15th CONFERENCE OF BALTIC SOCIETY OF SPORT SCIENCES

CHALLENGES AND SOLUTIONS IN SPORT SCIENCE

APRIL 28–29, 2022

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LITHUANIAN SPORTS UNIVERSITY

15th Conference of Baltic Society of Sport Sciences

CHALLENGES AND SOLUTIONS IN SPORT SCIENCE

Programme and Abstracts

28–29 April, 2022
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In the conference programme, the first speaker indicated in bold and underline is a young scientist and participated in the competition for the award of young scientists

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Prof. Dr. Paweł TOMASZEWSKI
Józef Piłsudski University of Physical Education in Warsaw, Poland

CONFERENCE PROGRAMME

April 28, 2022

9.00–9.15 OPENING AND WELCOMING

Introduction and welcoming conference participants
Prof. Dr. Diana RĖKLAITIENĖ, Rector of the Lithuanian Sports University
Linas OBCARSKAS, Vice-Minister of the Ministry of Education, Science and Sport

9.15–11.45 PLENARY SESSION

Moderators: Prof. Dr. Arvydas STASIULIS, Prof. Dr. Andra FERNĀTE, Prof. Dr. Jaak JÜRIMÄE

9.15
Dr. Alīna KURMEĻEVA
Latvian Academy of Sport Education, Latvia
THE DEVELOPMENT OF PARENTAL COMPETENCE MODEL IN INFANT FLOATING

9.45
Prof. Dr. Bruno FIGUEIRA
Vytautas Magnus University, Education Academy, Lithuania
THE ACUTE PHYSICAL LOAD IN BASKETBALL PLAYERS CONTESTED IN DIFFERENT BASKETBALL GAME EVENTS

10.15
Dr. Eva-Maria RISO
University of Tartu, Estonia
PHYSICAL ACTIVITY AND HEALTH INDICATORS OF ESTONIAN CHILDREN

10.45
Prof. Dr. Jerzy SADOWSKI
Józef Piłsudski University of Physical Education in Warsaw, Poland
THE EFFECTS OF FOCUS OF ATTENTION AND AUTONOMY SUPPORT ON MOTOR SKILL LEARNING

11.15
Prof. Dr. Arvydas STASIULIS, Prof. Dr. Carsten LUNDBY
Lithuanian Sports University, Lithuania; University of Lillehammer, Norway
LSU'S INNOVATIVE MOBILE LABORATORY AND ADVANCED AEROBIC CAPACITY TESTING CAPABILITIES IN MEASURING ATHLETES' TOTAL BLOOD AND HB VOLUME

11.45–12.15 Coffee break

12.15–15.00 PARALLEL SESSIONS

PEDAGOGY AND PSYCHOLOGY IN SPORT + SPORT MANAGEMENT AND SOCIOLOGY
Part 1

Moderators: Prof. Dr. Žermena VAZNE, Prof. Dr. Romualdas MALINAUSKAS, Assoc. Prof. Signe LUIKA, Prof. Dr. Vilija Bitė FOMINIENĖ, Assoc. Prof. Aušra LISINSKIENĖ

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Aleksandrs Astafičevs, Žermēna Vazne, Andra Fernāte
THE DEVELOPMENT OF THE GENERAL METAL TOUGHNESS AND SELF EFFICACY MULTIDIMENSIONAL MODEL

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Laura Batutytė-Gudžiauskė, Sniegina Poteliūnienė
STUDENTS ENJOYMENT OF PHYSICAL EDUCATION, PERCEIVED ATHLETIC COMPETENCE AND LEARNING ENVIRONMENT IN PHYSICAL EDUCATION

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MODERATE-TO-VIGOROUS PHYSICAL ACTIVITY GAME DESIGN AND USE IN PHYSICAL EDUCATION CLASSES: JOYMVPA PROJECT

