the Olympic movement and Olympic sports has being done in Ukraine in two relatively independent (though to some extent interconnected) directions – general education and special education.

General education direction deals with the knowledge promotion on Olympic movement background (from Ancient Greece up now), about development of modern Olympic sports, Games of Olympiads and Winter Olympic Games, about main principles of Olympism including not only special sports aspects but humanistic, social, moral and ethic ones etc. This Olympic education direction in our country is intended for wide population segments, especially youth, and thus in first turn it is realized at school and collegiate levels though naturally is not limited by these spheres.

Special attention is paid here to the effective forms of implementation of Olympic education at school level. E.g.: The Olympic Academy of Ukraine issued and spread a series of 11 color posters devoted to main principles of Olympic movement, its history, ancient and modern Olympic Games, symbols and signs etc.; there were published hand books, table games for younger children, magazines. Annually the Olympic lesson is conducted at the primary schools with keeping of all the Olympic ceremonies and rituals.

Special education direction is an integral part of a created in Ukraine system of professional preparation for various branches of physical education and sport sphere – PE teachers, coaches in various sports, specialists in sport management, and recreation. Here Olympic education is implemented through various forms: at special profile teaching courses on university curriculum; by participation in scientific forums, congresses, conferences, symposia; by means of publication of more than 70 books, several journals and other various printed materials by the publishing house "Olympic Literature"; through research work of 5 Olympic Study Centers (dissertations), with help of propaganda work in cooperation with mass media - lectures, quizzes, meetings with famous athletes, and art and literature contests.

For practical realization in Ukraine each of two above mentioned directions provides creation of an appropriate system, elaboration of methodological, organizational, material-technical and other fundamentals without which the process of Olympic education in the country could hardly be efficient.

Taking into consideration all these factors in Ukraine there has been created and realized a considerable complex of various endeavors aimed to development of both – general education and special education – directions of the Olympic movement.

DO ALTERNATIVE INSTRUCTIONAL APPROACHES RESULT IN DIFFERENT GAME PERFORMANCE LEARNING OUTCOMES?

Tallir, I., Lenoir, M., Musch, E., Valcke, M.

Ghent University, Belgium

The primary goal of games teaching is enhancing pupil's game playing ability. This study examined the effectiveness of two instructional approaches for basketball on pupils' actual game performance. Two experimental classes were assigned at random to the traditional game teaching approach and two classes received the experimental treatment based on the Invasion Games Competence Model (IGCM) (Musch et al., 2002). The study lasted 17 weeks, during which the 10 – 11 year old pupils received twelve 50-min lessons of basketball instruction. Data for the authentic assessment of basketball game performance were collected by means of video-analysis of 3 on 3 and 3 on 1 game play conditions. An at random sample of 21 of 97 participants was analysed. The software "Catmovie" enabled coding of the game performance on screen. Next to the cognitive decision-making component and the motor skill execution efficiency component, the motor skill execution effectiveness component was also coded. RMANOVA were carried out to check whether the IGCM instructional approach will have a significant positive impact on pupils' decision-making ability, while for the motor skill execution components better results are expected for the traditional instructional group. Authentic assessment of the game performance indicated that the three components significantly ($p<.005$) improved in both groups over time between the pretest and the post-test, but the IGCM group improved more over time (average increase of 15%) compared to the traditional instructional group (average increase of 5%). However, stability of these results in long-term (post-test vs. retention test) showed different results for both groups. For the traditional group the three components improved (average increase of 9%) after the retention period, while the scores of the IGCM did not change on these components. Moreover, it was found that for both groups game performance scores were significantly higher in the 3 on 1 condition than in the 3 on 3 condition. Finally, it was investigated whether decision-making ability during game play and the cognitive learning outcomes on a video-based decision-making test (Tallir et al, 2005) were related. The lack of correlations between the results on the video-based decision-making test and the decision-making during game play showed that these decision-making tests are not interchangeable.

Musch, E., Mertens, B., Graça, A., Timmers, E., Meertens, T., Taborsky, F., Remy, C., Multael, M., Vonderlinck, V., & De Clercq, D. (2002, October). The invasion games competence model: An alternative approach to games instruction and learning, presented on CD-ROM. Poster session presented at the AISEP congress of A Coruna, Spain.

Tallir, I.B., Musch, E., Valcke, M., & Lenoir, M. (2005). Effects of two instructional approaches for basketball on decision-making and recognition ability. International Journal of Sport Psychology, 36, 107-126.

EVALUATION AND GRADING IN PHYSICAL EDUCATION AT SCHOOLS

Vass, M., Prisztóka, G., Papp, G., Telek, I.

University of Pécs, Hungary

Introduction

Evaluation by grading has had a tradition for several centuries in the Hungarian public education. According to Ratio Educationis published in the 18th century, the students should be evaluated twice a year – at the end of the first term and at the end of the school year – by one grade summarizing all the grades as an average. In the course of history the number of grades used for evaluation has changed several times. At present, the evaluation of students in school subjects including physical education, too, is performed by a five-grade scale.

However, the Act of Public education permits ways of evaluation different from the five-grade scale to be used. In the first three classes, evaluation of pupils is permitted to be done only by verbal characterization. This method may be used in upper classes as well. The schools operating on the basis of alternative curricula, e.g. Waldorf schools, emphasize the efficacy of verbal characterization versus evaluation by grading.

The contexts of evaluation

First of all, evaluation can be associated with the notion of achievement. In the developed countries, achievement has become the focus of education policy. The results of great international comparative studies, e.g. PISA study, qualify the efficacy of the system of education through the achievement of the students in their studies.

The components such as success, efficacy and quality of achievement are closely associated with the mutual recognition of the degrees in the European Union.

"Equity" as one of the significant characteristic features of a system of education does not exclude the category of quality. Just on the contrary, the students of those countries are capable of achieving the best results, in which equal opportunity and equity for all are taken care of.

Study of the evaluation and its results

- Place of study: Hungary (10 counties)
- Date of study: April and May, 2005
- Participants: 1,479 fifth and eighth class pupils of 10-14

Method of study: questionnaire with open and closed questions,
simple mathematical and statistical analyses

Aim of study: * the students' stance on physical education
* evaluation of physical education as seen by the students

Results

- More than 90% of the students regard physical activities as significant. About the same number of students are fond of physical education.
- About the same number of students either regards grading important or is indifferent, whereas 25 % of the students regard grading as "not important".
- In their opinion, compared to other subjects, it is not difficult to get grades at physical education.
- Only 15% of the students would like to be evaluated by written characterization instead of grades.

References

1. Our Public Education in the European Union, VIth National Public Education Expert Conference, Debrecen, 2004.
2. Evaluation of PE Persons, ELTE PPK, 2005.

PHYSICAL EDUCATION LESSONS. THE STUDENTS' VIEWS OF BASIC SCHOOL

Pereira, A.

Polytechnic Institute of Viseu - Higher Education School, Portugal

Physical Education is an essential element and an integral part of the process of continuing education and human and social development (Bowyer, 1996). The development of effective strategies to secure and further develop Physical Education is an essential component of education (Stelzer et al., 2004).

The schools should mobilise good practices in Physical Education, improve a good curriculum (aims, themes, content, evaluation and monitoring), resources (facilities, equipment and teaching personnel) and should be responsive to physically educated students (learning outcomes) according to new lifestyles and social needs (Tannehill & Zakrajsek, 1993; Treasure, 2001)

The aim of this study was to know students' perceptions of Physical Education lessons in the schools and if the perceptions are congruent with students' expectations.

We applied structured interviews to 9th-year students of both sexes (n=50) from some Portuguese schools. In order to inspect the material we applied content analysis technique (Strauss & Corbin, 1998).

The majority of the students (93.3%) like to have Physical Education lessons because they can practise some sports and engage with their colleagues. They like practising collective sports but don't like gymnastics and athletics. The most important aspects in the Physical Education lessons are to have "a good teacher" and "a good relationship between teacher and students". In their opinion, the best lessons happen when there is "a good relationship between all the students" and "all the students are involved in the activities proposed by the teacher". They would like to have "sports alternatives": water sports, climbing, mountain biking judo and aerobics. They would choose up-dated activities/sports, which they know outside school.

Perhaps a new curriculum is needed to agree to students' views and interests and should place them in a position to make choices about their engagement in Physical Education lessons.

References

Bowyer, G. (1996). Student's perceptions of Physical Education. Journal of Physical Education, Recreation and Dance, V.67, nº1, 23-26

Stelzer, J. et al. (2004). Attitudes toward Physical Education: a study of high school students from four countries: Austria, Czech Republic, England and USA. College Student Journal, June 1, Vol. 38, Issue 2.

Strauss, A. & Corbin, J. (1998). Basics of Qualitative Research. Techniques and procedures for developing grounded theory (second edition). London: Sage Publications.

Tannehill, D. & Zakrajsek, D. (1993). Student attitudes toward Physical Education: a multicultural study. Journal of Teaching in Physical Education, 13, 78-84

Treasure, G. (2001). Students' perceptions of the motivational climate, achievements beliefs and satisfaction in Physical Education. Research Quarterly for Exercise and Sport, 72 (2), 165-175.

SCHOOLS AND FREE-TIME ACTIVITIES. THE STUDENTS' VIEWS OF BASIC SCHOOL

Pereira, A.

Polytechnic Institute of Viseu - Higher Education School, Portugal

A growing number of students are becoming involved in antisocial behaviour, which has negative consequences that include teacher and peer rejection, school failure and dropout, delinquency and involvement with drugs and alcohol (Gilman & Meyers; Perez, 2004; Fletcher & Nickerson; Wright, 2003).

Preventive strategies are needed to help overcome these problems. Free-time activities represent one such strategy that potentially can help those students to develop a pro-social behaviour, engage with school and improve their academic performance (Larson, 2000; Mahoney, 2000).

The aim of this study was to know students' perceptions of free-time activities in the schools and if the perceptions are congruent with students' expectations.

We applied structured interviews to 9th-year students of both sexes (n=70) from some Portuguese schools. In order to inspect the material we applied content analysis technique (Miles & Huberman, 1994).

For 62% of the students there should be changes in the future. The schools offered free-time activities, but some changes are necessary. The most practised activities at schools were being with their friends and playing sports. They would like to have "more activities options" and "sports alternatives": water sports, climbing, mountain biking, judo and aerobics. The majority of the students of this study would like a change in the free-time activities offered by the schools: they perceive it too "repetitive" and "boring". They would choose up-dated activities, which they know and practise outside school.

Perhaps in some Portuguese schools, new free-time activities are needed. These schools must organize free-times activities which are preferred by the students, improve healthy life styles and develop their education and cultural and civic training.

References

Dekovic, M. (1999). Risk and protective factors in the development of problem behaviour during adolescence. Journal of Youth and Adolescence, 28, 667–685.

Fletcher, A.; Nickerson, P. & Wright, K. (2003). Structured leisure activities in middle childhood: links to well-being. Journal of Community Psychology, Vol. 31; nº 6, 641-6549.

Gilman, R. & Meyers, J. ; Perez, L. (2004). Structured extracurricular activities among adolescents: findings and implications for school psychologist. Psychology in the Schools, Vol. 41(1), 31-41

Larson, R. (2000). Toward a psychology of positive youth development. American Psychologist, 57, 170-183

Mahoney, J.L. (2000). School extracurricular activity participation as a moderator in the development of antisocial patterns. Child Development, 71, 502–516.

Miles, M. & Huberman, A. (1994). Qualitative data analysis (2nd ed.). London: Sage Publications.

GENETIC TEACHING OF GAMES - FOR MORE UNDERSTANDING

Loibl, J.

Technical University Munich, Germany

Since the late 1960's, the theory of teaching games has changed from technique orientation to game orientation, taught in Germany under the concept of "Methodische Spielreihen", in England and the USA as the "Teaching Games For Understanding" approach.

The basic reason for this change is a difference in the "didactic reduction" or "elementarization" of a game, which in the one case leads to the skills of a game as the elements which have to be taught out of the context of the game situation before the game can be tackled. In the other case, it leads to an elementary form of the whole game, which can be played solving moderately simplified, but still complex game situations with simplified skills.

In this game oriented approach, there are two points on which attention needs to be focused.

Firstly: Playing this simplified form of the game will at some time or other lead to a demand for improving the skills. Here it is important to prevent a reversion to the traditional teaching of skills as ideal techniques copied from top athletes, and to ensure their being taught as functional solutions of specific game situations, bearing in mind the players' physical condition. Thus, a two-handed shot in basketball can be the optimal skill for a player with small hands and little strength although it is not the technique used by top athletes.

Secondly: There is more to playing a game than just playing the game. Dietrich (1984) has pointed this out introducing a so called "general playing ability", meaning the ability to develop a game, to get and keep a game going when difficulties arise.

Both in the "Spielreihen" and the "Teaching Games For Understanding" approaches, this ability is not taken into consideration, actually the development of this ability is even prevented, or at least hampered. The reason for this is that the central activities - finding the simplified elementary form of the game and introducing alterations when problems arise - are in the hands of the teacher. Whereas, the didactic reduction must in fact be carried out by the students, in order to give them the chance to develop the desired abilities through solving these problems with help from the teacher. Questions like "May we alter the rules of the game?" will lead to understanding the functionality of the rules, which are used as "adjusting screws" to obtain optimum excitement and the typical dynamical action structure of a specific game. Discussing possible solutions leads to the development of social competences like, e.g. autonomy, critical faculty and ability to work in a team.

Both problems are included in the concept of "Genetic Teaching", as called for by Dietrich (1984) and put into effect in the game of basketball by Loibl (2001).

References

Dietrich, K. (1984): Vermitteln Spielreihen Spielfähigkeit? Sportpädagogik, 8 (1), 19-21.

Loibl, J. (2001): Basketball – Genetisches Lehren und Lernen: spielen – erfinden – erleben – verstehen. Schorndorf: Hofmann.

FIRST GRADE SECONDARY SCHOOL STUDENTS' ATTITUDES TOWARDS PHYSICAL CULTURE OBSERVED IN THE YEARS 1995 - 2001

Rokita, A.

University School of Physical Education Wrocaw, Poland, Poland

Introduction

By diagnosing the first grade secondary school students' attitudes towards physical culture as observed in the years 1995-2001, the author wishes to determine their changes. It was hypothetically assumed that the attitudes towards physical culture of boys and girls shall statistically and significantly differ and that the changes of attitudes in the subsequent years shall not differ statistically and significantly.

Material and methods

In our examinations, we have employed the method of a diagnostic survey (Supińska 1995). The research was conducted seven times (in first grades) in the subsequent years (1995-2001). We have diagnosed the attitudes of 1693 students (906 girls and 787 boys) of VII Secondary School in Wrocław. The average age of the examined students was 15 years and two months.

Results

By using the Pearson chi-square test and chi-square test of the highest variability, on the level of significance α=0.05, we verified the hypothesis of the independence of sex and the answers to the statements with regard to cognitive, motional and behavioural components. It turned out that the above hypothesis must be rejected in the range of all the three components. In the group of boys the index of the cognitive component reached a neutral value in the subsequent years (min. 3,59 in 1998, max. 3,64 in 2000), and in the group of girls a positive value (min. 3,74 in 1995, max. 3,78 in 1997). It was the contrary in the case of the emotional component. In the group of boys the index reached a positive value (min. 3, 83 in 1997, max. 3,88 in 2000), and the group of girls negative (min. 3,34 in 1997, max. 3,63 in 2001). The indexes of the behavioural component for both of the groups in all the seven years reached a neutral value (boys min. 3,60 in 1997, max. 3,65 in 2001, girls: min. 3,56 in 1995, max. 3,62 in 1997).

By using the Pearson chi-square test and chi-square test of the highest variability, on the level of significance α=0.05, we verified the hypothesis of the independence of the year of the examination and answers to the questions with regard to cognitive, emotional and behavioural components both for the group of girls and boys. It turned out that we cannot reject this hypothesis for all of the three components.

Conclusion

After conducting the analysis of the results of the examinations it turned out that, taking into account the index of the general result, the attitudes towards physical culture of boys of the first grade secondary school in the years 1995, 1996 and 1999-2001 are positive, whereas they are neutral in the years 1997, 1998. The attitudes towards physical culture of girls of the first grade secondary school in the years 1995–2001 are neutral.

References

Supińska U., (1995). Attitudes towards physical culture of the youth who finish their education at secondary school: studies, diagnosis, AWF Wrocław.

PERFORMANCE EVALUATION OF SELECTED IRANIAN COLLEGIATE SPORT ASSOCIATIONS

Salehi Sadati, S.S., Moradichaleshtori, M., Jafari, A.

Islamic Azad University Tehran Markazi Branch, Iran

The purpose of this study was to evaluate the performance of some selected Iranian collegiate sport associations, in terms of their effectiveness, from Viewpoints of stakeholder groups of these associations, including student-athletes as well as coaches of universities in Tehran, members of the selected associations, and experts of these selected sport types(i.e. Badminton, Football, Basketball, Wrestling, Handball, and Volleyball). A total of 546 respondents(270 student- athletes, 120 coaches,120 experts, and 36 members of associations) responded to two respective questionnaires developed for this study(one for students and another designed for other three groups). The collected data were analyzed by some statistical methods such as One-sample T-test, ANOVA, and Dunnett C as the following test of ANOVA . In Addition, for determining the consistency of questionnaires and normal distribution of collected data, Cronbach's alpha and Kolmogorov-Smirnov were used respectively. Results showed that student-athletes, coaches , and experts evaluated the performance of selected associations as weak(Means<3, p<0/05), as such did the members of wrestling association(Mean=2/78). Members of other associations, however, didn't evaluate it as weak (Means>3). There was also a significant difference between Viewpoints of members of associations and those of other groups in each sport type(p<0/05). Among the questions of 2nd part of all questionnaires, only items of 5 , 6, and 14 obtained acceptable means(Means>3), while they all are subscales of a total performance indicator(i.e. organizing intercollegiate games). Results indicate that from Viewpoints of all stakeholder groups, despite the sig. difference between members and other groups, performance of studied associations was not favorite.

ARGUMENTS IN FAVOUR OF DIFFERENTIATED EDUCATION DURING THE PHYSICAL EDUCATION LESSON

Mihailescu, L., Gada, T., Gada, M., Folea, E., Dia, A.

University of Pitesti, Romania

INTRODUCTION

Physical education is a complex formative and educational process which consists of integrating the movement functions with personality; in school, this process must have as datum points the individual characteristics of every student. Romania is among the first countries in the world that made efforts in this direction since 1933, with the help of GH. ZAPAN and P. LAZAR.

Our research has as objective the following work hypothesis: we have considered that differentiated education of students during the physical education lesson is an objective necessity in the actual educational context, because it determines the achievement of movement abilities development objectives and the improvement of students' health through the increase of individual effort capacities and of after effort recovery abilities.

METHODS

The purpose of our paper is the research of differentiated education effects on students according to the above stated hypothesis. To this sense, we have organized an educational experiment during the 2003/2004 school year in four education units in Pitesti, Romania: three secondary schools (V-VIII years) and a national college (IX-XII years).

The experiment sample has the following structure: the primary level 480 students: 270 girls and 210 boys, the high-school level: 360 students: 212 girls and 148 boys.

During the research we have used the following physiological and movement testing: Harward test, Ruffier test, Dorgo test, and J.C.R. test; we have also determined the "z" index with mathematical significance for the differences in the comparisons we have made during our research.

CONCLUSIONS/ DISCUSSIONS

The results of the experiments confirm the research hypothesis and offer valid arguments in the sense of forwarding the differentiated education as the principal education method in school physical education.

- Differentiated groups education according to the differentiated objectives of lessons makes sure that every student goes through all the lesson themes in comparison with the frontal, direct education.
- Differentiated itineraries used in the physical education lesson respect the bio, psycho and movement characteristics of students generating motivation, active and aware participation, and satisfaction among the students.