12.45
Amir Dana, Sheida Ranjbari, Tayebeh Baniasadi, Sedighe Khajeaflatoon Mofrad
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EXPRESSION OF PROSOCIAL AND ANTISOCIAL BEHAVIORAL SKILLS OF YOUNG ATHLETES IN LITHUANIA

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Jānis Šults, Andris Rudzītis, Andra Fernāte
YOUNG BASKETBALL PLAYER'S CHARACTER DEVELOPMENT AS A TOOL FOR ATHLETIC GROWTH VALUE EDUCATION IN BASKETBALL

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Aušra Lisinskienė, Albertas Skurvydas, Marc Lochbaum, Daiva Majauskienė, Dovilė Valančienė, Rūta Dadelienė, Natalja Fatkulina, Asta Šarkauskienė
DID COVID-19 PANDEMIC CHANGE PEOPLE'S HEALTH, LIFESTYLE AND BODY MASS INDEX?

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Aurimas Puodžiūnas, Šarūnas Šniras
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Aušra Lisinskienė, Albertas Skurvydas, Marc Lochbaum, Daiva Majauskienė, Dovilė Valančienė, Rūta Dadelienė, Natalja Fatkulina, Asta Šarkauskienė
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Andra Fernate, Zermena Vazne
CONTENT VALIDITY AND RELIABILITY OF A QUESTIONNAIRE ON TEACHERS' VALUE ORIENTATIONS IN PHYSICAL EDUCATION

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Silvija Baubonytė, Irena Valantinė
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14.05
Anastasija Ropa
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Adam Metelski
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PEDAGOGY AND PSYCHOLOGY IN SPORT + SPORT MANAGEMENT AND SOCIOLOGY
Part 2

Moderators: Prof. Dr. Saulius ŠUKYS, Assoc. Prof. Andre KOKA, Assoc. Prof. Renata RUTKAUSKAITĖ, Assoc. Prof. Artūras SIMANAVIČIUS, Dr. Henry TILGA, Prof. Dr. Michal LENARTOWICZ

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Miglė Bacevičienė, Rasa Jankauskienė, Laima Trinkūnienė
TESTING THE MODERATING ROLE OF THE PARTICIPATION IN SPORTS IN THE ASSOCIATION BETWEEN PERCEIVED MEDIA PRESSURES TOWARDS APPEARANCE, MUSCULAR BODY INTERNALIZATION AND BODY DISSATISFACTION IN ADOLESCENT BOYS

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Nelė Žilinskienė, Stanislav Sabaliauskas, Donatas Gražulis, Tomas Kaukėnas
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Paula Grikietė, Audronė Dumčienė
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Kristina Poderienė, Aistė Žemaitytė, Kristina Motiejūnaitė, Liepa Bikulčienė
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Egle Raim, Audronė Dumčienė
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Aleksandr Iljins, Signe Liuka
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COACHING AND PERFORMANCE
Part 1

Moderators: Assoc. Prof. Ugis CIEMATNIEKS, Dr. Priit PURGE, Prof. Dr. Jonas PODERYS, Prof. Dr. Antanas SKARBALIUS

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Mohammed Amine Azzouzi, Mustafa Söğüt
A SYSTEMATIC REVIEW OF THE EFFECT OF PLYOMETRIC TRAINING ON VERTICAL JUMP PERFORMANCE IN YOUNG BASKETBALL PLAYERS

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Svetlana Rudmieze, Andra Fernate
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Oskars Blaus, Uģis Ciematnieks
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Iva Dimova, Petya Petkova
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COACHING AND PERFORMANCE
Part 2

Moderators: Assoc. Prof. Kristina BRADAUSKIENĖ, Assoc. Prof. Daniele CONTE, Prof. Dr. Dariusz BOGUSZEWSKI, Prof. Dr. Rūtenis PAULAUSKAS

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SPORT PHYSIOLOGY, BIOCHEMISTRY, MEDICINE
Part 1

Moderators: Prof. Dr. Inese PONTAGA, Assoc. Prof. Eglė KEMERYTĖ-IVANAUSKIENĖ, Prof. Dr. Arvydas STASIULIS