BIBLIOGRAPHY

- CARSTEA GH, 2000 – "Teoria si metodica educatiei fizice si sportive", Editura AN-DA, Bucuresti
- CERGHIT I., 2002 – "Sisteme de instruire alternative si complementare", Editura Aramis
- CUCOS Ctin, 2003 – "Pedagogie", Editura Polirom, Iasi
- DRAGNEA A., 2002 – "Masurare si evaluare in activitatile motrice", Editura Universitatii din Pitesti
- DRAGAN I., 1994 – "Medicina sportiva aplicata", Editura Editis, Bucuresti.

COMPARISON OF MIDDLE SCHOOL STUDENTS' ATTITUDES TOWARD PHYSICAL EDUCATION WITH REGARD TO GRADE, STUDENT'S GENDER, TEACHER'S GENDER AND SPORT PARTICIPATION

Hunuk, D., Demrhan, G.

Hacettepe University Health Science Institution, Turkey

The purpose of this study was to compare attitudes of Middle school students toward physical education with regard to grade, student's gender, teacher's gender and sport participation. Totally 1260 students, who are selected according to random sample method from 22 middle schools;180 girls and 199 boys from the sixth grade, 246 girls and 155 boys from the seventh grade, 212 girls and 268 boys from the eighth grade, were voluntarilly participated to this study. To assess participants' attitudes toward physical education "The Attitude Toward Physical Education Scale For Children", that was developed by Sherrill and Toulmin (1977), and adapted by Özer and Aktop (2003) to Turkish, was administered. The Cronbach coefficient alpha reliability was found as .86 and the intraclass correlation coefficient was found as .83. The difference between attitude points of students was calculated by the Two way ANOVA analysis and result of analyseses showed that: for average attitude points of 6., 7.and 8. grade elementary school students participated to the study, there is a statistically significant difference among students of different grades. And a significant difference between girls and boys, with the boys scoring higher. Also when the results of this study was examined by sport participation, a significant difference between sport participants and nonsport participants ($p<0.05$). Additionally a significant difference between grade and sport participant or nonsport participant was observed. ($p<0.05$) Lastly a difference between grade x student's gender x teacher's gender ($p<0.05$) was calculated. Consequently, by the increase of the students' grade, the average of students' attitude scores decreases; meanwhile the boys' and sport participants' attitude scores are higher. In the view of this results, it can be concluded that grade, gender and sport participation may effect the attitudes related with physical education.

EXPECTED ACHIEVEMENT IN "GENERIC SKILLS" THROUGH PHYSICAL ACTIVITY PARTICIPATION OF HONG KONG PRIMARY SCHOOL STUDENTS

Sum, K.W., Hui, S.C.

Chinese University of Hong Kong, Hong Kong

The purpose of this study was to investigate the expected achievement in "generic skills" through physical activity participation of Hong Kong primary school students. A 50 items of generic skill development questionnaire was developed by the research team.

Results

The overall findings were the following:

1.Collaborating

Nearly half (47.9%) of the junior students had different assigned roles during their physical activity classes. Such experience increased to 63.1% upon progress to senior forms.

2.Communication

The junior students reported no problem at all communicating with their instructors/teachers (93.6%). The majority (75.9%) of them knew how to express their problems to their teachers.

3.Creativity

Close to 60% of the junior students had an experience in creating their own movements, while there is a decrease to 40% in such experience in senior forms. Only 47.9% of the junior students had an experience in designing activities outside their P.E. classes. This also decreased to 32.3% in senior forms.

4.Critical Thinking

About 70% of the students were able to analyze the reasons for winning or losing in games, and were able to provide suggestions for improvement. Meanwhile, close to 45% of the senior students criticized the truthfulness of physical activity information.

5.Information Technology

Less than half of the students (40.4% of juniors; 45.2% of seniors) were able to use the internet to obtain physical activity information; 25.1% of junior students communicated with others using I.T on matters related to physical activities, while only 14.7% of senior students had ever tried to use I.T. to complete sports-related assignments.

6.Numeracy

More than half (54.7%) of the junior students had the experience in handling numbers during physical activity participation. More than 10% of them found it difficult to differentiate sports-related symbols and court lines.

7.Problem Solving

Close to 70% of all students reported no difficulty in identifying the reasons for winning or losing a game, or in analyzing their performance.

8.Self-Management

Most junior students (71.8%) knew which kind of sports they were good at, while 55.5% knew their weaknesses. Close to 80% of all students were willing to take up their responsibilities.

9.Study

More than half (55.9%) of the junior students read materials related to physical activities, and 46.6% of the senior students had an experience in collecting information from materials related to physical activities.

Conclusions and Discussions

The Physical Education KLA provides a context for the development and application of generic skills. The findings revealed that there are plenty of rooms to improve the collaboration, creativity, and critical thinking skills of students, and that there is likewise a need to promote the information technology, numeracy, problem-solving, and study skills of Hong Kong primary school students through enhanced participation in physical activities.

TECHNOLOGY OF TEACHING SPORTS TECHNIQUE OF GYMNASTICS EXERCISES

Niznikowski, T., Sadowski, J., Booban, W., Mastalerz, A., Niznikowska, E.

Józef Pisudski Academy of Physical Education in Warsaw, Poland

The process of teaching coordinationally complex exercises along with a constantly rising level, quality and stability is getting more and more difficult. There appears a necessity to apply new techniques to a deeper analysis of the structure of sports exercises in order to identify the most significant elements of a particular movement. Information concerning the most characteristic and the most significant, from the point of view of teaching the movement, stages of a physical movement is necessary to prepare effective training programmes. Identifying such stages, described in literature as junction elements of sports technique, should be an initial step to prepare pedagogical training technologies.

Therefore, the aim of the paper was to study an effective pedagogical training technology of the process of teaching acrobatic exercises.

Pedagogical experiment, 60 Hz (JVC GR-DVL 9800 NTSC) camera and APAS 2000. Cinematographic analysis systems were used to analyse the round-off tucked back somersault (n=30).

On the basis of the research it was concluded that pedagogical teaching technology includes three components: the first one – a deep biomechanical analysis of phase structure of movement, the second one – didactic teaching structure, and the third one – contemporary teaching technology including algorithms as well as programmes of teaching acrobatic exercises.

ETHNIC PEDAGOGICAL CONDITIONS OF USE OF GAMES AND COMPETITIONS OF TRADITIONAL PHYSICAL EDUCATION OF NATIVE SMALL PEOPLES OF NORTH (ON EXAMPLE OF KHANTS)

Krasilnikov, V.

Russian state professional-pedagogical university (s. Yekaterinburg is), Russia

The article was prepared on the basis of the materials received in ten expeditions (1990-1993) in places of residing of one of ancient peoples of Siberia - Khants, and on the study of the literary and the archival materials also.

More than a hundred national games, competitions and original physical exercises which were classified in view of age features, the trade activity, traditional way of life were revealed by the author as the result of those field researches.

The national pedagogics of Khants has developed means and in parallel with it has generated the system conditions for an effective use of national games with the view of education of children. The use of national games, competitions in specially created ethnic pedagogical conditions will allow to enrich considerably the spiritual life not only of Khants, but also other peoples of the North and the whole Russia.

Poster presentation (PP)

PP3-08 Nutrition 1/1 - "Exhibition Hall"

EFFECT OF TOWER CLIMBING EXERCISE & ALPHA LIPOIC ACID ADMINISTRATION

Sanghyun, K., Kijin, K., Hongsoo, K., Yoonjung, S.

Keimyung University, Korea, Korea, South

The purpose of this study is to examine the effect of climbing exercise and alpha lipoic acid(ALA) administration on bone metabolism in ovariectomized female Sprague-Dawley rats, and for this study, climbing exercise was executed in the self-made vertical tower cage, and regular amount of ALA was administrated into the abdominal cavity of rat for 8 weeks. Followings are the results of analysis about weight, bone mineral density, bone mineral content, bone strength, and blood variables.

First, spayed group generally presented higher weight than the other group, and the SS group presented significantly lower weight than OA group from 6 weeks after administration, and OC group from 7 weeks after administration.

Second, in case of bone mineral density and bone mineral volume, OEA group showed significantly higher gross bone mineral density than SS group and OC group, and there was no significant differences between all groups in case of leg bone mineral density.

Third, as a result of measurement, the length, weight, bone density, and bone strength of all groups showed no statistically significant difference.
Fourth, there were no statistically significant differences between groups in case of blood osteocalcin, E2, PTH, and LH. so it is considered that more researches are needed to get significant results of other factors except weight, gross bone mineral density and leg bone mineral density.

EFFECTS OF CARNOSINE AND ANSERINE SUPPLEMENTATION ON EXERCISE PERFORMANCE AND INTRACELLULAR PH DYNAMICS DURING ISOMETRIC KNEE EXTENSION EXERCISE

Maemura, H., Suzuki, Y., Takahashi, H., Takahata, Y., Morimatsu, F., Takamatsu, K.

Nippon Meat Packers, Inc., Japan

PURPOSE: The purpose of this study was to investigate the effects of long-term chicken breast extract (CBEX) supplementation which was a rich source of carnosine and anserine on exercise performance and intracellular pH dynamics during isometric knee extension exercise. METHODS: Twelve healthy male subjects were divided into CBEX group (n = 6) and placebo group (n = 6). The CBEX group was orally administered 200 ml CBEX drink which contained 4g of carnosine and anserine per day for 30 days. The placebo group was orally administered 200 ml the same taste CBEX drink which contained no caronosine and anserine. Before and after the ingested period, the subjects performed isometric knee extension exercise (load: 40% maximal voluntary contraction) until the exhaustion to measure endurance time and intracellular pH using phosphorus magnetic resonance spectroscopy (31P-MRS). RESULTS: The endurance time was significantly increased after supplementation in the CBEX group (pre: 165 ± 14.7s, post: 193.3 ± 10.8s, P < 0.01). Subjects in the CBEX group who increased endurance time were inhibited degradation of intracellular pH during isometric knee extension exercise. Furthermore, a significant correlation was demonstrated between changes in endurance time and changes in degradation of intracellular pH (r = 0.852, P < 0.01). CONCLUSION: These results suggest that the long-term ingestion of carnosine and anserine can improve exercise performance resulting from inhibiting the degradation of intracellular pH.

EFFECT OF BIOLOGICALLY ACTIVE ADDITIVE "PALI - PALI" ON THE FUNCTIONAL STATUS OF ATHLETS AT PHYSICAL LOAD

Sukhov, S., Kulnazarov, A., Ivanov, A.

National Research and Practical Center of Physical Culture, Almaty, Kazakhstan , Kazakhstan

Introduction
A biologically active additive ((BAA) "Pali - Pali" replenishes the deficiency of micronutrients and essential substrates, improves tissue metabolism and exerts antihypoxia action. It consists of: succinic acid, fumaric acid, taurine, glicine, L-arginine, L-carnitine, extract of Schizandra chinensis Baill, vitamins В1, В2, В6. The goal of the study is to study the effect of BAA on the functional status and physical performance of athletes in physical load.
Methods
To register electric - physiological characteristics of biologically active points (BAPs), there was used the Electric-Puncture Diagnostic System (EDS) developed as a set of hard- and software. EDS allows measuring in several algorhythms. The study findings were expressed in conventional units (c.u). There were taken measures at 40 control (c) BAPs of all arm and leg meridians on both sides of the body. Along with measuring individual BAPs, there were determined the indicators proposed by us: sum of all cBAPs, sum of arm meridians cBAPs, sum of leg meridians cBAPs, sum of heart and lung meridians' cBAPs, sum of cBAPs of meridians of nervous and endocrine systems, an upper/lower factor which reflects the balance between the upper and lower parts of the body. Along with electric puncture diagnostics, there was conducted a complex testing. 10 mountaineers were tested twice with interval of one day. Examination was conducted in the rest and after a maximum aerobic load. At the second examination two pills of BAA were offered to the athletes 90 minutes before the physical load.
Results
It was found that the physical load resulted in some elevation of sums of cBAPs of all meridians, sum of cBAPs meridians of arms, sum of cBAPs of heart and lung meridians, sum of cBAPs of meridians of nervous and endocrine systems and the upper/lower factor, in comparison with resting state. Intake of 2 pills of BAA had a considerable effect on the results of electric-puncture diagnostics. The abovementioned indicators have significantly increased in comparison with the rest and to a higher extent than at the first examination. In particular, the sum of cBAPs of heart and lung meridians rose from 352.8±6.1 to 373±4.1 c.u. (P<0.05). The upper/lower factor has increased from 0.94±0.01 to 0.97±0.009 (P<0.05) demonstrating the better balance between the arm and leg meridians and good adaptation to physical load. At single intake of BAA the total volume of performed work and volume of work performed in the regimen of maximum oxygen consumption did not change. It seems that only prolonged administration of BAA might affect this indicator.
Conclusion
One can conclude that BAA "Pali-Pali", according to the findings of electric-puncture diagnosis, has a positive effect on the functional status of athletes. First of all, this is confirmed by the growth of the indicator "a sum of cBAPs of heart and lung meridians" which speaks about oxygen-transporting function.

EVALUATION OF RISKS IN CONSUMPTION BEHAVIOUR IN SPORT SCIENCES STUDENTS

Coquart, J., Mille-Hamard, L., Dehaut, F., Duhame, A., Garcin, M.

Laboratoire d'Etudes de la Motricité Humaine, EA 3608, France

INTRODUCTION
This paper presents the results of a study carried out in the framework of the Regional Health Programme concerning Risks in Consumption Behaviour (CCAR 2002-569). The goal was to evaluate consumption and the associated risk factors among athletes in the university environment.
SUBJECTS
A questionnaire was filled in by 984 students (67.18% men and 32.82% women) enroled at the Sports Sciences Faculty (from the 1st to the 4th year).
STATISTICS

Results were expressed as frequencies and percentages for categorical variables and as the mean + - SD (standard deviation) for continuous data. Comparative analyses were done using the chi-square.

RESULTS

The questions concerned the students' knowledge regarding the classification of different substances, whether they are legal or illegal, their effect on sporting performance, and their consumption habits. The substances presented were nutritional ergogenes, legal and illegal drugs, and different medicine likely to be consumed by a young and or a sporting population.

The students who have at least 70% of correct answers relative to knowledge are mainly men, enroled in the third year of studies or higher, and therefore more than 20 years old (P<0.05).

The substances most consumed with the unique aim of enhancing performance, with a frequence greater than or equal to 3 times in the last 3 months are cola-based drinks (24.7%), tea or coffee (22.6%), and vitamins (17.2%). The consumers of cola-based drinks are mainly men, students in years 1 and 2 at university (P<0.02).

Concerning alcohol consumption (in terms of frequency and quantity consumed on a particular occasion), or tabacco or cannabis, 36.8% consume at least 4 glasses or more of alcohol on a particular occasion, 13.3% and 11.2%, respectively, consume cannabis or alcohol at least 3-4 times per week, and 7.9% smoke more than 10 cigarettes per day. Harmful users of alcohol (frequence and quantity) and cannabis tend to be men (P<0.0001). There is no effect of age among these harmful users (P>0.05) except for consumers of alcohol in terms of frequency.

DISCUSSION

Students must be made more aware of the knowledge concerning substances and their effects and of the relevance of the consumption of nutritional ergogenes, as of the first year in university. These sport sciences students are mainly involved in heavy bouts of drinking but infrequently, corresponding to after-match parties. It would seen that the priority of a health policy must be the consumption of alcohol among this population of university athletes.

ACKNOWLEDGEMENTS

This study received financing from the regional authorities « Nord-Pas de Calais ».

COMPARISON OF ANTHROPOMETRIC AND DIETETIC EVALUATION BETWEEN THE MOST EXPERIENCED PLAYERS AND THE NEW PLAYERS OF CAPOEIRA

Soares, E.A., Costa, L.

Institute of Nutrition - Federal University of Rio de Janeiro and State University of Rio de Janeiro, Brazil

Capoeira, an African-Brazilian fight, was originally developed by slaves. It puts together martial art, dance, folcklore, acrobatics, and game. It is practiced in 156 countries and its tradition is preserved until nowadays. There are not many researches about the physical conditions of the capoeira players, so the proposal of this study was to compare the body composition, somatotype and dietary assessment between the most experienced players and the new players of capoeira. The anthropometric and dietetic assessments were applied to two groups of men between 18 and 30 years old. The first group held 30 experienced capoeira players (with more than 4 years of practice) and the second group of college students (n=30), new players from Federal University of Rio de Janeiro, Brazil. The anthropometric parameters examined were: height, body weight, skinfolds, circumferences and breadths (1) (2). The dietetic parameters examined were consumption of energy, macronutrients and micronutrients (24 hours dietary recall and 3 days food diary methods). The nutrients consumption was compared to the american recommendations (3) (4). The most experienced players of capoeira showed smaller fat percentage (8,55 ± 2,9% vs. 13,92 ± 2,7%) and sum of seven skinfolds (64,51mm ± 16,9 vs. 104,86mm ± 20,3) with significant differences (p<0,05) and showed balanced mesomorphy. They presented inadequate food habits with high-protein (1,8 ± 1,0g/Kg/day), low-carbohydrate (5,3 ± 2,5g/Kg/day) and unbalanced-lipid diets (34,2 ± 7,0% of the total energy intake), however adequate micronutrients levels were found. The new players showed a balanced-lipid diet (28,3±7,3% of the total energy intake) with signifficant differences (p<0,05) to the experienced players, high-protein (1,6 ± 0,6g/Kg/day) and low-carbohydrate diets (5,0 ± 1,8g/Kg/day), their diets tended to be low in vitamin C and calcium and they showed balanced endomorph. In conclusion the capoeira probably have positive effects on body composition and can be introduced like a physical activity to improve health. There is a need for the professional who gives nutritional orientations to both groups and also more researches about capoeira, effort intensity and nutritional status of the players could be done.

(1) JACKSON AS, POLLOCK ML. Generalized equations for predicting body density of men. Br J Nut. 1978; 40:497-504.

(2) CARTER JEL. The Heath-Carter Anthropometric Somatotype – Instruction Manual. Departament of Exercise and Nutritional Sciences of San Diego State University; 1998.

(3) AMERICAN DIETETIC ASSOCIATION, Position of the American Dietetic Association, Dietitians of Canada, and the American College of Sport Medicine: Nutrition and Athletic Performance, J Am Diet Assoc. 2000; 100:1543-56.

(4) FOOD AND NUTRITION BOARD, Dietary Reference Intakes Table – The Complete Set, Institute of Medicine of the National Academies, 2004 [Updated: 2005 Mar 3]. Available from: http://www.iom.edu/board.asp?id=3788.

MONITORING OF NUTRITIONAL STATUS OF OBESE WOMEN SUBMITTED TO THE DIET AND PHYSICAL ACTIVITY INTERVENTIONS

Soares, E.A., Reis, V.C., Barbosa, R.M.

Institute of Nutrition - Federal University of Rio de Janeiro - State University of Rio de Janeiro, Brazil

Obesity is an important risk factor for the main causes of morbi-mortality and incapacitation in Brazil1. It is showing a progressive increase of its prevalence2. Many studies point out to a perceivable improvement in the nutritional status of obeses submitted to the diet intervention, being more notable when it is coming associated with the regular physical activity3. The objective of this study was to monitor the nutritional status of 16 sedentary obese women, aged 37 to 65 years and with Body Mass Index (BMI) from 30 to 45 kg/m2, submitted to the diet and physical activity interventions concomitantly, during the period of 20 weeks. The data at the initial moment of the research was collected by a convinience sample. It was realized the anthropometric assessment using measurements about body mass, height, triciptal skinfold thickness and waist, hip and arm circunferences. The BMI, the waist to hip ratio and the arm muscular área were evaluated. The biochemical assessment was obtained by the serum lipids profile, fasting glycemia, insulin and free fatty acids levels in the blood and the dietetic assessment was realized through the food history of each participant for comparison with the Brazilian Food Guide Pyramid4. The "t" Student test was used to verify statistical significance over two moments considering the significance level 5%. It

could be observed that the obese women showed modest reduction of body weight and not significant improvements in the others anthropometric parameters. There was a trend of improvement in the serum lipids profile, despite the results not had been significant. As the dietary assessment, there was an increased habitual ingestion of legumes, meats, fats and sugars, and reduced of vegetables, fruits and dairy foods consumption at the initial moment, and after the intervention, an increase in the consumption of fruits and vegetables, beyond a reduction in the consumption of total fat, with significant differences (p<0,05). In conclusion, the program and the nutritional education proposal resulted in effective improvements in the obeses food habits.

References:

1 Monteiro CA, Conde WL. Tendência secular da obesidade segundo estratos sociais: nordeste e sudeste do Brasil 1975-1989-1997. Arq Bras End Metabol 1999; 43(3):186-94.

2 Sichieri R, Silva NN. Metodologia da pesquisa nutrição e saúde no município do Rio de Janeiro. Epidemiologia da Obesidade. Rio de Janeiro: Eduerj; 1998.

3 Harper A, Peterson M. Viewpoint weight loss strategies: a change of focus is required. Obes Rev 2004; 4(4):239 – 40.

4 Philippi ST, Latterza AR, Cruz ATR, Ribeiro LC. Pirâmide alimentar adaptada: guia para escolha dos alimentos. Rev Nutr 1999; 12(1): 65 - 80.

THE EFFECT OF SKIPPING A BREAKFAST ON BLOOD GLUCOSE LEVELS AND PERFORMANCE OF SWIMMERS

Soultanakis, H., Giatsiou, V., Afendra, E., Platanou, T.

Faculty of Physical Education and Sport Sciences, University of Athens, Greece, Greece

Fasting of different durations prior to exercise affects performance (Dohm et al., 1986; Zinker et al., 1990). So far, no studies have focused on the effect of an overnight fast on swimming performance. The purpose of this study was to determine the extend to which a 12-hour overnight fast can affect endurance, as determined by best swimming performance time of a 2000 meter swim trial, with (+Br) or without breakfast (-Br). Eight healthy male swimmers with a mean age of 21.4±1.9 years participated in this study. Under the +Br condition, all swimmers consumed the same breakfast, containing 690 calories, 110 gr of carbohydrate and 21.8 gr of protein. One day prior to both performance tests, all swimmers consumed balanced daily meals containing a total of 3045 calories (429 gr carbohydrate, 143 gr protein, 84.4 gr fat) under both conditions. Prior and post swimming, blood glucose, blood lactate and heart rates were monitored with or without the consumption of breakfast. Breakfast of the +Br trial, was consumed 120 minutes prior to swimming and a cross-randomized design was followed in terms of whether the swimmers performed the fed or the fasted trial first. Blood glucose, blood lactate and heart rates, didn't demonstrate any significant changes under the two different conditions and blood glucose never dropped to hypoglycemic levels at any condition prior or post the swim trials. Resting blood glucose level of the +Br trial was 94.75±11.8 mg/dl, while resting blood glucose level of the –Br trial was 86.5±6.2 mg/dl. Differences in performance time were observed by using a paired-t test with dependent measures. Mean performance time of the +Br trial was 26:05.28±2:53.23 min/sec, and significantly lower than the –Br trial which was 26:53.28±3:14.19 min/sec after an overnight fast (p≤0.01). The difference between the two 2000 meter trials was of a magnitude of 48 seconds. The maintenance of glucose homeostasis under short or even longer periods of fasting has been repeatedly demonstrated and is probably a result of increased gluconeogenesis and decreased utilisation of glucose in the muscle. However, this is not without a cost since the shift of metabolism caused by even an overnight 12-hour fast leads to decrements of swimming performance as also evidenced in our study.

1. Dohm GL, Beeker RT, Israel RG, Tapscott EB. (1986). Metabolic responses to exercise after fasting. J.Appl.Physiol,61(4):1363-8.

2. Zinker BA, Britz K, Brooks GA. (1990). Effects of a 36-hour fast on human endurance and substrate utilisation. J.Appl.Physiol, 69 (5):1849-55.

EVALUATION OF ENERGY BALANCE AND NUTRITIONAL STATUS OF ARTISTIC GYMNASTS

Azevedo, B.A., Melo, C.M., Miyamoto, M.V., Ribeiro, S.M.

São Judas Tadeu University, Brazil

BACKGROUND: The intense training and inadequate food habits can cause deleterious effect in the nutritional status and consequently in the health of artistic gymnasts. OBJECTIVES: to evaluate some aspects of the nutritional status and the energy balance in girls practicing artistic gymnastic. CASUISTIC: 14 artistic gymnasts, between 9 and 14 years old, pre-menarche, from a Olympic Training Center of São Paulo- SP- Brazil. EVALUATED PARAMETERS: energy ingestion by 3 food diary, calculated from the NUTRI/UNIFESP software; body composition from bioelectric impedance (Biodinamics 450E®); weight, stature and BMI (body mass index), classified according WHO; resting energy expenditure from indirect calorimetry (VO2000, Imbrasport®), and from the Weir equation. The resting energy expenditure was transformed into daily energy expenditure multiplying the rest value by 1,82 (very intense activity level, WHO). RESULTS: from the stature/age index, 21.4% of the girls was below 3th percentile and 14.3% between the percentiles 3rd and 10th. From BMI/age index, the majority of girls (85,71%) was classified into the normality, but close to lower limit, and 14.29% was below of 3rd percentile. The average percentage of body fat was 11,64±3,16. The energetic balance, considering difference between the energy ingestion and energy expenditure, was negative for all of them, with average value of -758,21± 292,18KCal. The girls related story of muscular fatigue, pains and intense sleep frequently. No sexual characteristics that would demonstrate the beginning of the puberty (including girls next to 14 years old), have been observed. COMMENTARIES and CONCLUSIONS: The observed inadequacy of energy ingestion seems to be reflected in the sexual maturation and anthropometric parameters. Chronically, the negative energy balance would cause bone alterations (by retardation in the menarche), immune deficiencies, and others health problems. It is advised the urgent necessity of clarification to the professionals and persons involved with these athletes.

EFFECTS OF NEGATIVE ENERGY BALANCE FROM INTENSE TRAINING AND FOOD RESTRICTION ON BODY COMPOSITION PARAMETERS AND LEPTIN LEVEL IN FEMALE RATS

Silva, R.J., Santos, Z.A., Gonçalves, P.M., Ribeiro, S.M.

São Judas Tadeu University, Brazil

Background: the negative energy balance could cause body composition alterations that would be harmful to reproductive and locomotor systems. Objective: to evaluate the effect of negative energy balance from intense training and food restriction on body composition of

rats. Methods: wistar female rats, two months old, had been divided in 4 groups in accordance with the physical training and food restriction: RT (trained with food restriction), FT (trained and ad libitum fed), RS. (sedentary with food restriction), FS (sedentary and ad libitum fed). The physical training was carried out through a treadmill, two times/day with one hour sessions, during 8 weeks. 50% food restriction was applied on the ingestion of the fed group. The diet of fed groups was in accordance with AIN-93. Parameters evaluated: body weight variation (BWV), weight of brown adipose tissue (BAT), weight of perirenal adipose tissue (PAT), chemical analysis of the body composition and blood leptin level. Data analysis: ANOVA and Tuckey pos-hoc test have been used. Results: food restriction seems to have exerted higher influence than training in the reduction of the body weight, on the subcutaneous and visceral fat, and on the leptin levels. The values for each variable are: leptin (ng/dL): RT= 0,44± 0,43; FT= 3,77± 1,02, RS = 0,64± 0,37; FS = 4,40± 1,31 ($p<0,05$); BWV (g): RT = -45,72± 18,44, FT= 47,57 ±12,96, RS = -43,73± 16,40, FS = 43,53± 9,72 ($p<0,05$); BAT (g): RT = 0,38± 0,12, FT= 0,67± 0,32, RS = 0,26± 0,08, FS = 0,35±0,11 ($p<0,05$); PAT (g): RT = 0,17± 0,24, FT= 11,13 ±3,58, RS = 0,42±0,31, FS = 12,17±1,40 ($p<0,05$); % subcutaneous fat (%): RT = 2,80±1,37, FT= 11,57±2,34, RS = 4,30±1,77, FS = 13,06±2,20 ($p<0,05$). Conclusion: the food restriction, and therefore negative energy balance, significantly modified the parameters of body weight variation in female rats. This can represent risks to bone integrity and reproductive system.

RESTING ENERGY EXPENDITURE AND EPOC (EXCESS POS-EXERCISE OXIGEN CONSUMPTION): COMPARISON BETWEEN RESISTANCE EXERCISE TRAINED AND NON-TRAINED INDIVIDUALS

Rocca, S.M., Melo, C.M., Urasaki, R., Ribeiro, S.M.

São Judas Tadeu University, Brazil

Background: the energetic expenditure, in resting or in exercise, depends on many factors, including degree of training, body composition and exercise type. Objectives: (1) to compare resting energy expenditure (REE) between subjects trained (T) or non-trained (NT) submitted to a resistance training session; (2) to compare the EPOC (excess pos-exercise oxygen consumption) derived from a resistance exercise session in these subjects; (3) to compare the REE from indirect calorimetry with predictive equations from WHO (World Health Organization). Casuistic and methods: 10 men, 20 to 30 years old, BMI between 20 and 29Kg/m2, divided in two groups: 5 resistance exercise trained (T) and 5 non- trained (NT). Body composition was analyzed from bioelectric impedance (Biodinamics 450e®). The experimental protocol had carried through a resistance training session per 40 minutes, involving large muscular groups. The oxygen consumption (indirect calorimetry) was measured by metabolic analyzer VO2000®. The gas collection had been carried through 15 minutes interval, in the following instants: resting (R), before the exercise session (BE), immediately after the exercise (IA), 2h after (2h) and 4h after (4h). The t-student test and Pearson correlation coefficient were applied to compare the groups. Results: resting oxygen consumption from NT and T were 2.27+-0.77 and 2.69+-0.24 mL.kg.min, respectively. Immediately after the exercise, 2h after and 4h after, the values of the consumption of oxygen from NT were 2.92+-0.70; 2.28+-0.41 and 2.05+-0.31 mL.kg.min-1, and from T were 2.92+-0.40; 2.20+-0.49 and 2.38+-0.23 mL.kg.min-1. The predicted energetic expenditure was significantly higher than measured ($p<0,05$) in both groups. The lean mass correlated positively with the predicted resting energy expenditure in both groups ($p<0,05$). Conclusions: it can be concluded that the intensity of the exercise considered in the present study, was not enough to cause to significant differences between oxygen consumption from trained and non-trained individuals, at rest or pos-exercise.

DETERMINATION OF METABOLIC TRANSITION BY LACTATE MINIMUM TEST IN PROTEIN MALNOURISHED RATS DURING SWIMMING EXERCISE

de Mello, M.A., Voltarelli, F., Eliete Luciano

Sao Paulo State University, Brazil

Introduction: Protein malnutrition is a public health problem which affects grate part of world population, mainly in the developing countries. In Brazil, even in regions with high per capita income, there is a significative incidence of malnutrition (6%). In regions with low per capita income, the rates of malnutrition are even worse: 17% of population with under five years of age is malnourished. There is little information in the literature on the biochemical ability of malnourished organisms to perform physical exercise. Purpose: The present study aimed to determine the aerobic/anaerobic metabolic transition (MT) by lactate minimum test (LMT), adapted to rat condition in swimming exercise, in sedentary animals submitted to protein malnutrition. Methods: Male wistar rats were separated into two groups, according to the dietary protein level: Control (C),17% protein from 30 to 150 days old (n=10) and Malnourished (M), 6% protein from 30 to 150 days old (n=10). To demonstrate the efficiency of the low protein diet in inducing malnutrition we evaluated: a) blood albumin and total protein concentrations; b) liver lipids concentrations and c) body weight and length. For determination of the MT we used the LMT adapted to rat condition. Paired student t test was used to indicate statistical differences between groups ($p<0.05$). Results: The M rats showed hypoalbuminemia (3.8±0.4g/dL), hypoproteinemia (4.5±0.3g/dL); fatty liver (12.0±1.2mg/100mg); low body weight gain (222.9±53.3g) and low body length gain (7.3±0.9cm) when compared to C Group (albuminemia: 7.4±0.4g/dL; proteinemia: 7.5±0.2g/dL; liver lipids concentration: 4.4±0.5mg/100mg; body weight gain: 435.7±31.4g and body length gain: 11.8±0.8cm). M rats showed blood lactate concentration at MT (4.2±0.4mmol/L) lower in relation to C animals (6.2±0.1mmol/L), at the same exercise workload (C=4,9±0,3 e M=4,9±0,2% of body weight). Conclusions: The low protein diet used in the present study showed be efficient in inducing malnutrition. The lower values of blood lactate concentration presented by malnourished rats in relation to control animals, at the same exercise workload, suggest that protein restriction alters the kinetic of lactate during swimming exercise. Further studies are required in order to identify the factors involved in the blood lactate concentration decrease during swimming exercise performed by malnourished rats.

Supported by: CNPq, CAPES and Fapesp.

Poster presentation (PP)

PP3-09 Motor Learning 1/1 - "Exhibition Hall"

REDUCED STEREO VISION HAMPERS LEARNING IN ONE-HANDED CATCHING

Mazyn, L.I., Lenoir, M., Montagne, G., Delaey, C., Savelsbergh, G.J.

Ghent University , Belgium

While the mechanisms of stereopsis are well known today (Collewijn & Erkelens, 1990), its functional significance has, quite surprisingly, been given much less attention. With regard to traffic behaviour, Bauer et al. (2000) found that, in situations of limited car velocities and/or liberal time constraints, a lack of stereo vision was not detrimental to drivers' performance. Several other studies did not find adverse effects of a diminished stereo vision on the quality of life in general (Kuang et al., 2005). However, Mazyn et al. (2004) established that people with a congenital or early-onset lack of stereopsis do suffer from their visual restriction in a one-handed ball catching task, especially when temporal constraints are involved. The aim of this study was to investigate to what extent a lack of stereo vision interferes with the learning of a natural interception task. If stereopsis entails essential information for accurate catching performance that cannot be substituted by other informational cues, it is expected that catchers with low stereo vision will only make a limited, if any, progress during the learning period.

Poor catchers with good (N = 8; Stereo+) and weak (N = 6; Stereo−) stereo vision participated in an intensive training program spread over two weeks, during which they caught over 1400 tennis balls in a pre-post-retention design. A significant group x time interaction (F4,40 = 9.112, p < .001) indicated that while the Stereo+ group improved from 13% to 70% successful catches, catchers in the Stereo− group did not significantly improve (from 10% to 30%), this progress being indifferent from a control group (N = 9) that did not receive any training.

These results show that the compensatory strategies that people without stereo vision might have developed during their lifetime may not be sufficient to successfully deal with interceptive tasks under temporal constraints, not even by task-specific or extensive training. This finding is of particular interest for people that participate in ball sports or traffic situations (truck, bus or taxi drivers), who should be aware of their limited depth perception in situations where only small time windows are available for reacting adequately to external events.

Bauer, A., Kolling, G., Dietz, K., Zrenner, E., & Scheifer, U. (2000). Are Squinters second-class motorists? Influence of stereoscopic disparity on driving performance. Klinische Monatsblätter für Augenheilkunde, 217, 183-189.

Collewijn, H., & Erkelens, C.J. (1990). Binocular eye movements and the perception of depth. In E. Kowler (Ed.), Eye movements and their role in visual and cognitive processes (pp. 213-261). Amsterdam: Elsevier Science.

Kuang, T.M., Hsu, W.M., Chou, C.K., Tsai, S.Y., & Chou, P. (2005). Impact of stereopsis on quality of life. Eye, 19, 540-545.

Mazyn, L., Lenoir, M., Montagne, G., & Savelsbergh, G.J.P. (2004). The contribution of stereo vision to one-handed catching. Experimental Brain Research, 157, 383-390.

SELF-CONTROLLED PRACTICE OF DECISION-MAKING SKILLS

Bund, A., Memmert, D.

University of Darmstadt, University of Heidelberg, Germany

Self-controlled practice of decision-making skills

Introduction

For a considerable time now, psychological research has concerned itself with the effects of self-initiated and self-controlled practice conditions. Numerous studies exist in the field of sport which analyze the influence that self-controlled activities have on the acquisition of motor skills (cf. Chiviacowsky & Wulf, 2005). Findings consistently show that giving learners control over the practice situation has a beneficial effect on the learning of motor skills. However, this effect occurs with a delay. Self-controlled practice conditions have not yet been used for the study of decision-making processes and of the com-parision between experts and novice performers. The main aim of this study was to investigate a self-controlled learning process with regard to the acquisition and improvement of simple, cognitive decision-making skills within the scope of the expert-novice paradigm.

Method

56 participants were allocated randomly to one of four groups. All subjects were given a three-minute period to get familiar with the game of tic-tac-toe. (4x4 fields, 3 fields per column, row/diagonal wins). The game was computer-programmed and presented on a PC. They were allowed five seconds per move, which was shown on the monitor. 28 participants (=experts) practiced the game in an acquisition phase (8 blocks of 20 games). Afterwards, 14 participants of this experts (Exp-Self) and 14 novices (Nov-Self) practiced tic-tac-toe in the treatment phase (8 blocks of 20 games) in a self-paced schedule. This means that the subjects had the op-portunity to reflect on solution strategies after each game as long as they wanted. Participants in both joked groups (Exp-Jok, Nov-Jok) had no control over the practice schedule. Each was yoked to a participant in the self-control group with the identical temporal structure. The dependent variables assessed with the tic-tac-toe test was game success (win, draw, lose) and mean decision-making time in a pre- and posttest (1 block of 20 games) as well as in tests of retention and transfer (each with 2 blocks of 20 games) one week later.

Results and discussion

Both expert groups improved their performance in their acquisition phase significantly, F(7, 364) = 3.78; p < .001; ε = 0.46, and , F(7, 364) = 3.21; p < .001; ε = 0.44. Therefore, significant differences were found between experts and novices at the beginning of the treatment phase, F(1, 54) = 4.12; p < .001; ε = 0.78, and F(1, 54) = 4.82; p < .001; ε = 0.81. First preliminary results revealed significant improvements for game success and mean decision-making time from the pretest to the posttest. The final results of the retentions test and the transfer test could not presented untill the ECSS conference.

References

Chiviacowsky, S., & Wulf, G. (2002). Self-controlled feedback is effective if it is based on the learner's performance. Research Quarterly for Exercise and Sport, 76, 42–48.

MOTOR RECOVERY AFTER ACL RECONSTRUCTION: COGNITIVE AND VISUAL CONTROL OF BALANCE

Reininga, I., Lemmink, K., Mulder, T., Diercks, R., Stevens, M.

University Medical Center Groningen, University of Groningen, Netherlands

Rupture of the anterior cruciate ligament (ACL) is a common sports injury. After an ACL rupture the proprioception is reduced. Despite reconstruction of the ACL the proprioception remains decreased. During rehabilitation, motor programs adapt to the altered proprioceptive information through motor learning. Cognitive and visual control of movement are used in this learning process. Completion of the learning process can be read from the decrease in dependency on cognitive and visual control. To gain insight into this process, a balance test is developed that determines the progress in the learning process. The preliminary results are presented here.

Dependency on cognitive and visual control of balance can be measured by adding an attention-demanding task and restricting vision while performing a balance task. The decrease in postural control is a measure of the dependency on cognitive and visual control. The developed balance test consists of one-leg stance on a force platform with and without an attention-demanding task and restricted vision. The balance test is conducted in 6 patients, 1 and 3 months after ACL reconstruction. Control data were obtained from 37 healthy subjects.

In optimal condition (e.g. without an attention-demanding task and restricted vision), postural control of patients 1 and 3 months postoperative was comparable with the postural control of healthy controls. In case of one-leg stance with an attention-demanding task, patients performed worse than controls 1 month after reconstruction. Besides, the attentional demands of postural control seem to decrease over the period of rehabilitation; patients performed better at 3 months. With restricted vision, 1 month postoperative, 3 patients were not able to maintain one-leg standing balance without making touchdowns with the nonsupporting leg. Apparently the dependency on visual information was too high in this stage of rehabilitation to maintain one-leg standing balance. At 3 months postoperative, more patients were able to perform the balance test with restricted vision, indicating a decrease in dependency on visual control of balance in course of rehabilitation.

It can be concluded that the dependency on cognitive and visual control of balance after ACL reconstruction can be measured by means of the balance test. The dependency diminishes in course of rehabilitation, indicating a completion of the learning process in which the motor programs adapt to the altered proprioceptive information from the knee. In addition, the dependency on cognitive and visual control of balance increased for the patient's healthy and operated leg during the early stages of rehabilitation. This bilateral increase in dependency on cognitive and visual control of balance support the hypothesis that, after ACL reconstruction, motor programs for postural control have to be reorganized in accordance with the altered proprioceptive input from the knee.

EXAMINE THE LEARNING CURVE OF COMPLEX MOTOR SKILL

Chen, H.H.

National Taitung University, Taiwan

The purpose of this study was to investigate the behavior of learning the complex motor skill by examining the structure of multi-time scales of motor learning curves as well as the coordination assembling of movement form. The task in this study was the cascade juggling which is common in the show for entertainment. The performer tosses one ball in the air and catch another while keep the other aloft alternatively. For most of the people, the temporal and spatial pattern of juggling is quiet different from the intrinsic coordination of bimanual that a transition of movement coordination was expected to reveal during the process of learning.

Four adults without disability of movement and the experience of juggling volunteered as the participants learned to juggle over 4 weeks of practice. Two high speed cameras (120 Hz) and the motion analysis system collected the 3D trajectory of the position of three balls and the markers attached on the joint of arms and trunk of participants. The number of ball been caught was recorded as the outcome score of performance. The temporal structure of movement was derived from the duration of hand hold the ball—Th and the duration of hand unload—Tu. The principal component analysis (PCA) for the coordinates of 3 dimensions of balls and the joints of arms and torso was operated for the spatial structure of the movement.

The results showed that all participants learned to juggle and increase the score of outcome performance. The form of curves revealed different individually and the power law fitted better for the learning curves. The temporal and spatial structure also changes over practice. The numbers of components decreased and the structure of the elements of each components change accounted for the change of coordination of movement over practice.

ENHANCING THE USEFUL FIELD OF VISION IN NON-PLAYERS THROUGH A PERCEPTUAL-MOTOR PROGRAM

Matos, R., Godinho, M.

Faculty of Human Movement Sciences, Portugal

Literature gives us several examples of better visual information processing of expert compared to novice players (Kioumourtzoglou et al., 1998), better peripheral vision of people engaged in sports compared to those who are not (Matos & Godinho, 2005) and, probably, some advantage in certain aspects of driving performance (Hancock et al., 2002).

We conceived and developed a Program of training of the Useful Field of Vision and Peripheral Reaction Time to try to verify if these parameters are trainable.

We intended to find an answer to this question to allow us to conclude if the differences we found between young female basketball players, swimmers and non-players (Matos & Godinho, 2005) were due to sportive experience or any other factor prior to the engagement of subjects in sport.

The aim of this study was to see if a group, with no significant sport or driving experience, submitted to a Perceptual-Motor Program, would score significantly better in UFOV Test ®, and also detect more quickly peripheral stimulus in the CPVRT Test - Complex Peripheral Vision Reaction Time (Godinho et al., 2005), where subjects had to press a button as soon as they detect a ball entering their field of view in any of the two slopes positioned to their left or right.

The Program of training consisted of 5 half-an-hour sessions, where the experimental group subjects (N=11, Age=20,07 SD=0,85) executed several different tasks. They were instructed to focus there gaze in a place between the two objects they had to react to, in an unpredictable sequence and timing.

RESULTS AND CONCLUSIONS: the application of this Perceptual Training Program was successful, as the experimental group improved more than the control one, specially in the UFOV test. The results of this and previous experiments emphasise the fact that exercise and

sport practice increase perceptual skills that may be transferable for other tasks, that share some of these perceptual features, namely driving.

REFERENCES

Godinho, M., Lopes, V. & Matos, R.. (2005). Peripheral vision after 65. In FMH (ed.), Active Lifestyles: The Impact of Education and Sport, Book of Abstracts of AIESEP 2005 World Conference, pp. 13.

Hancock, P., Kane, M., Scallen, S. and Albinson, C. (2002), 'Effects of gender and athletic participation on driving capability', International Journal of Occupational Saf Ergon., 8(2), 281-292.

Kioumourtzoglou, E., Kourtessis, T., Michalopoulou, M., and Derri, V. (1998), 'Differences in several perceptual abilities between experts and novices in basketball, volleyball and water-polo', Perceptual and Motor Skills, 86(3 Pt 1), 899-912.

Matos, R., & Godinho, M. (2005). Influence of Sports Practice in the Useful Field of Vision in a Simulated Driving Test. In FMH (ed.), Active Lifestyles: The Impact of Education and Sport, Book of Abstracts of AIESEP 2005 World Conference, pp. 262.

ANALYSIS OF VISUAL BEHAVIOR OF KOREAN BADMINTON PLAYERS FOR ENHANCEMENT OF ANTICIPATION ABILITY IN SINGLE´S MATCH

Gu, H.-M., Lee, S.C., Lee, S.M.

Korea Institute of Sport Science, Korea, South

The purpose of this study was to analyse visual behavior of korean badminton players for enhancement of anticipation ability in single's match. As subjects 10 male and 9 female players were participated in the experiment executed in real situation. In the experiment each subject tried to anticipate the direction of a shuttle and respond as good as possible over 36 times to a returned shuttle, and 4 normal(30Hz/s) video cameras(one for the movement of subject serving a shuttle and responding to a returned shuttle, one for the movement of player hitting a served shuttle, two from eye-mark recorder of subject) were used for analysing visual behavior and responding movement. These 4 videos from each video camera were synchronized and formed to a video by a device developed especially for this purpose. From analyzing frame by frame of this video, events like impact of a shuttle, response impact by a subject, begin of response were define, and dependent variables like reaction time of racket or knee and response time from impact of a shuttle by other player to a response impact by a subject were calculated and compared with each groups.

As results, subjects showed extra rapid response time, especially about 0.5 seconds(15 frames) to a smash. But there ware significant differences in response time to a smash between top-ranked players and not-top-ranked players and between successful responses and unsuccessful responses. And each subject showed his typical pattern of visual behavior, but all patterns were not appropriate to a good anticipation of a shuttle direction and a rapid response. A proper pattern of visual behavior recommended by experts was a shuttle-player's body-impact zone.

From results above it was concluded that for a good anticipation and good response every badminton player has to find out and correct his pattern of visual behavior to a proper pattern, if needed. And a proper visual perception training must be developed for enhancing anticipation ability to search proper informations in proper time.

CONTRIBUTIONS OF VISION-PROPRIOCEPTION INTERACTION TO THE POSITION ESTIMATES OF A MOVING HAND AND TARGET

Tanaka, H. 1, Worringham, C. 2, Kerr, G.K. 2

1 Tokyo University of Agriculture and Technology, 2 Queensland University of Technology, Japan

Motor tasks to manually intercept or track a moving target require estimates of both target and hand positions. In most cases, interceptions of a moving target are very accurate as compared to purely visual extrapolation of the target movement (Zago and Lacquaniti, 2005). This observation leads us to hypothesize that using only visual information may produce inaccurate estimates of target location. The present study investigated the relative importance of visual and proprioceptive signals in estimating the target locations in a dynamic environment.

Eighteen subjects performed a position estimation task in which a target travelled horizontally on a screen at a constant velocity and then disappeared from view. They were asked to estimate the target's invisible positions in two manners: passively observing or manually tracking. In the tracking trials, the visual feedback of a cursor representing the hand position was 1) always visible, 2) disappeared simultaneously with the target disappearance, and 3) always invisible. For both tasks subjects were required to verbally report the position of the "invisible" target at the time of a stimulus tone according to a scale displayed on the screen. Of interest was whether proprioceptively derived information could be used to improve the accuracy of visual estimates of the dynamic target positions, and how accurately the dynamic hand position was estimated with each of the vision and proprioception conditions.

Sensorimotor signals during manual tracking affected the performance in the visual estimation of target location. In the passive observing trials, target's invisible displacements were systematically underestimated. In the manual tracking trials, if vision of the cursor was given, the extent of the underestimation appeared to decrease. Continuous display of the cursor produced very accurate estimates of the target's invisible displacements, as if the subjects were seeing the target.

No vision of the cursor significantly increased tracking errors and this effect was magnified by the target disappearance. When vision of the cursor was presented, tracking errors became much smaller. Importantly, tracking errors were not influenced by removal of the cursor in the following interval after the target disappearance.

These results suggest that vision-proprioception interaction is critical for accurately representing the target-hand relationship in extrapersonal space. As long as the target-hand spatial relationship is accurately represented in the brain, it is efficiently updated using proprioceptively derived kinematic information. Such an online sensorimotor representation of hand kinematics would not only produce accurate estimates of the hand position, but also subserve a function in predicting the target position in the world.

References

Zago, M. and Lacquaniti, F., Cognitive, perceptual and action oriented representations of falling objects, Neuropsychologia, 43 (2005) 178-188.

CHANGES IN BODY COORDINATION IN CHILDREN FORM AZORES ISLANDS. A 3 YEARS LONGITUDINAL STUDY

Lopes, V.P., Ribeiro Maia, J.A.

School of Education, Polytechnic Institute of Bragança, Portugal

The purpose of this study was: (1) to analyse longitudinally the changes in body coordination (BC) in children during 3 years (6 to a 9 years old); and to analyse the stability of BC. Sample size comprises 142 girls (6,37±0,31 years old at the first evaluation and 8,42±0,35 at the third), and 143 boys (6,44±0,29 years old at the first evaluation and 8,34±0,39 at the third). BC was evaluated according to the body coordination test battery (KörperkoordinationsTest für Kinder) developed by Kiphard and Schilling (1974). The battery comprises four tests: backward balance (BB), jumping sideways (JS), hopping on one leg (HL), and shifting platforms (SP), from the 4 tests it is obtain a motor quotient (MQ) that permit the classification of children BC. A mixed ANOVA was used to analyze the changes along the 3 years and the differences between boys and girls. Intra-class correlation coefficient was used to analyze the stability in the all items test battery. In both boys and girls and in all items of test battery there were significant increases during the 3 years. In MQ the results show a linear increase in girls and no significant changes in boys. The BC level was higher in boys than in girls at all 3 evaluations, although in both boys and girls the level was low. It was found moderate (0.50) to strong (0.80) stability in both boys and girls. In summary: (1) boys had a higher BC level than girls; there were a linear increase in MQ in girls. BC shows moderate to strong stability.

Kiphard, E. J.; Schilling, F. (1974). Korper-koordinations-test fur kinder ktk. Weiheim: Beltz Test.

INVESTIGATION OF FORCE CONTROL IN ADOLESCENT SOCCER PLAYERS

Karsai, I., Soós, I., Téczely, T.

University of Pécs, Hungary, University of Sunderland, UK, Hungary

Objectives: The aim of our study is to examine the feature of the force control ability and the awareness of the force exertion of young soccer players. Kicking and stopping the ball precisely requires a high level of force control of the motor system, which coordinates the movement of the lower limb. According to my hypothesis, the football players should present high level of accuracy and consistency in each measured parameters and they are able to express their performance in values. To investigate the perception -action circle and proof the hypothesis I used an isometric test. This test provides insight into the development and function of a part of the motor system which can play important role in the performance during the games.

Methods: The subjects were 13 soccer players (male), age: 14.1 ±0.55 y., weight: 55.2 ±11.55 kg, height: 169.0 ±11.14 cm. They attend training six days of the week and participate in the championship of the regional soccer association. After completing written consent, according the Ethical Committee of the University of Pécs, the participants exerted isometric force with the knee extensor muscles on a force measure device to learn how to execute the target force. The target force was given at 100 N. The duration of the familiarisation process was 30 sec., the actual magnitude of the force exertion was displayed, the participants sat in upright position, and knee angle was set at 90 °. After 5 minutes resting period they attempted to reproduce the target force without visual feedback from the magnitude of the exertion, and they repeated it in the same condition two times thereafter. They were also asked to estimate their actual achievement after each exertion. The magnitude of the execution was recorded using electronic force measure equipment at 33.3 Hz. The participants were asked to give voice sign when they felt to reach the target force level to stop the experiment. From the row data the constant error (CE) and the estimation error (EE) were computed. To test the hypothesis the Pearson's Correlations Coefficient was applied using SPSS 13 software.

Results: The result of the first trial 103.1 ±42.9N was the closest value to the target among the three attempts (2.trial 116.0 ±48.7N and 3.trial 109.3 ±46.6N). The 2.trial showed the largest positive deflection in the performance despite of the fact that they estimated their achievement higher than the target after the 1.trial (est. after 1. trial 102.9 ±6.3N). The estimation is in accordance with the expected trend after the 3.attempt but not with the real target value (est. after 3. trial102.3 ±42.9N) Relating the computed values the CE and the EE showed significant association r=0,992 n=13 p<0.001.

Conclusion: This result suggests that the noise in the performance arises from the not clearly defined nature of the stored information and from the competition between the automatic and conscious regulatory system.

SUBTLE MEMORY AND DYNAMIC ATTENTION DURING TWO TASKS OF COGHEALTH PROGRAM OF SHOOL CHILDREN

Nagata, A., Tajima, T.

Toyama International Research Center for Traditional Medicine, Japan

Introduction: This study was designed to evaluate with the cognitive performance of the school child and with the higher brain neurological system of human, quantitatively. We adopted CogHealth soft-program as this task of this experiment. Another object is to propose the evaluating function with the mild cognitive impairment of aging. Method: Twenty-six healthy adults (average age: 37.1yrs, AG) and fifteen children subjects (average age: 8.1yrs, CG) were employed to this study. Two tasks of the playing-card games of CogHealth were displayed on the CRO of PC. The first game is asked to determine whether a single pair of cards presented on the display was the same. If they were the same, subjects press the "K" yes key (memory M task). The second game are require to press the key as fast as possible whenever anyone of five cards may touch to two lines at the top- and bottom at the CRO (dynamic D task). These tasks require a rapid response correctly and to operate pushing the key on the random series of thirty cards. Those data of response times were processed to obtain estimating variables of their reaction velocity, the frequency rhythm, their mental fatigue, their integrated cognition and their subtle memory with using the time series analysis of the computer soft program (MEMCalc). Trajectory Charts and Power Spectrum of their reaction time were processed to get the motion (F), the locus-distance (LD), the gradient(β) and the total power spectrum (TPS). Furthermore these demographic and psychometric parameters were evaluated to compare with the aging and with one way of ANOVA, statistically. Results: As resulting of these processing variables, total reaction times of AG and (CG) were observed at average 475msec(846msec of pupils) of M task, and 438msec(730msec) of D task, individually. The subtle memory and the dynamic attention of CG showed inferior to those of AG ($p<0.05$). At the case of D task, parameters of F and LD appeared significant difference between two groups, and two values of β and TPS were obtained to average –4.4(-7.4) gradient, and 0.2mV・Hz(0.7) area, significantly($p<0.05$). Discussion/Conclusion: There have been appeared a developmental delay of the higher brain neurological system, and of a psychometric association with aging about CG. Data of the task rhythm (F), the short-term memory (β), the mental fatigue (TPS), and the psycho-saturation(LD) might display to evaluate with a cognition level related to aging quantitatively. These results seem to indicate that those variables should help to indicate the demented attitude and the attentive levels related to the calendar aging and the

activity habits in their life Then, we concluded that CogHealth program should be applied for human to be diagnosed an action of the cognition in the psychotherapy field.

Reference : Darby, D. P. Maruff, A. Collie, M. McStephen, Mild cognitive impairment can be detected by multiple assessments in a single day. J. Neurology 59:1042-1046, 2002.

Poster presentation (PP)

PP3-10 General I (Physioth./Rehab./Traumat.) 1-2 - "Exhibition Hall"

THE EFFECT OF MASSAGE ON SOME OF FUNCTIONAL INDICATORS OF DELAYED ONSET MUSCLE SORENESS (DOMS)

Moradi, L., Tarverdizadeh, B., Behpour, N.

Islamic Azad University, Iran

Introduction: Delayed onset muscle soreness not only affects daily life of sedentary peoples but also is detrimental to athlete's competition or training participation. Various researches have reviewed different methods in treatment of DOMS's sign and consequences which their findings are conflicting and confusing. For example, "Megan et all" (2003) showed that massage has not significant effect on pain induced by DOMS but"Hilbert et al" (2003) demonstrate massage as a proper treatment for DOMS. With respect of the necessity of finding an appropriate, safe and fast treatment method for recovery and reparticipation of athletes in athletic events, this research has studied massage effect in DOMS treatment.

Methods and subjects: 20 female physical education students participated voluntarily in this study. In day 1 and in order to DOMS inducing, all of the subjects performed specific eccentric training for non dominant upper arm flexor muscles. In day 2, subjects divided randomly to two homogenous experimental (treated with massage) and control groups. Before, 24 and 48 hours after eccentric training in control group, and before and after massage treatment in experimental group, functional indicators of DOMS including perceived pain, elbow joint's flexion and extension range of motion, resting angle of elbow joint and arm circumference evaluated in two groups.

Findings: Eccentric training significantly induces DOMS. Massage has significant effects on signs and symptoms of DOMS and significantly reduces pain, increase flexion's ROM, and decrease resting angle and circumference of elbow.

Discussion: Massage, by stimulation of free endings of nerves, may reduce pain and spasm induced by DOMS and thereby, may increase ROM of elbow joint and decrease resting angle of elbow. On the other hand massage can increase circulation of blood and lymph and reduce inflammation and swelling.

THE EFFECT OF TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION (TENS) ON SOME OF FUNCTIONAL INDICATORS OF DELAYED ONSET MUSCLE SORENESS (DOMS)

Moradi, L., Tarverdizadeh, B., Behpour, N.

Islamic Azad University, Iran

Preface: Delayed onset muscle soreness not only affects daily life of sedentary peoples but also is detrimental for athlete's competition or training participation. Various researches have reviewed different methods in treatment of DOMS's sign and consequences which their findings are conflicting and confusing. With respect of the necessity of finding an appropriate , safe and fast treatment method for recovery and reparticipation of athletes in athletic events, this research has studied TENS effect in DOMS treatment.

Method and subjects: among the physical education students of Islamic Azad university central Tehran branch, 20 subjects participated voluntarily in this study. In day 1 and in order to DOMS inducing, all of the subjects performed specific eccentric training for nondominant upper arm flexor muscles. In day 2, subjects divided randomly to experimental (whose treated with TENS) and control groups. 24 and 48 hours after eccentric training , before and after TENS treatment, functional indicators of DOMS including perceived pain, elbow joint's flexion and extension range of motion, resting angle of elbow joint and arm circumference evaluated in two groups.

Findings: TENS, by inhibition of pain in presinaptic level of spinal cord's posterior horn or by endorphin secretion, may reduce pain induced from muscle fibers damage and predictable inflammation and swelling of muscle and thereby increasing elbow joint range of motion. With pain reduction and breakage of pain-spasm cycle in biceps muscle, as an antagonist to triceps, elbow joint's extension range of motion increased. Resting angle of elbow joint also decreased as pain and spasm of muscles decreased. Spasm reduction, circulation elevation, and inflammation reduction in muscle, which reported after electrical stimulation, accounted for arm circumference reduction.

MULTI-PURPOSE CYCLE ERGOMETER DEVICE

Netreba, A., Popov, D., Borovik, A., Vinogradova, O.

SSC RF Institute of Biomedical Problems RAS, Russia

Accurate assignment of physical load is an essential task of athletic training. Traditionally velocity of contraction is evaluated when working with free loads and force of contraction is determined in speed controlled devices. Worked out by our group multi-purpose cycling ergometer allows to automatically assign both parameters in concentric and eccentric regimes. The physiological testing of the device was performed using a training procedure directed at an increase of force, power and size of main muscle groups involved in pedaling. 16 healthy physically active males gave their consent to participate in the experiment. A group of 8 subjects was trained in concentric regime and another group of 8 subjects - in eccentric regime. The training sessions took place twice a week. Training session consisted of 7 exhaustive sets (50-130 s) with 10 min resting periods between them. Before and immediately after 9 weeks training period maximal anaerobic power was determined in Wingate test, maximal voluntary contraction (MVC) was recorded in isometric regime, and the volume of quadriceps femoris muscle was estimated using the MRI data. The blood lactate concentration was used as an index of intensity of a standard training session and an activity of muscle CPK in blood as an index of damage of muscle cells. The delayed onset of muscle soreness (DOMS) was determined as well. The significant increases of force, power and size of m. quadriceps femoris were obtained as a result of training with no differences between groups. However eccentric training turned out to be more efficient: the blood lactate increase after eccentric training session was noticeably lower than after concentric. The level of DOMS after an eccentric training at multi-purpose cycling ergometer was much lower than the effects of eccentric training described in the literature The "floating" seat of

ergometer device worked out by our group might damp down the stroke loads arising as a result of eccentric exercise. The obtained results allow supposing that the worked out training device may be used for training of disabled people.

LONG-TERM RESULTS OF FITOC (FREIBURG INTERVENTION TRIAL FOR OBESE CHILDREN)

Korsten-Reck, U., Korsten, K., Kromeyer-Hauschild, K., Bjarnason-Wehrens, B., Berg, A.

University Medical Center, University Freiburg, Germany

Hypothesis: Till now long-term results of outpatient intervention trials in childhood are rare. We examined the long-term anthropometric, leisure time and nutritional behavior data of the FITOC participants.

Methods: We included 53 adolescents (♂:24, ♀:29). The average age of the boys was 17.0 ± 3.3 years and the girls, 15.9 ± 2.8. Anthropometric data and data from questionnaires on leisure time and nutritional behaviour were summarized at the beginning, after the first control examination (after 8.7 months) and after the long-term examination more than 3 years later (6.2 ± 2.7 years). Statistics: Step by step multiple regression with backwards elimination (Exclusion criteria: p<=0.10 within a partial F-test).

Results: BMI-SDS (♂: p=0,001; ♀: p<0,001) decreased significantly after eight months of intensive therapy and physical performance increased significantly. Long-term examinations confirmed a significant decrease in BMI (♂: p=0,003; ♀: p=0,013). Between the beginning and the long-term examination, there is evidence of a significant increase in the levels of physical performance in boys (p= 0.002) but only a tendancy in girls (p= 0.065). Before taking part in the FITOC program, a third of children were inactive (31.4 %). At the long-term examination only 1.9 % had remained inactive. Nearly half of the adolescents reported (47.2 %) that they were active during more than 3 hours per week. Using multiple regression we can show that long-term BMI-SDS changes are dependent upon the mother's weight (p= 0.035) and level of physical activity (p= 0.004).

Discussion: Success after the intensive therapy phase could be stabilized long-term by a follow-up program. It seems that behavior patterns in adolescents can be established long-term by means of outpatient intervention.

MULTIPLE SCLEROSIS AND THERAPEUTIC CLIMBING: AN INTERVENTIONAL LONG TERM PILOT STUDY INDICATES BENIFICAL EFFECTS

Kern, C. 1, Bühlmeyer, K. 1, Käser, T. 1, Banik, B. 1, Eberhardt, U. 1, Kleinert, J. 2, Michna, H. 1

1Technical University Munich, 2 German Sport University Cologne, Germany

Introduction

Multiple sclerosis (MS) is a neurological disease of the central nervous system that often affects young individuals. It is characterised by various debilitating symptoms (Kesselring et al., 2005). So far most advices for patients with MS include only limited physical activity since fatigue and overexertion or activated immune cells (Peters3 et al., 1997). The aim of this study was to investigate if climbing might be an appropriate physical activity for patients with MS and has a positive effect on their mental state.

Methods

This pilot study consisted of ten patients (7 female, 3 male), with a mean age of 38 (+-6) years. Scales on the EDSS-scale ranged between 0 and 7 (mean = 3,9), mean age at diagnosis for MS was 26 years (+-6). All of the patients were interested in sports before their diagnosis, only 5 of them were actually doing sports (swimming, fitness, cross country skiing) at the beginning of the study. The study was undertaken on six 2,5h climbing sessions on consecutive Saturdays. Controlled top rope climbing and safety-standards were ensured. Questionnaires (perceived physical and psychological state, Kleinert1, 2001), scientific observation and interviews (group reflection and individual interviews) were used to detect alterations of their comfort, physical and mental condition.

Results

All participants describe an improvement of their physical and mental conditions significantly and enhanced their sense of balance and quality of life.

The perceived physical flexibility before/after increased significantly from session 3 to 6. Regarding the psychological state the same significant differences were found for the dimension self-confidence. While the fatigue in the first session was higher after climbing, it changed for the remaining 5 sessions.

Results from the observation papers, reflections and answers on the questionnaires and interviews revealed that all of the patients with MS felt "better" after climbing. The patients felt "more powerful" and "clearer in mind". Furthermore all of them reported to handle their problems of everyday life more easily. One patient stated to overcome the anxiety of altitude during the six times of climbing completely. A strengthening of self-confidence and a reduce of anxiety were registered.

Conclusions

In summary our climbing intervention improved physical and psychological functions in MS patients. Therefore, it might be appropriate to advise participation in regular exercise programs such as a climbing training. To prove long term effects we will do a follow-up-survey after a year and we are now engaged to extend the evaluation of mental and physical effects of climbing with MS-patients and incorporate further details on motor control.

References

1 Kleinert J., Liesenfeld M. in: Denken, Sprechen, Bewegen. Köln, p 283-289, 2001

2 Kesselring J., Beer S. in Lancet Neurol., 4(10), p 643-652, 2005

3 Peters C., Raabe-Oetker A.: Neurologie und Sport. Köln, p 61-90, 1997.

EFFECT OF MUSCLE ATROPHY BY FIBER TYPE IN IMMOBILIZED MOUSE SOLEUS MUSCLE

Sakamoto, M., Maehara, A., Kurita, J., Harada, T., Futami, T., Oka, K.

Kitasato University, Japan

Introduction

Skeletal muscle shows high plasticity in response to external conditions. We previously reported that immobilized soleus muscles in a shortened position forms a degenerated structure called the wave-like structure. We also reported that the wave-like structure offers a sensitive marker of morphological change induced by disuse (Oka et al. 2003). Furthermore, frequency of wave-like structures induced by

immobilization was higher in type II fibers than in type I fibers. However, changes of fiber-type distributions and relationships between wave-like structures and extent of fiber atrophy in immobilized soleus muscles remain unclear.

The present study aimed to clarify changes in fiber-type distributions in immobilized soleus muscle and the extent of muscle atrophy induced by immobilization in the shortened position in both type I and type II muscle fibers.

Methods

The soleus muscles of 5-week-old female ICR mice were used in this study. Under anesthesia, the left hind limb was immobilized at the ankle joint in maximum dorsiflexion. Cross-sections of soleus muscle were made using a cryostat for controls and after immobilization for 3, 5, 7 or 10 days. First, the distribution of fiber types in soleus muscle after immobilization was investigated. ATPase activities of the soleus muscle sections were observed using the routine ATPase methods. All fibers were classified as type I or II and numbers of fibers were counted for each type. Next, fiber cross-sectional area (CSA) of soleus muscle was investigated in each group. Measurements of muscle fiber CSA were analyzed using image-analyzing software. Results were analyzed using 1-way analysis of variance. If statistical significance was achieved ($P<0.05$), pairwise comparisons were performed using Scheffe's method.

Results

1. Fiber-type distribution

Type I and II fibers were scattered in a checkerboard distribution in each animal. No deviation of distribution was observed and numbers of each fiber type were almost equal. Distribution of type I fibers did not differ significantly between immobilization groups.

2. Fiber cross-sectional area

In controls, CSA was larger for type I fibers than for type II fibers. After immobilization, CSA for both fiber types decreased with time. However, significant differences were observed between 10-day immobilization and controls for type I fibers. In type II fibers, CSA at 5, 7 and 10 days of immobilization was significantly decreased compared with controls.

Discussion/Conclusion

In this experiment, muscle atrophy was induced in both type I and type II fibers with time. However, atrophy occurred earlier periods for type II fibers than for type I fibers. Regarding relationships between wave-like structure and muscle atrophy, muscle atrophy was delayed compared to wave-like structures. Wave-like structures were thus observed in the early stages after immobilization.

Reference

Oka K et al (2003). Health and Behavior Sciences 2: 21-26.

TIME COURSE OF CHANGES IN MUSCLE PAIN DURING TWO DIFFERENT PHYSICAL TRAINING INTERVENTIONS IN FEMALES WITH TRAPEZIUS MYALGIA

Andersen, L.L., Søgaard, K., Hansen, P.B., Andersen, C., Skovholm, K., Rosendal, L., Sjøgaard, G.

National Institute of Occupational Health , Denmark

Trapezius myalgia (TM) is frequent in women engaged with repetitive and monotonous work tasks. Previously, strength training has been shown to relieve shoulder-neck pain, however, the time course of changes in pain has not been determined in detail. Further, specific recommendations of training are to be documented. In this context it has been hypothesized that training of large muscle groups can help alleviate pain in small non-involved muscle groups due to increased blood flow and release of central humoral factors. Aim: To investigate the effect of muscle specific strength training vs. cardiovascular training with large non-affected muscles on the time course of changes in trapezius muscle pain in females with TM. Methods: 13 females clinically diagnosed with TM (45±6 yrs, 166±6 cm, 72±14 kg) were randomized into two training groups; STR (n=6) trained specific heavy-load strength training for the shoulder and neck muscles with various dumbbell exercises with 8-12 RM loads; BIC (n=7) trained with their legs on a bicycle ergometer at 70 % VO2-max while keeping their shoulders relaxed. Training in both groups was performed for 20 min 3 times/wk for 10 wks. Pain from the trapezius muscle was determined by each subject on a 100 mm visual-analog-scale (VAS) during each training session. Acute effect of training on pain: comparison of VAS immediately before and after each training session. Longitudinal effect of training: the change over time in 2 pain parameters, general and worst pain since the last training session. Results: Prior to the training intervention pain in general during the last 3 days was similar in STR and BIC (28±15 and 39±25 mm, respectively). In response to training BIC tended to decrease pain acutely (26±16 vs 22±18 mm, P=0.07), whereas no change occurred in STR (11±9 vs 12±11 mm, P=0.58). Over the 12 wks of training STR decreased pain markedly (from 28±15 to 7±12 mm VAS general; and from 40±30 to 9±11 mm VAS worst) whereas no change was observed in BIC. In STR the decrease in pain occurred linearly with the number of training sessions. Discussion: The present study demonstrated that STR and BIC can have beneficial effects on muscle pain in females with TM, but that the time course of these effects are quite different. While BIC tended to decrease pain acutely but not longitudinally, STR showed a marked decrease in pain over a prolonged period of time. Furthermore, the decrease in pain in STR was linearly related to the number of training sessions, which indicates that strength training should be performed for a prolonged time period to be effective. Thus, different mechanisms may help to alleviate muscle pain in response to STR and BIC. Speculatively, the acute effect of BIC may occur due to a general increased blood flow, elevated core temperature and/or a release of central humoral factors, whereas the longitudinal effect of STR may be related to improved microcirculation and an enhanced intramuscular biochemical milieu.

ENERGY EXPENDITURE IN YOUTH OBESITY THERAPY: WHICH EXERCISE INTERVENTION BURNS MOST?

Thiel, C., Claußnitzer, G., Vogt, L., Banzer, W.

Johann Wolfgang Goethe-University Frankfurt/Main; medinet Spessart-Klinik, Bad Orb, Germany

Objective: Physical activity (PA) plays an important role in the prevention and rehabilitation of obesity in youth. To provide an evidence base for obesity intervention programmes and their quality, efficient and enjoyable exercise modes and doses need to be identified. This study assessed amount, energy expenditure (EE) and intensity (INT) of seven different structured exercise interventions during a 4-week rehabilitation.

Methods: Individual heart rate (HR) – EE relationships were obtained in 20 adolescents without comorbidities attending inpatient obesity therapy (13.6±1.4 years, BMI 31.8±4.1 kg/m2, peak VO2 30.1±4.9 ml/(kg*min)). Representative time intervals of seven exercise therapy programmes were selected for HR monitoring. According to the flex HR method, oxygen consumption (VO2) and EE were calculated using the individual HR-VO2 regressions.

Results: Adolescents completed 7.5h of exercise therapy per week, increasing EE by a net 1,871±533 Kcal/wk and accumulating 3.5±1.1h of moderate to vigorous PA (MVPA: >40% of oxygen consumption reserve, VO2R) corresponding to 47±15% of total exercise time. EE

[KJ/kg/h] and INT [%VO2R] of walking (14.0±2.9; 29±8) differed significantly from swimming (19.9±5.9; 47±17), 65-85W cycle ergometry (19.6±3.7; 46±8), strength/stability circuit (18.9±3.7; 44±9) small group games/relays (19.0±5.4; 45±16) and team sports (20.6±7.0; 48±19) (Friedman test, $p<0.05$), but not from water games (18.0±4.4; 42±14).

Discussion: Objective assessment of exercise intensity is crucial to provide evidence for the selection of efficient therapeutic interventions in obesity therapy. Three out of four adolescents accumulated more than 150 minutes of structured therapy-induced MVPA per week, fulfilling specific guidelines for cardiovascular health in obese youth‡, and reaching the upper end of the recommended range of general ACSM energy expenditure goals by spending more than 300Kcal/day. However, the interindividual differences - 5 subjects showed an average INT of 30%VO2R or less - indicate that exercise therapy needs to be tailored even more towards individual needs to increase its efficiency. Since EE and INT showed significant differences only between walking and all other exercise modes except water games, the choice of appropriate therapy programmes should mainly be guided by adolescents' preferences to promote long-term activity behaviour change.

‡ Williams CL et al. Circulation 2002; 106(1): 143-60.

IMPROVEMENT IN PHYSICAL FUNCTIONAL ABILITY IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE AFTER COMBINED AEROBIC AND RESISTANCE TRAINING

Pereira, A. 1, Santa-Clara, H. 1, Simões, I. 2, Cabri, J. 1, Fernhall, B.

1 Faculty of Human Movement, 2 Garcia da Orta Hospital University of Illinois Urbana-Champaign, Portugal

In patients with chronic obstructive pulmonary disease (COPD) aerobic exercise training has been demonstrated to reduce the functional limitations imposed by this disease. In general, resistance-training increases muscle strength and this may be related to the improved performance of the activities of daily living and also by improving endurance and functional capacity. Objective: The purpose of this study was to assess the effectiveness of combined aerobic and resistance training exercise in physical functional ability in patients with COPD. Methods: Forty men performed combined exercise training for 10 weeks, 3 times a week. Ten patients with moderate COPD formed the experimental group (EG) (age, 66±6 yrs; weight, 81.5±9.8 kg; height, 177±5.0 cm) and 30 healthy subjects matched by age served as a control group (CG), (age, 67.5±3.5 yrs; weight, 69.3±7.7 kg; height, 164,0±0,8 cm). The aerobic exercise was set at 60-70% HR reserve for 30 minutes and the resistance exercise was performed in 5 weight machines, 2 sets of 8-12 repetitions at 50-70% of 1RM. Assessment included a Maximal Graded Exercise Test, an one repetition maximum for each resistance machine used in the exercise program and the Furllerton's functional fitness test for older adults, before and after training program. Results: The pre-values of the functional fitness test were different ($p<.05$) between EG and CG groups (30-second chair stand 13,8±1,4 vs. 17,3±2,3; arm curl 10,0±4,1 vs. 15,8±1,5; 6-minute walk 480,7±47,3 vs. 592,4±43,6; chair sit-and-reach -5,8±12,2 vs. -1,08±4,2 respectively) and no differences were observed for the back scratch test (EC, -6,5±7,8 and CG, -4,2±4,5) and for 8-foot up-and-go (EC, 4,7±0,4 and CG, 6,3±1,3). Both groups increased ($p<.05$) values after combined exercise with modification rates in 30-second chair stand (EC, 42,2±22,0% and CG, 23,1±13,5%), arm curl (EC, 109,4±64,1% and CG, 19,1±13,1%) 6-minute walk (EC, 12,2±2,7% and CG, 7,1±10,1%). Conclusions: In conclusion, the combined exercise training seems to be effective for the physical functional ability of older healthy men and patients with COPD. As is true for healthy persons, exercise training for patients with COPD improves exercise capacity by optimizing global functional condition.

EFFICACY OF A SUPERVISED EXERCISE PROGRAMME IN PATIENTS WITH AN ACUTE LATERAL ANKLE SPRAIN: A RANDOMISED CLINICAL TRIAL

Koes, B.W., van Os, A.G., Bierma-Zeinstra, S.M., Kleinrensink, G.J., Bernsen, R.M., Verhaar, J.

ErasmusMC, Netherlands

Backgroud: Acute ankle sprains occur frequently. It is unclear whether conventional treatment should be supported by (supervised) exercises during the recovery period after an acute ankle sprain.

Objective: To assess the efficacy of usual care combined with a supervised exercise programme versus usual care alone in patients with an acute ankle sprain.

Methods: Randomised clinical trial. Adults with a acute ankle sprain were recruited in hospital emergency rooms and in general practices. They were randomized to receive usual care + supervised exercises or usual care only. Primary outcomes were subjective recovery and the occurrence of a resprain. Measurements were carried out at baseline and after 4, 8 and 12 weeks.

Results: A total of 102 patients were included in the trial. Both study groups improved over time. Although the improvement rate was somewhat higher in the supervised exercise - group there were no statistically significant differences between the studygroups on the primary outcome measures. There was a significant difference regarding appreciation the the treatment received in favor of the supervised exercise-group.

Conclusion: Combining usual care with a supervised exercise programme does not significantly improve subjective recovery or reduce the occurrence of re-sprains compared to usual care alone in patients with an acute lateral ankle sprain.

THE EFFECTS OF QIGONG GYMNASTIC EXERCISES AND MANUAL MANIPULATION THERAPY ON THE CORRECTION OF BAD POSTURE AND COBB ANGLE OF HIGH SCHOOL GIRLS WITH SCOLIOSIS

Park, G.D., Lee, T.H., Lee, W.J., Ju, S.-B.

Exercise Prescription, Korea, South

The purpose of this study is to evaluate the effects of Qigong therapy and manual manipulation therapy, which are not surgical procedures, performed on scoliosis patients in Y girls high school for 8 weeks. A total of 31 students, including 16 scoliosis patients aged between 16 and 19 and 15 normal students, made up the study population. Qigong therapy was performed on 8 scoliosis patients and manual manipulation therapy on the remaining 8 patients. The patients were treated with Qigong therapy and manual manipulation therapy for 8 weeks and the effects on Cobb angle and body balance have been evaluated. The results of the analysis have shown the following:

1. The effects of Qigong gymnastic exercises and manual manipulation therapy on Cobb angle:

A meaningful decrease in Cobb angle has been observed according to the period and to the interaction of the period with group when the patients are treated with Qigong therapy or with manual manipulation therapy ($P<.01$).

2. The effects of Qigong gymnastic exercises and manual manipulation therapy on the balance of body:

When it comes to the static balance of the body, a meaningful difference in the disturbed area has been observed with B1 (standing on both feet with eyes closed) and E1 (standing on the left foot with eyes closed) among groups and in the interaction of the period with the group (P<.05). A meaningful difference in the trajectory has been observed only in B2 (standing on both feet with eyes closed) in the interaction of period with the group (P<.05). As for dynamic movement, a meaningful difference in G1 (Sine wave L-R shift), H (Sine wave A-P shift) and I (oval) has been observed only in the period (P<.05). After 8 weeks of the treatments, compared with before the treatments, there has been a meaningful increase in stability in the Qigong group (P<.05) and a numerical decrease has been observed in the manual group.
To conclude, Qigong therapy has helped the scoliosis patients to improve body balance, and manual manipulation therapy has shown effect on Cobb angle on X-rays. Therefore, early detection of scoliosis during adolescence and steady Qigong gymnastic exercise or stretching, which improves muscles around the spine, may keep Cobb angle of students normal.

A CHANGE IN THE INTRAMUSCULAR OXYGEN HEMODYNAMICS DURING THE JET AQUA MASSAGE IS RECEIVED

Sudo, A., Akasaki, F., Tsunoda, N., Watanabe, T.

Kokushikan University, Japan

It is also known that water pressure increases the venous return, and decreases the hart rate (Arborelius et al., 1972; Larsen et al., 1994). And that the hart rate taken when the immersion level was stood at xiphoid, at a temperature of 36 °C was almost same as that measured in the lying on back position on land (Sudo,2001,ECSS). In this study we observed the circulation of the right vastus medialis muscle with a laser tissue blood-oxygen monitor during jet aqua massage is received when subjects were immersed to the xiphoid process in this water. 9 males and 3 females served as subjects. Measurements were made with the subjects in each of 4 conditions, that is in a standing on the ground before into the water, in standing position and during jet aqua massage (500 l/min) in the water in a standing on the ground after into the water. After the sensor of a laser tissue blood-oxygen monitor was installed over the right vastus medialis muscle, tissue oxygen saturation (StO2) level, tissue total hemoglobin (HbT) level, tissue deoxygenated hemoglobin (HbD) level, and tissue oxygenated hemoglobin (HbO2) level were measured. These results showed that blood pressure during the jet aqua massage was significantly lower than that a standing sitting on the ground, and StO2 level during jet aqua massage level was the highest while 4 conditions.

PHYSICAL FITNESS, FUNCTIONAL ABILITY AND HEALTH RELATED QUALITY OF LIFE IN CHILDREN WITH SEVERE HAEMOPHILIA: A PILOT STUDY

Takken, T., Engelbert, R., van der Net, J., Vos, R., van der Berg, M., Helders, P.

Univeristy Medical Center Utrecht, Netherlands

Objective

To investigate physical fitness, functional ability and health related quality of life of children with severe haemophilia, who are on prophylactic treatment.

Methods

Thirteen boys with severe haemophilia, treated at the University Medical Centre Utrecht,The Netherlands receiving prophylactic treatment (3 times a week 20-40 units per kg), mean age 11.0 yrs (range 7-15) were included. Body composition and joint health status (Haemophilia Joint Health Status) were measured. Aerobic exercise testing was performed using maximal exercise test with expired respiratory gas analysis until volitional exhaustion. Functional ability was assessed with the Dutch translation of the Activity Scale for Kids (performance and capability) and Health Related Quality of Life (HRQoL) was determined with the Haemo-QoL, a disease specific questionnaire.

Results

Body composition was comparable with healthy peers. Joint health status was almost normal (decrease (%): mean (sd) score: 1.1 (2.3), range 0-8).

Peak heart rate and peak respiratory gas exchange ratio's indicated that the children tested were able to perform at maximal or near maximal level (HRpeak 190 ± 9 beats.min-1 (range 171-206); RERpeak 1.22 ± 0.14 (range 0.86-1.33). VO2peak/kg was comparable to the normal population 47.42 ± 8.29 ml.min-1.kg-1 (Z-score mean (sd) VO2peak/kg/kg: -0.5 (sd: 1.4; range: -3.4 – 1.7). One child reported a joint bleeding in the right ankle the day after the exercise test.

Functional ability (performance and capability) was comparable to healthy controls (median; interquartile range: 100 (95.3-100) respectively 100 (94.5-100). In Health HRQoL, the correlation between patient report and parent report was high (R=0.73; p = 0.007). Mean (sd) in % HRQoL(normal: 0%, impaired: 100%) for child and parent was 12.4 (8.9, range: 3.2-12.4), respectively 11.8 (6.4, range: 2.1-11.8). The dimensions with most impact on HRQL were 'Friends', 'Perceived support', 'Treatment', and 'Dealing'.

Conclusion

Exercise testing seems to be a safe procedure under the current prophylaxis regime in most of the patient with a severe Haemophilia. The patients with severe haemophilia have a normal physical fitness compared to healthy peers. Joint health status, and functional ability were also found to be normal. The HRQoL revealed impact primarily on the psycho-social domains, rather than the physical domains.

Poster presentation (PP)

PP3-11 Biochemistry 1/1 - "Exhibition Hall"

SERUM CONCENTRATIONS OF ADHESION MOLECULES DURING RESISTANCE EXERCISE

Petridou, A. 1, Chatzinikolaou, T. 2, Fatouros, I. 2, Mastorakos, G. 3, Mitrakou, A. 4, Papassotiriou, I. 5, Mougios, V. 1

1 University of Thessaloniki, 2 University of Thrace, 3 Athens University, 4 Henry Dunant Hospital, 5) Aghia Sophia Children's Hospital, Greece

Introduction

Adhesion molecules are proteins expressed on the surface of a variety of cells (such as vascular endothelial cells, leukocytes, and platelets) and mediating leukocyte response to inflammation (1). Part of these molecules is released to the plasma as soluble forms and their

concentrations have been positively correlated to the risk for cardiovascular disease (2). Studies on the effect of exercise on the concentrations of soluble adhesion molecules have produced controversial results. The only study that measured soluble adhesion molecules after resistance exercise found a reduction in P-selectin 24-144 h postexercise but no changes in E-selectin, vascular cell adhesion molecule-1 (VCAM-1), and intercellular adhesion molecule-1 (ICAM-1) 1.5-144 h postexercise (1). In this study we assessed the effect of resistance exercise on the concentrations of soluble adhesion molecules during and immediately after the exercise protocol.

Methods

Sixteen healthy young men volunteered to participate in the study. After an overnight fast, subjects executed a 30-min resistance exercise protocol selected so as to stress the major muscle groups. Participants performed 3 sets of 10 resistance exercises with 10-12 repetitions at 70-75% of 1RM, in a circuit training fashion. Participants were instructed to perform each repetition in 4-6 s with a 30-s pause between exercises and 2 min rest between sets. Blood samples were drawn from an antecubital vein at baseline and at the end of the first, second, and third sets. Serum concentrations of VCAM-1, ICAM-1, E-selectin, P-selectin, and L-selectin were determined using the Evidence® biochip array analyzer. Differences were examined through the nonparametric Friedman test, because not all parameters displayed normal distribution, as examined by Shapiro-Wilk test. The level of statistical significance was set at 0.05.

Results

There were no significant changes in the serum concentrations of the adhesion molecules determined during the 30-min resistance exercise, although all concentrations were elevated at the end of the third set by 3-10%: VCAM-1 from 440±95 to 463±73, ICAM-1 from 318±94 to 348±128, E-selectin from 11±3 to 12±4, P-selectin from 79±14 to 85±11, and L-selectin from 1177±185 to 1218±210 (mean±SD in ng/mL).

Discussion

Our data show that resistance exercise at 70-75% of 1RM did not affect the serum concentrations of adhesion molecules in healthy young males. Combined with the finding that resistance exercise did not affect most of the soluble adhesion molecules and decreased P-selectin for up to six days (1), and since elevations in the concentrations of soluble adhesion molecules are thought to hamper the immune response (3), the data suggest no considerable negative effect of resistance exercise on immune function.

References

1. Smith L et al. (2000). Eur J Appl Physiol 82:61-67.

2. Silvestro A et al. (2005). Thromb Haemost 93:559-563.

3. Nielsen H & Lyberg T (2004) Scand J Immun 60: 356-362.

EOSINOPHIL TRAFFICKING AND ACTIVATION AFTER DOWNHILL RUNNING

McKune, A. 1, Smith, L. 1, Semple, S. 1, Sibanda, E. 1, Mokethwa, B. 2, Wadee, A. 2

1 Tshwane University of Technology, 2 University of the Witwatersrand, South Africa

Introduction

Acute physical stress induces leukocyte trafficking from the circulation to the mucosal lining of the gastro-intestinal tract and lung (1). Although circulatory eosinopenia (3) and eosinophil activation (2) have been reported after strenuous exercise there is limited research in this area. The purpose of the study was to examine eosinophil responses to strenuous exercise and the role of circulating cell adhesion molecules in this response.

Methods

Eleven active, untrained males, mean (SD), age 19.7 (0.37)yr; weight 78.5 (3.06)kg; body fat 14.6 (3.2)%; VO2 max 47.8 (3.6)ml/kg/min, performed a 60 min bout of downhill running (-13.5% gradient), at a speed that would elicit 75% of each subjects VO2 max, on a level grade. Blood samples were obtained before, immediately post exercise (IPE), and every hour for 12 h after and every 24 h for 6 d. Eosinophil levels were determined using a Coulter Counter. Serum eosinophil cationic protein (ECP) concentrations were determined by a radioimmunoassay technique. ICAM-1 level was determined using an ELISA. Each dependent variable was analyzed using a repeated measures ANOVA, with significance set at $P < .05$. Where appropriate the Bonferroni post-hoc test was performed.

Results

Percentage eosinophils in the circulation were significantly reduced ($p=0.0006$) after the downhill run from IPE-8 h (-42% to -76%). ECP level increased after the run and was significantly ($p<0.0001$) elevated (+63%) at 12 h. ICAM-1 level was not significantly altered.

Discussion

The disappearance of eosinophils from the circulation suggests the trafficking of these cells to peripheral sites. The elevation of ECP suggests that eosinophils may also be activated. The ICAM-1 result was surprising considering that this molecule is primarily responsible for the firm arrest of eosinophils to the endothelial cell surface, before they move through the vessel wall to the tissues (5). Recently it was proposed that in response to strenuous exercise, eosinophils may migrate to, and become activated in, the upper respiratory tract and that repeated activation may be responsible for asthma-related airway symptoms in athletes (2). However, in addition to pathological effects, eosinophils have been shown to have protective (defence against parasites) and tissue repair functions (4). Therefore, eosinophil responses to acute physical stress have been suggested to be part of an evolutionary conserved protective mechanism to enhance "immune surveillance" in areas of the body more susceptible to pathogen invasion (1). Whether the results of the present study represent a protective or pathological eosinophil response to downhill running is unclear and requires further investigation.

1. Dhabhar, F. (2002). Brain, Beh and Imm 16: 785-98

2. Domej, W. et al (2002). Chest 121: 1111-16

3. Nieman, D. et al (2003). Int J Sports Med 24: 535-40

4. Roitt, I. et al (2001). Immunology, Mosby: Edinburg

5. Wardlaw, A. (2001). Clinical Medicine 1(2): 214-18.

NETTLE DIET AND REGULAR EXERCISE INFLUENCE RAT BRAIN LESION AND MEMORY

Stadler, K., Sasvári, M., Jakus, J., Jung, J.K., Chung, Y.H., Nyakas, C., Radák, Z.

Semmelweis University, Hungary

The effect of swimming training and that of enriched lab chow containing 1% (w/w) dried nettle (Urtica dioica) leaf were investigated on the prevention of severity of brain injury caused by N-methyl-D-aspartate (NMDA) lesion in Wistar rats.

The functional effect of lesion was tested by open-field activity and passive avoidance learning tests. The oxidative stress (reactive carbonyl derivatives, free radicals) and inflammation (nuclear factor-κB, NF-B, activator protein-1, AP-1) markers were determined in rat brains.

Results demonstrate that according to learning and behavioral tests, both treatments seem to improve the adverse effect of brain injury caused by NMDA lesion. Nettle supplementation decreases the level of reactive species and the DNA binding activity of NF-κB. Nettle was found to be an effective antioxidant supplement, down-regulator of inflammatory transcription, and could also promote learning performance in brain. Exercise increases the concentration of reactive species in cerebellum, and alters the activity of transcription factors. The additive effect of the two treatments were more profound in the down-regulation of inflammatory transcriptor processes in NMDA lesion.

EFFECT OF THREE DIFFERENT GRIP POSITIONS ON THE MECHANICAL EFFICIENCY IN HANDBIKING

Abel, T., Lindschulten, R., Thees, B., Strüder, H.K.

German Sport Univeristy Cologne, Germany

Introduction: Handbike as a wheelchair sport has gained increased popularity in Germany. It is a very attractive sport and important for the prevention of cardiovascular diseases. During the last 5 years race performance has increased enormously due to a systematic training and developments concerning the handbike itself. In 2005 the world record for a Hanbike City Marathon was 1:07:21 (Heidelberg). In comparison to wheelchair propulsion handbiking has a higher mechanical efficiency (ME). Actually a lot of different biomechanical aspects in handbiking are going to be examined to increase the performance of the athletes. The aim of this study was to examine the effect of three different grip positions on the ME in handbiking.

Methods: Fifteen male and six female participants (age 26.6  4.8 years, height 178.0  11.9 cm, weight 74.7  13.3 kg) performed three different stage tests until exhaustion sitting in a race handbike connected to an ergo meter (Cyclus II, Richter; Germany). All participants were able bodied persons with a good training status of the upper extremity. The angel between the grip and the crank was set by 90° (horizontal = H), 0° (vertical = V) and 10° (diagonal, common way of cranking = D). The initial load was 20 watts increased by 20 watts each five minutes. Expired air was collected continuously (ZAN 600, ZAN, Germany), blood samples to determine lactate concentrations were taken at the last 30 seconds of each stage (Biosen C, Eppendorf, Germany). Heart rate was monitored continuously (Polar X-Trainer, Polar, Finland), RPE-scale was used.

Results: The relative maximum functional performance (watts/kg), maximum heart rate (bpm) the associated lactate concentrations (mmol/l) and maximum oxygen uptake per kilogram body weight (ml/kg) for the different grip positions were: Horizontal 1.43  0.21 watts/kg, 170.14  12.81 bpm, 9.54  1.93 mmol/l, 30.86  4.57 ml/kg; Vertical 1.38  0.20 watts/kg, 171.81  13.87 bpm, 9.91  2.29 mmol/l, 29.75  5.13 ml/kg; Diagonal 1.40  0.22 watts/kg, 169.19  13.31 bpm, 9.34  2.36 mmol/l, 29.39  4.70 ml/kg;. In all grip positions the RPE values were 20 meaning a very heavy load. No statistically significant differences could be found between the mentioned physical reactions.

Conclusion: In opposite to the expectations there were no differences between three different grip positions (horizontal, vertical, diagonal) in handbiking at maximum load. The mechanical efficiency during a stage test until exhaustion showed no differences, so at this knowledge no grip position could be recommended for athletes. In further studies it has to be proven whether these findings are negotiable to prolonged work load durations and to athletes with a spinal cord injury. In addition it would be of particular interest to combine the test setting with EMG registrations.

SALIVARY FREE IGF-I AND TOTAL PROTEINS: EFFECTS OF AN ACUTE PHYSICAL EXERCISE ON CYCLISTS

Antonelli, G., Cappellin, E., Spinella, P., Gatti, R., Liviero, C., De Palo, E.F.

University of Padua, Italy

Introduction. It is commonly accepted that IGF-I influences and is influenced by physical exercise [1], but the literature data about the effects of physical exercise on the IGF-I system does not give the same uniform results [2]. We recently developed a new ELISA to measure free IGF-I in saliva [3]. Aim. The aim of this study was to investigate the effects of an acute physical exercise on the salivary free IGF-I (sIGF-I) levels and explore if a relation with the plasma IGF-I levels exists. We also examined the salivary total proteins (sPr) to verify if a relation with sIGF-I exists and if physical exercise has an effect on sPr. Subjects & Methods. Well-trained male cyclists were recruited (n=18, 19±1 ys, 70±4 kg and 179±4 cm). Saliva and blood specimens were collected from each cyclist at rest (B; 5-10 min before exercise) and at the end of a 45 min cycloergometer test at 50-60% of VO2max (E). sIGF-I and sPr measurements were carried out using ELISA [3] and colorimetric methods, respectively. Plasma concentrations of free IGF-I were assayed with the "Active free IGF-I ELISA" kit reagents. Results. sIGF-I concentrations demonstrated a significant difference before (B) compared with the end (E) of the physical exercise ($p<0.01$; 16.4±8.0 and 26.2±16.7 pmol/L respectively). The plasma free IGF-I concentrations did not demonstrate any difference comparing B and E (25.3±16.9 and 21.1±8.4 pmol/L respectively). The sPr level was significantly lower comparing B and E conditions ($p<0.001$; 326±156 and 629±345 mg/L respectively). A positive correlation between sPr and sIGF-I, both before and after exercise ($y=0.001x+0.039$, $p<0.01$; $y=0.001x+0.073$, $p<0.05$, respectively) was observed. A positive correlation between salivary and plasma free IGF-I was found only after the exercise ($y=1.448x-0.032$, $p<0.001$). Discussion. The literature data about the effects of a physical exercise in circulating IGF-I levels demonstrated mixed results. In this study, plasma free IGF-I concentrations did not differ comparing pre- versus post-exercise. A significant increase in sIGF-I after the exercise was observed ($p<0.01$). A correlation between saliva and plasma free IGF-I was found only in post-exercise. This could be explained by local synthesis of IGF-I in the basal condition, however, exercise might lead to a free diffusion from plasma to saliva. Little is known about the effect of exercise on salivary protein content and in this protocol we observed a significant increase of sPr. A correlation between sPr and sIGF-I both in pre and post exercise was also found. Further investigation would confirm the effect of a different type and duration of physical exercise on the sIGF-I concentration.

References.

1. Berg U et al. (2004) Horm Res 62 Suppl 1:50.

2. Walker KS et al. (2004) Med Sc Sports Exerc 36:787.

3. Antonelli G et al (2005). Proceedings of the 10th annual congress ECSS, 194.

Funded by Ministero della Salute – Roma(I) (progetto anti-doping).

PARTICULARITIES OF ACID-BASE DEEP PICTURE DURING AEROBIC EXERCISE IN AN OLYMPIC CHAMPION GIRL (CASE STUDY)

Talaban, M.-D., Tocitu, D., Catanoiu, S., Dafinescu, C.

National Institute for Sport Research, Romania

Introduction

The acid-base equilibrium deep picture (ABDP) is a recent concept meant to the detailed tracing of oxygen status in patients under critical condition, i.e. the evaluation of how oxygen behaves along its entire passage, especially its employment in the tissues. In case of athletes for whose performance the acute response of oxygen to exercise is capital, examination of ABDP may clear up a little bit more of the complexity of the functional adaptations produced through physical training or, on the contrary, may spotlight unexpected particulars.

Methods

After 9 mths of systematic training with a view to her participation in the OG, a member rower of the Olympic squad, female, aged 27, height 182 cm, weight 61.5 kg, active body-mass 54.5 kg, VO2max 5700 mL/min, presented, under rest conditions, normal values: pH–7.411;pCO2-37.6 mmHg;pO2-69 mmHg;ABE–0.8 mmol/L;cLac–0.5 mmol/L;cGlu–72 mg/dL. The athlete was investigated for the ABDP, on blood samples collected after a 60 min session on water, at a rate of 16 bpm, and an atypical ABDP was discovered, suggesting at first sight a defective adaptation of the respiratory function at the intensity of performed exercise. Nevertheless, the athlete's evolution would demonstrate the contrary when, in a short time, she won the Olympic gold medal in the 2X LW event at the Games. The samples were analyzed with microAstrup analyzer, series 700 (Radiometer).

Results

Immediately after the aerobic training performed at about 50% intensity of VO2 max, at a HR of 156 bpm, pH increased to 7.459, pO2 rose to 107 mmHg, sO2 grew to 99.6% in the presence of a normal value for p50(a) with 25.12 mmHg, the lactate concentrations tripled to reach 2.7 mmol/L, cBase(Ecf)c climbed with 2 mmol/L towards the alkaline side, cGlu went up to 96 mg/dL.

Discussion/Conclusion

With this female rower, who trained systematically for a long period of time, we found that the exertion performed at an overload calculated to insure a lactate steady state determined a slight hyperlactatemia (2.65 mmol/L) in the presence of slight hypocapnia (35.3 mmHg), alkalemia (7.459) and hyperbasemia (1.6 mmol/L). The growth of lactatemia associated to hypocapnia and respiratory alkalosis induced through alveolar hyperventilation, respectively, although rare, is mentioned in the medical literature. The mechanism is supposed to imply the inhibitive effect of pCO2 decrease and pH increase on the piruvat carboxilase activity. In sport biology, pH and lactate simultaneous increase is unusual. We make it out with an Olympic elite rower just for the purpose of emphasizing that such a particular, especially blood alkalinisation during aerobic effort, does not affect high performance in sports with aerobic dominance but represents a limit of ventillatory threshold as marker for training monitoring.

References

Baggott J, Gas Transport and pH Regulation, (1977): 1025-1054

Mincu I, Ionescu-Tîrgovişte C, (1978). Echilibrul acidobazic: 216-232.

EFFECT OF N-ACETYLCYSTEINE ON METABOLISM OF GLUTATHIONE, CELL DAMAGE AND ERYTHROPOIETIN PRODUCTION IN ATHLETES EXPOSED TO ENDURANCE EXERCISE

Zembron-Lacny, A., Slowinska-Lisowska, M., Witkowski, K., Szygula, Z., Szyszka, K., Stefaniak, T.

University of Physical Education Poznan, Faculty of Physical Culture Gorzow Wlkp., Poland

Introduction/Purpose: Glutathione is a ubiquitous thiol playing important role in cellular defense against oxidative stress. Previous studies have shown, that glutathione metabolism and production of erythropoietin (EPO) may be modulated by N-acetylcysteine (Hildebrandt et al. 2002, Sen and Packer 2000). The aim of this study was to determine whether an endurance exercise induces oxidative stress and whether intensification of glutathione metabolism by oral treatment with N-acetylcysteine reduces cell damage, results in changes of EPO level and inhibits fatigue in athletes performed incremental exercise.

Methods: A randomized, double-blind, placebo controlled design was used to determine the effect of N-acetylcysteine on glutathione metabolism, erythropoietin level and markers of cell damage. Subjects (n = 16) were given oral dose of 1200mg N-acetylcysteine (NAC) daily for eight days before exercise and 600 mg on the day of exercise test. Blood samples were obtained 5 min before a graded cycle ergometer exercise (VO2max), immediately post exercise and after 24 h rest. Protein carbonyls (PC), lipid peroxidation products (TBARS), erythropoietin (EPO), myoglobine (Mb) and glutathione (GSH) levels as well as glutathione peroxidase (GPx) and glutathione reductase (GR), creatine kinase (CK), lactate dehydrogenase (LDH) activities were evaluated.

Results: The applied exercise caused significant changes in some tested parameters (GPx, PC, TBARS, CK). The rest concentration of GSH (+33%), activities of GR (-22%) and GPx (-18%) were altered by NAC administration. After NAC, oxidative stress markers PC (-31%) and TBARS (-37%) as well as cell damage markers - CK (-31%) and LDH (-20%) were lower. NAC significantly increased Hb, Ht and EPO levels and reduced amount of erythrocytes. Nevertheless, maximal oxygen consumption and heart rate, lactate concentration and maximal work load did not change after NAC intake.

Conclusions: Our study has shown that an incremental exercise increases oxidative damage level and initiates changes in glutathione metabolism whereas, the N-acetylcysteine administration enhances antioxidant glutathione system, attenuates oxidative stress and influences hematological parameters level in subjects' blood.

References

Hildebrandt W, Alexander S, Bärtsch P et al. Effect of N-acetylcysteine on the hypoxic ventilatory response and erythropoietin production: linkage between plasma thiol redox state and O2 chemosensitivy. Blood 2002; 99: 1552-1555.

Sen CK, Packer L. Thiol homeostasis and supplements in physical exercise. Am J Clin Nutr 2000; 72: 653-669.

EFFECTS OF REPEATED BOUTS OF SOCCER-SPECIFIC INTERMITTENT EXERCISE ON SALIVARY IGA AND CORTISOL

Sari-Sarraf, V., Reilly, T., Doran, D.A., Atkinson, G.

Research Institute for Sport and Exercise Sciences, United Kingdom

Lowered salivary immunoglobulin A (s-IgA), the predominant component in the secretions lining the mucosal surface, or chronic s-IgA deficiency has been associated with an increased incidence of upper respiratory tract infections (URTI). This association in elite athletes

may be due at least in part, to the repetitive intensive-exercise sessions undertaken without sufficient recovery between them. An imbalance between training/competition stress and recovery may lead to chronic fatigue, under-performance and more severe immunodepression. Competing and/or training hard frequently may compound the effects of a single session of exercise. The aim of the study was to identify the cumulative effects of soccer-specific intermittent exercise undertaken on different occasions 48 hours apart on secretory immune response. Nine males (mean ± se age: 25.7±1.6 years; height: 1.81±0.02 m; mass: 76.6 ± 2.6 kg; body fat: 14.7 ± 1.3 % and : 57.1 ± 3.7 ml·kg-1min-1) completed two trials of 90-min soccer-specific intermittent exercise performed 48 hours apart at the same time of day on a motorized treadmill. The participants were initially assessed for maximal oxygen consumption ( ). Unstimulated saliva samples were collected via passive expectoration before, immediately post-exercise, 24 hours and 48 hours post-exercise. The mean heart rate (149 ± 2 vs.147 ± 2 beat·min-1) and perceived exertion (13.4 ± 0.5 and 13.2 ± 0.6) for the two intermittent exercise trials did not differ significantly (P>0.05). The pattern of change in salivary responses, including solute secretion rate, IgA secretion rate, IgA to osmolality ratio and cortisol did not differ between the different time-points. The s-IgA concentration was increased immediately after both the first exercise trial (EX1) (215.7 ± 53.4 to 335.6 ± 81.9) and the second exercise trial (EX2) (144.2 ± 31.2 to 271.2 ± 61.9) and declined throughout the subsequent 24-48 hours (F6, 48 =3.85, P<0.05). The declines in saliva flow rate during EX1 were similar to EX2 (642 ± 120 to 502 ± 51 and 680 ± 95 to 502 ± 37 ml·min-1, respectively) (F6, 48 =4.82, P<0.05) and at the time period 24 hours after exercise, saliva flow rate after both trials was increased above its initial level (P<0.05). The saliva osmolality increased immediately after each exercise trial and this change after EX2 was higher than in EX1 (36.4 vs. 28.3) (F6, 48 =9.6, P<0.05), suggesting an increase in the amount of dehydration. The results suggest that performing soccer-specific intermittent exercise twice within 48 h did not significantly affect salivary IgA secretion rate and IgA to osmolality ratio or cortisol concentration and therefore did not compromise mucosal immune responses. In conclusion, a 48-h rest is sufficient for salivary IgA and cortisol responses to recover from previous soccer-specific exercise.

TRAINING AND OVERREACHING EFFECTS IN OXIDATIVE, ANTIOXIDANT, OXIDANT STRESS MARKERS AND HSP72

Zoppi, C.C., de Macedo, D.V.

Faculdade Social da Bahia and Universidade Estadual de Campinas, Brazil

Physical training is known to induce several adaptations that can be systemic or at skeletal muscle level. These adaptations are desired to increase athletic performance. Frequently athletes are submitted to hard training in order to push performance to its upper limit, although when training loads are excessive and the regeneration is not enough the athlete is said to be overtraining. Overtraining syndrome is the result from an imbalance between training loads and regeneration processes, and induces autonomic changes that impair performance. Overreaching is known as the initial phase of overtraining and occurs in consequence of metabolic imbalance leading to a decrease in ATP synthesis, inducing short term fatigue. Free radicals are high reactive molecules, that can oxidize intracellular structures and thus impair cell function, and strenuous exercise could increased their production. So the aim of this work was to study the behavior of oxidative stress, antioxidant defenses and oxidative metabolism markers in subjects submitted to a training protocol that tends to achieve overreaching process. 30 male Wistar rats were divided in exercise group (n=25) and control group (n=5). The exercise protocol consisted in 8 weeks endurance training and a 3 weeks overreaching protocol. During endurance protocol, animals were exercise once a day, while volume and intensity were smoothly enhanced, and at overreaching protocol, only frequency was increased untill exercise group reached 4 sessions per day, volume and intensity remained the same of the last week of endurance protocol. Thiobarbituric acid reactive substances (TBARs) and carbonylated proteins (PC) were measured as oxidative attack markers, glutathione reductase (GR), catalase (CAT) and citrate synthase (CS) activities were measured as muscle antioxidant and oxidative markers and also stress protein HSP72 were measured to ensure stress levels in soleus (SO), extensor digital longus (EDL) and semitendinuous (ST) muscles. Although endurance training induced significative increase in TBARs and PC levels (p<0.05), antioxidant and oxidative enzymes increased as well, and at the end of 8 weeks training protocol the stress markers TBARs, PC and HSP72 levels were back to baseline values. On the other hand, overreaching protocol induced oxidative stress situation leading to significative decreases (p<0.05) in antioxidant and oxidative enzymes, giving rise to TBARs and PC levels in all muscles, but mainly in the SO type I fibers muscle. Similar to other results, HSP72 was also highly expressed in all muscles studied, but at a higher level in SO muscle, suggesting a high stress imposed by the overreaching protocol. In conclusion, our data suggest that overreaching can be induced by oxidative stress mainly in type I slow twitch muscle fibers, and the measure of these markers could be a useful tool in sports field as markers of overreaching installation.

Poster presentation (PP)

PP3-12 Molecular Biology 1/1 - "Exhibition Hall"

EXPRESSION OF UBIQUITIN PROTEOLYTIC PATHWAY COMPONENTS IN HUMAN SKELETAL MUSCLE FOLLOWING REPEATED BOUTS OF ECCENTRIC EXERCISE

Vissing, K., Nedergaard, A., Overgaard, K., Schjerling, P.

University of Aarhus, Denmark

Introduction

Muscle damage induced by single bout eccentric skeletal muscle exercise provides long-lasting protection from subsequent bouts of eccentric exercise (repeated bout effect) (1). Cellular mechanisms involved in such adaptations are undefined, but one theory involves the ubiquitin (UBI) proteolytic pathway. Accordingly, it has been shown that expression of UBI-components like ubiquitin and 20S-proteasome is lessened after a repeated bout of eccentric exercise (2). A number of pathway-specific enzymes, (collectively referred to as E3-ligases) are speculated to specify the myofibrillar proteins that are to undergo proteolysis. Furthermore the transcription factor FOXO is speculated to be involved in the expression of pathway-specific genes. Such ligases and transcription factors have, however, not been investigated during repeated eccentric exercise. The purpose of this study was, therefore, to investigate the expression of selected E3-ligases as well as other UBI-pathway components during repeated eccentric exercise. The hypothesis was a less profound overall exercise-induced expression after the repeated bout.

Methods

Biopsies were obtained from the vastus lateralis muscles of 14 untrained male volunteer subjects performing two bouts of 30 min step-down exercise separated by 8 weeks (3). Isometric knee extensor MVC was measured with a strain gauge transducer and soreness of

the knee extensor region was evaluated on a visual analog scale. mRNA levels for Ubiquitin (UBI), proteasome subunit alfa1 (PSMA1), FOXO and five E3-ligases, E3alfa, Murf1, Murf2, Murf3 and atrogrin1, were quantified by Northern blotting.

Results

Eccentric exercise reduced muscle strength, but strength was less reduced after bout 2 compared to bout 1 ($p<0.05$). Muscle soreness was lower following bout 2 as compared with bout 1 ($p<0.05$). UBI and PSMA increased compared to pre level and UBI showed an increase after bout 1, not evident after bout 2 ($p<0.05$). Murf2, Murf3 and atrogin1 all underwent regulation after eccentric exercise ($p<0.05$), but with no difference between bout 1 and 2. Murf1 underwent more profound regulation after bout 2 than bout 1 ($p<0.05$) and FOXO responded more to concentric than to eccentric exercise ($p<0.05$). E3alfa did not change.

Discussion/Conclusion

Patterns of strength reduction and muscle soreness were as expected. Among selected molecular markers of the ubiquitin proteolytic pathway, a repeated bout effect was observed for Murf1 and UBI, but not for other targets. The UBI-pathway might be involved in adaptation underlying the repeated bout effect, but this requires more investigation. In this regard the mRNA level for these genes may not reflect the alterations at the protein level.

References

1) Nosaka K et al., Med Sci Sports Exerc., 2001, 33, 1490-5

2) Willoughby D et al., Med Sci Sports Exerc., 2003, 35, 2023-2031

3) Newham DJ et al., Muscle Nerve, 1983, 6, 380-5.

EFFECT OF EXERCISE TRAINING ON ANGIOGENIC GROWTH FACTOR EXPRESSIONS IN THE AGED RAT HEART

Iemitsu, M., Maeda, S., Jesmin, S., Otsuki, T., Miyauchi, T.

Institute of Health and Sport Sciences and Center for Tsukuba Advanced Research Alliance (TARA), Japan

Exercise training improves aging-induced deterioration of angiogenesis in the heart. Vascular endothelial growth factor (VEGF), transforming growth factor (TGF)-beta1, and basic fibroblast growth factor (bFGF) are important angiogenic growth factors. However, it is unclear whether these angiogenic growth factors participate in the mechanisms underlying exercise training-induced improvement of capillary density in the aged heart.

PURPOSE: The present study was aimed to clarify whether angiogenic growth factors, such as VEGF, TGF-beta1, and bFGF, in the heart contributes to a molecular mechanism of exercise training-induced improvement of capillary density in old age.

METHODS: The present study investigated whether mRNA and protein levels of VEGF, TGF-beta1, bFGF, and fetal liver kinase (Flk)-1, which is a VEGF receptor, in the aged heart are affected by exercise training, using the hearts of sedentary young rats (4 months old), sedentary aged rats (23 months old), and exercise-trained aged rats (23 months old, swimming training for 8 weeks, 5days/week, 90 min/day).

RESULTS: Total capillary density and capillary to myocyte ratio in the heart were significantly lower in the sedentary aged rats compared with the sedentary young rats, whereas those in the exercise-trained aged rat were significantly higher than the sedentary aged rats. The mRNA and protein expressions of VEGF and Flk-1 in the heart were significantly lower in the sedentary aged rats compared with the sedentary young rats, whereas those in the exercise-trained aged rats were significantly higher than the sedentary aged rats. Additionally, cardiac bFGF mRNA and protein expressions in the heart were significantly higher in the sedentary aged rats compared with the sedentary young rats, whereas there were no significant differences in these expressions between the sedentary aged rats and the exercise-trained aged rats. The expression levels of TGF-beta1 mRNA and protein in the heart did not differ among three groups.

CONCLUSIONS: These findings suggest that exercise training-induced upregulation of cardiac VEGF angiogenic signaling may play roles, at least in part, in the molecular mechanism of the exercise training-induced improvement of angiogenesis in old age.

Supported by grants from the Ministry of Education, Culture, Sports, Science and Technology of Japan (17700484).

EFFECTS OF 6 WEEKS INTERVENTION OF DIET AND EXERCISE ON VEGF PROTEIN EXPRESSION OF SKELETAL MUSCLE FIBER TYPES IN DIET-INDUCED OBESE RATS

Changbae, H., Kijin, K., Wookwang, C., Nayoung, A.

Keimyung University, Korea, South

This study measured VEGF protein expression of different skeletal muscle fiber types after 6 weeks intervention of energy intake restriction and exercise in diet-induced obese rats. These changes were analysed the differences among the different 6 weeks intervention programs of diet, exercise, and diet plus exercise.

Subjects were consisted of 2 weeks-aged male Sprague-Dawley rats, and were divided into 6 groups as control, obese, and 4 intervention groups (diet alone, exercise alone, diet plus exercise type A, and diet plus exercise type B).

VEGF protein expression in skeletal muscle were measured in pre and post-treatment of 6 weeks by western blotting analysis. After intake of high fat diet of 6 weeks, diet-induced groups showed a significant higher body weight as compared to control group.

Exercise group and diet plus exercise type B group showed a significant weight loss after 6 weeks intervention, but diet alone group and diet plus exercise type A group showed no significant change of body weight after 6 weeks intervention. Diet plus exercise type B group showed a significant lower visceral fat volume after 6 weeks intervention, and obese group showed a higher visceral fat volume than the other groups. Diet alone group, and diet plus exercise type B group showed a significant higher VEGF protein expression in red gastrocnemius after 6 weeks of treatment as compared to pre-level of control group. Diet alone group, exercise group, and diet plus exercise type B group showed a significant higher VEGF protein expression in white gastrocnemius after 6 weeks of treatment as compared to pre-level of obese group, but these groups showed no significant differences as compared to pre-level of control group.

Exercise group showed a significant higher VEGF protein expression in soleus after 6 weeks of treatment as compared to pre-level of control group, and exercise group and diet group showed a significant higher VEGF protein expression in soleus after 6 weeks of treatment as compared to post-level of control group.

In conclusion, VEGF protein expression of type IIb fiber in gastrocnemius's white muscle showed a significant activation after exercise. However, VEGF protein expression of intervention groups showed a challenge to insufficient exercise duration and in obese rats. Further research is needed on the analysis of VEGF mRNA in muscle and adipose tissues before meaningful mechanism can be drawn in dietary and exercise intervention of obesity.

THE RELATIONSHIP BETWEEN EPSTEIN-BARR VIRUS REACTIVATION AND UPPER RESPIRATORY INFECTION DURING INTENSIVE TRAINING AND COMPETITIVE PERIOD

Yamauchi, R., Nakamura, D., Kimura, F., Suzuki, K., Kono, I., Akimoto, T.

Consolidated Research Institute for Advanced Science and Medical Care, Waseda University, Japan

It is well known that highly trained athletes suffer from a high incidence of upper respiratory tract infections (URTI). Thus, it is important for all athletes to manage risk of URTI through training and competitive periods. In some previous research, salivary secretory immunoglobulin A (SIgA) has been used for evaluation of the risk of URTI. However, there has been a moderate relationship between SIgA levels and URTI. Here we established a new index to monitor the risk of URTI in intensive training period on the field.

To establish the detection system that evaluates reactivation of Epstein-Barr virus (EBV), we examined the metrology of the amount of EBV-DNA appearance in saliva from three steps. First of all, method of extracting DNA from saliva was examined. Second was making of working curve that uses EBV-DNA fragment insertion vector by polymerase chain reaction (PCR). The last was quantification of the amount of EBV-DNA appearance based on working curve. We prospectively investigated the relationship between daily changes in EBV-DNA as well as SIgA level, and appearance of URTI symptoms in collegiate soccer players during a training period of 2 months.

The SIgA concentration did not significantly decrease before appearance of URTI symptoms. However, the saliva flow rate and SIgA secretion rate tended to decrease 3 days before the appearance of URTI symptoms compared to that in the non-infection period. For EBV-DNA, total DNA was extracted from the saliva samples. The working curve was obtained from the result of PCR that used the EBV-DNA inserted vector. It became possible to quantify the amount of EBV-DNA appearance by being based on working curve that we established. The detection system of the amount of EBV-DNA appearance was constructed. The appearance of EBV-DNA was also related to the appearance of URTI symptoms. Our findings suggest that monitoring of SIgA secretion rate and EBV-DNA may be useful for assessment of risk status of athletes for URTI.

POTENTIAL BIOLOGICAL SIGNIFICANCE OF TRAINING-INDUCED CHANGE OF HSP72 MRNA IN MYOCARDIUM OF RATS

Wei, Y., Chen, P.

Shanghai University of Sport , China

Introduction

This article's aim is to evaluate the effects of exercise on myocardial metabolism and mechanical performance with the concentration of myocardial enzyme in plasma, heart function and ultrastructure as the indexes.

Methods: SD rats were randomly divided into four groups: 1) control group, 2) training for 1 week period group, 3) training for 2 weeks period group, and training for 3 weeks period group. There were 9 rats every group. The rats were trained on treadmill in the intensity of 75%VO2max for 1 week,2 weeks,3 weeks separately. After training all rats were decapitated at intervals of 24 hr. The concentration of Creatinkidnase (CK) and Creatinekidnase Isoenzyme (CK-MB) in plasma was measured by the method of NAC, and that of Oxaloacetate Transnase (AST/GOT) in plasma was observed by the method of malate dehydregenase. The myocardial damage was examined with electron microscope. Mechanical function was assessed according to rate pressure product (RPP) and ±dp/dt max. The hearts were reserved for the detection of HSP 72mRNA expression by reverse transcription-polymerase chain reaction (RT-PCR).

Results: The HSP 72mRNA was expressed in all rats' myocardial cells.2)A significant increase in the concentration of not only CK, CK-MB but also AST was observed in 1-week-period group compared with control group. And with the increase of the exercise period, the concentrations of those three enzymes decreased gradually.3) The decrease of LVSP, dp/dt max and dp/dt min was more pronounced in 1-week-period group than in control group, while the decrease of LVEDP was not statistically different between the two groups ($p>0.05$). And with the increase of the exercise period, the decrease of LVSP, dp/dt max and dp/dt min recovered gradually, while the decrease of LVEDP continued to even lower level in rats.4) All of the ultrastructure of myocardial cells showed damage after one week exercise. And with the increase of the exercise period, the myocardial damage recovered gradually.

Discussion / Conclusions: Physical training-induced expression in HSP 72mRNA is paralleled with the heart function. Exercise could protect myocardial cells from damage by increasing the expression of the HSP72 protein.

References

[1].Locke M.(1995).Am. J.Physiol,269(Heart Circ.Physiol.38);H320-H325

[2].Skidmore R.(1995).Am. J.Physiol,268:R92-R97.

[3].Ang D,et al.(1991).J Biol Chem,266:24233-24236.

[4].Hutter M,et al.(1994).Circulation,89:355.

[5].Mestril R & Dillmann W.H.(1995) J Mol Cell Cardiol,;27(1):45～70.

EFFECTS OF DIFFERENT EXERCISE DURATIONS ON THE EXPRESSION OF HEAT SHOCK PROTEIN 72MRNA IN MYOCARDIUM OF RATS

Wei, Y., Chen, P.

Shanghai University of Sport , China

Introduction

This article's aim is to study whether exercises of different durations can effectively induce the expression of myocardial HSP72 messenger RNA (mRNA).

Methods: SD rats were randomly divided into four groups: 1) control group, 2) training for 1 week period group, 3) training for 2 weeks period group, and 4) training for 3 weeks period group. The rats were trained on treadmill in the intensity of 75%VO2max for 1 week, 2 weeks, 3 weeks separately. After training all rats were decapitated at intervals of 24 hr and HSP 72 mRNA expression of myocardium was detected by reverse transcription-polymerase chain reaction (RT-PCR).

Results: 1) HSP72 mRNA can be basically expressed in rats of control group.2) There is a significant increase of HSP72 mRNA in myocardial cells in 1-week-period group compared with control.3) A decrease of HSP72 mRNA was observed in 2-week-period group compared with 1-week-period group，but there was no statistical difference between the two groups. 4) The decrease of HSP72 mRNA was more pronounced in 3-week-period group than in 2-week-period or 1-week-period group.

Discussion / Conclusions

Exercise is a sufficient stimulus to induce or enhance the synthesis of heat shock and/or stress proteins in myocardial cells. HSP72 mRNA can accumulated in cells after long time exercise. But the accumulation decreases gradually and HSP72 mRNA recovers to normal level after some time.

References
[1] Locke M.(1995).Am. J.Physiol,269(Heart Circ.Physiol.38);H320-H325
[2] Fehrenbach.E,et al.(2000).Med.Sci.Sports Exerc,32(3):592-600.
[3] Locke M.,et al.(1991).Am.J.Physiol.261(Cell Physiol.30):C774-C779.
[4] Peterson.R & Lindquist.S.(1989).Cell Reg,1:135-149.
[5] Salo.D.C.(1991).Free Rad.Biol.Med,11:239-246.

THE EFFECT OF ENDURANCE EXERCISE TRAINING ON SKELETAL MUSCLE APOPTOSIS INDUCED BY MITOCHONDRION

Tsung-I, C., Ming-I, C.
Tzu-Chi University, Taiwan

Mitochondrion may play an important role in signals affecting skeletal muscle apoptosis involved a lot of mechanisms after exercise. Therefore, the purpose of this study is to investigate the influence of exercise training on skeletal muscle apoptosis induced by mitochondrial pathway. Animals, male Wistar rats, were randomly assigned to either a control group or an exercise group. Exercise group were trained 5 days weekly for 12 weeks on treadmill. An exhausted exercise test was performed after a rest period of 7 days after 12 weeks exercise training. Rats were sacrificed at pre-exercise (PRE), post-exercise 0 hour (PE0) and post-exercise 48 hour (PE48), respectively. The soleus and gastrocnemius were dissected out and frozen in liquid nitrogen rapidly. Muscle samples were stored at -80℃ until subsequent analysis. The citrate synthesis activity of soleus of trained was significantly higher than untrained at PRE, PE0 and PE48 ($p < .05$), respectively. The gastrocnemius weight-to-body weight ratio and soleus weight-to-body weight ratio of trained were significantly higher than untrained ($p<.05$), respectively. In gastrocnemius, the apoptosis index of trained at PE48 was significantly higher than PRE ($p<.05$); the untrained at PE48 was significantly higher than PRE and PE0 ($p<.05$), respectively. The apoptosis index of gastrocnemius and soleus of trained were significantly lower than untrained after PE48 ($p<.05$), respectively. These finding suggest that skeletal muscle may modulate their apoptotic signals expression and the oxidative activity of mitochondria after exercise training, lead to attenuating the time of skeletal muscle apoptosis or inhibiting the apoptotic signals expression, and then the probability of hypertrophy occurred.

Poster presentation (PP)

PP3-13 Sociology 1/1 - "Exhibition Hall"

CICLO LAZER - KNOW YOUR CITY RIDING A BIKE

Stanganelli, P.J., Sawaf, C.
Curitiba City Hall, Brazil

Introduction: Curitiba, Brazil, is a city with 1.5 million inhabitants, 52m² of green area per inhabitant, 170 km of cycleways and 23 parks, in this sense, counts with a structure that allows for the cycling activity and consequent democratization of options for people to go to work, go home or have some leisure time. Through cycleways and specific programs that stimulate the continuous use of bicycles and knowing the city, the citizens enjoy also the physical, mental and social benefits within a community. Methods The city of Curitiba offers a program called Ciclolazer, which promotes meetings with cyclists on Saturdays aiming to know typical neighborhoods, parks, monuments, events sites, historical streets and new locations while enjoying the activity of bicycle riding around the city. The rides are about 15 km long. It stars at 2:30 pm from a central point in the city and last three hours. Each participant must have his own bicycle and helmet. Also at the beginning and in reference points of the tour, the participants are informed about the characteristics of the places, such as their memory heritage and context. Results The data was collected on March 19, 2005 with 140 participants, before they started the Ciclolazer program. The age of the participants (71.5% males and 28.5% females) was distributed as follows: + 20 years old – 14.3%; + 30 years old – 28.5%; + 40 years old – 21.5%; + 50 years old – 35.7%. When the participants were asked if they knew who promoted the program, 7% did not know what to answer, 93% identified the City Hall as the promoter. Nevertheless, 7% of the respondents understood that the executive agency of the program was the City Hall, 7% thought that the Secretariat of Environment was responsible for the event and 86% mentioned the Municipal Secretariat of Sports and Leisure. Five other multiple-choice questions related to aspects of social inclusion by means of the project were also made to the participants. Conclusions: Upon the analysis of the answers given by the subjects we can verify that people over 30 years old are more assiduous and, thus, evidence a clear intention to make good use of their free time and an interest to know the city, having sport as a source of social regulation (Cunha 2002). It is worth mentioning that 71.5% of the participants feel themselves as "very much included" through Ciclolazer while a process of citizenship, and that the bicycle, used as a means of leisure, should also have its use as a means of transport better stimulated. The research shows that 93% of the participants could know new places and 100% of them made at least one new acquaintance. As seen by the participants, the main benefit from this activity is health, assuring that there is a process of social inclusion while riding a bicycle, which is, according to Driver (1980) one of the main forms of leisure today.

CHARACTERISTICS, POSITION AND ORGANISATIONAL FORMATS OF NEIGHBOURHOOD SPORT IN FLEMISH MUNICIPALITIES (BELGIUM)

Theeboom, M., van den Bergh, K.
Vrije Universiteit Brussel, Belgium

Introduction
In recent years, sport promotion on neighbourhood level has gained popularity in Flanders (Belgium). During the first years, neighbourhood sport was primarily aimed at underprivileged youth in urban deprived areas. However, as a result of the growing number of initiatives that have been set up in recent years in Flanders, this concept has now become more diverse. Consequently, it has become unclear how neighbourhood sport in its actual form, can be described in terms of general objectives, target groups, organisational formats, etc. By order of the Flemish Minister of Sport, an inventarisation study was set up in 2005 to determine the actual position of neighbourhood

sport in Flanders. All Flemish municipalities were asked to fill in an on-line questionnaire (response: 71.4 %). Also, in-depth interviews were held with 30 Flemish expert witnesses.

Results

Findings showed, among other things, that larger municipalities are more involved in the organisation of neighbourhood sport. There is a wide diversity of organisational formats, which is largely depending on the type of co-ordinating organisation, as well as on the aims and specific target group. Most municipalities are organising neighbourhood sport as a means of sport stimulation and aim at those groups that are not, or only to a limited extent, participating in (organised) sport. A part from sport stimulation, the larger municipalities (cities) also aim for social integration through these sport initiatives. The most popular target groups are children and youngsters, which are often recruited through schools. There is an increased interest of working together on the local level with other structures. While most organising municipalities encourage participants afterwards to become involved in organised sports (in clubs), there is only a moderate interest of sport clubs to co-operate in neighbourhood sport. Although there is an interest among a majority of the participating municipalities to include new sport activities, the actual programmes mainly consist of traditional sports.

Discussion

Neighbourhood sport can primarily be regarded as a form of sport stimulation and can be situated between unorganised (informal) sport and (traditionally, or alternatively) organised sport. The primary goal is to encourage people to become (more) sports active, be it in a more formal context (e.g., sports clubs), or through regular participation in neighbourhood sport. The choice of activities, as well as the organisational level and type of guidance approach, will vary according to the target group and specific neighbourhood characteristics. Finally, one can ask if neighbourhood sport can perhaps be regarded as a preamble for a future sport-for-all policy (e.g., locally organised, structural co-operation between a number of actors, demand-oriented approach, diversity in organisational formats, broad definition of sport, creative use of infrastructure, etc.).

Poster presentation (PP)

PP3-14 General II (Ethics, History, Law, Communication, Economics) 1/1 - "Exhibition Hall"

BODY BUILD CLASSIFICATION AND PROFICIENCY IN COMPETITIONS OF ADOLESCENT FEMALE VOLLEYBALLERS

Stamm, R., Stamm, M.

University of Tartu, Estonia

There are several anthropometric studies of adolescent female volleyballers, but most researchers have confined themselves only to height, weight and body fat content, which, however, remains insufficient (Avloniti et.al. 2001, Martirosov 2001). The aim of the present study was more detailed research into adolescent female volleyballers' body build and finding its correlations with proficiency in competitions.

The sample consisted of 74 girls aged 13-15 years from the eight most successful volleyball teams of age group U16, who participated in Estonian championships in 2004.

All the girls were measured anthropometrically, 14 body measurements were taken. To record the games, the computer program Game was used. The performance of two opposing teams was recorded simultaneously; in total 56 parallel recordings of 28 matches were made.

The proficiency of each player in performing the elements of the game (serve, reception, block, attack and number of points scored) was related to anthropometric measurements and analyzed in the body build classification. The basis for creating the classification of girls with different age was the mean height, weight and their standard deviations for the whole sample. The 5 SD classification was made by three classes of concordant height and weight and two classes of disconcordant height and weight –pycnomorphs, leptomorphs. The girls' proficiency in the game for the whole tournament was assessed in the same body build classes. The most successful players belonged to the 3 body build class – girls with big height and big weight. The least successful were girls of the 1 class – with small weight and small height. The players of other classes – 2 (medium height, medium weight); 4 (pycnomorphous), 5 (leptomorphous) – occupied an intermediate position. Out of the total number of points (1823), the girls of class 1 scored 5.1% and the girls of glass 3 – 35.6%; classes 2, 4 and 5 – respectively 22.98%, 17.01% and 19.31%.

When we correlated all the anthropometric variables with individual indices of proficiency for elements of the game we found statistically significant correlations between wrist circumference and attack (r = 0.375). Reception of serve was essentially better in the case of smaller circumference of lower chest (r =-0.349), waist (r = -0.411) and hip (r= -0.343).

In summary, we can say that body build is in correlation with player's performance and our body build classification proved to be appropriate for simultaneous assessment of body build and proficiency in the game.

Martirosov E.G. (2001) Body build of sportsmen engaged in Olympic sport events. Acta Kines Univ Tartu,6,172-175

Avloniti A.et al. (2001) Kinanthropometry and body composition of female athletes in various sports during growth. 6th Annual Congress of ECSS 24-28July 2001,279.

JOINT EFFORT OF MÉDIATERROR AND OLYMPIC BUSINESS ON WRESTLING

Barna, T.

Semmelweis University Faculty of Physical Education and Sport Sciences (TF), , Hungary

Introduction

As sport has become a business that is spectacle and intended for consuming, mass communication has almost annexed sport with the help of television. Nowadays a huge amount of sport rules are also modified according to the demands of television and this is true for wrestling as well. The power of the media is doubtless. But it could have become a wonderful means of democracy, e.g. in favor of increasing Olympic profit, but slowly it has been transformed to the symbol of oppression. The contextual values of wrestling started to be transformed as a result of the negative trends of the 90ies.

The sport has to pay a heavy price for these frequent changes in the rules lacking any scientific demanding.

Key-words: wrestling, media, roules , technical points

Methods

The followings were applied during 1250 bouts (WCh'85, Atlanta '96, Athen '04, WCh. 05)
Direct recorded information from the minutes of the bouts
- number of bouts
- duration of bouts
- number of falls
- number of technical points
Indirect observation methods
- simple attack
- complex attack
- attempted attack and completed attacks are registered on a special survey sheet
Results
1. As a result of the changing rules of the past years, wrestlers have minimised their actions initiated from standing, have decreased the number of their complex, but spectacular actions, have set themselves for holds worth one or two points. The number of falls has not changed, but technical falls decreased to half in the past years, so - although suitable to TV broadcasting - wrestling has gradually lost its spectacle and spirit.
2. The number of technical points for a time unit has not changed, which unambiguously means the devaluation of the contextual value of wrestling, although the length of the bouts shows a tendency to decreased.
References
[1]. BARNA T. (1993): Nemzetközi szabadfogású élversenyzők teljesítményének többszempontú elemzése. TF. Budapest. 1993. Doktori értekezés, Könyvtár.
[2]. BARNA T. (2002): Cselekvéshatékonyság vizsgálata küzdősportban. TF. Budapest. 2002. Ph.D értekezés, Könyvtár.
[3]. FÖLDI L. (2002): Földi . Pécs, Minaret Kiadó 186old.
[4]. LENI RIEFENSTAHL (1938) OLIMPIA Turul Video Melbourne 2004.

THE PHENOMENON OF SPORT AS FONTAL FESTIVITIES

Hogenova, A.

Charles University , Czech Republic

Ethical spring of sportive activity. Phenomenological description of festivities. The mystery of festivities as a uncovered delitestence is the base of original meaning of phenomenon sporting activity. Medusa´s head as the manifestation of „logos" in the face of atlete in the moment of the highest performance. The highest performance as the form of sacrifice. Hermeneutical interpretation of sacrifice as „kenosis" (Greek word). Kenosis as the clearance from the shape. The highest performance in sport as „the clearance from the shape." The basic similarity with the base of sacrifice. The aproximation to the holiness. The holiness is identical with phenomenological description of festivities. The loss of festivity today and profane character of existence. The role of sport in the proces of conversion to the authentical life today. Fair play as the source of the clearence from the shape (sacrifice from phenomenological point of view). Sport as the possibility to the authentical life in the presence. Normal people are alive in the imaginings of the future, because the future is more important as the presence. The necessity of explanation of phenomenological character of sport as the access to the ethical education in the schools and in the life.
References:
1. Alkemeyer, T., Sport als Mimesis der Gesellschaft. Zur Auffuehrung des Sozialen im symbolishen Raum des
Sports. In: Zeitschrift fuer Semiotik, H.4, 1997, S. 365-396.
2. Descartes, R., Meditations on First Philosophy. Cambridge: Cambridge University Press 1996.
3. Heidegger, M., Parmenides. Frankfurt am Main: Vittorio Klostermann 1982.
4. McNamee, M., Suffering and Sport. Some Philosophical Considerations. Philosophy of Sport and Other
Essays. Eds. Macura, D., Hosta, M., Faculty of Sport - University of Ljubljana, Slovenia 2004.

READINESS OF ENTREPRENEUR IN SPORT: A STUDY IN PHYSICAL EDUCATION STUDENTS

Tojari, F., Khodayari, A., Rezaean, S.

Azad University, Tehran Branch (Iran) ,Azad University, Karaj Branch (Iran) , Iran

The purpose of this study was to examine readiness of entrepreneur in physical education university bachelor students.75 voluntary students (M=24.23, SD=3.01) were completed entrepreneur readiness questioner (ERQ) .chi square test results indicated that don't significant relationship between entrepreneur in sport and sex . Descriptive statistics results show that 50persent of students was ready for entrepreneur in sport in next five years, 43.3 percent believed that their readiness for entrepreneur in sport is moderate, and 40.5 percent believed their information isn't sufficient for entrepreneur in sport and they must learn more.

Authors index

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

Y

Z