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SPORT PHYSIOLOGY, BIOCHEMISTRY, MEDICINE
Part 2

Moderators: Prof. Dr. Sigitas KAMANDULIS, Dr. Nerijus EIMANTAS, Prof. Dr. Vahur OOPIK, Prof. Dr. Jan GAJEWSKI

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PHYSICAL ACTIVITY, RECREATION AND HEALTH
Part 1

Moderators: Assoc. Prof. Kalvis CIEKURS, Assoc. Prof. Miglė BACEVIČIENĖ, Assoc. Prof. Dr. Donatas GRAŽULIS

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Maricarmen Almarcha, Ignacio Gonzalez, Natàlia Balagué
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THE DEVELOPMENT OF THE GENERAL METAL TOUGHNESS AND SELF EFFICACY MULTIDIMENSIONAL MODEL

Aleksandrs Astafičevs, Žermēna Vazne, Andra Fernāte
Latvian Academy of Sports Education, Latvia

Background. When an athlete faces difficulties or finds oneself in stressful situations, the result may be determined by the ability to control one's positive and negative emotions. In the scientific literature, mental toughness is described as one of the most widely used but least understood terms in sports psychology (Gucciardi & Gordon, 2009). Self-efficacy is an important concept in sports where athletes who want to be successful need to believe in their ability to be successful. In modern sport science, the concept of self-efficacy is one of the more widely studied concepts (Rubio, Hernández, Sánchez-Iglesias, Cano, & Bureo, 2018).

Research methods. The sample of respondents consisted of 264 athletes (women and men) aged 18 to 33 years (21 ± 2.96), representing both individual and team sports and with an average of 9.5 ± 0.27 years of experience in sports. The following methods were used to implement the research task: descriptive statistics, factor analysis and modeling.

Results and discussion. A factoral analysis identified a four-factor structure consisting of "Self-efficacy and determimnation", "Self control", "Visualization and Positive cognition" and "Self belief" factors. Determining statistically reliable interrelationships between respondents' indicators of general mental toughness and general self-efficacy, as well as the established four-factor structure, is the basis for a scientifically argued multidimensional factor model.

Conclusions. The implementation of the content of the general mental toughness component and self-efficacy multidimensional factor model contributes to the improvement of the players' general mental toughness and general self-efficacy indicators ($p < 0.05$).

References

Gucciardi, D. F., & Gordon, S. (2009). Revisiting the performance profile technique: Theoretical underpinnings and application. *The Sport Psychologist, 23*(1), 93–117.

Rubio, V. J., Hernández, J. M., Sánchez-Iglesias, I., Cano, A., & Bureo, R. (2018). The effects of coaches' Pre-game Speeches on young players self-efficacy. *Revista de Psicologia del Deporte, 27*(1), 59–66.

Keywords: general mental toughness, self-efficacy, model, sports psychology.

TESTING THE MODERATING ROLE OF THE PARTICIPATION IN SPORTS IN THE ASSOCIATION BETWEEN PERCEIVED MEDIA PRESSURES TOWARDS APPEARANCE, MUSCULAR BODY INTERNALIZATION AND BODY DISSATISFACTION IN ADOLESCENT BOYS

Miglė Bacevičienė, Rasa Jankauskienė, Laima Trinkūnienė

Lithuanian Sports University, Lithuania

Background. Perceived media pressures towards appearance and internalization of body beauty standards are associated with body dissatisfaction (BD) and increased risk of disordered eating behaviours in adolescents (Jankauskiene & Baceviciene, 2021; Neumark-Sztainer et al., 2018). Previous studies suggested that internalization of muscular and athletic body image is associated with body dissatisfaction and disordered eating in boys (Rodgers et al., 2020). Participation in sports has bidirectional associations with body image (Sabistona, Pilab, Vania, & Thogersen-Ntoumani, 2019). The effect of adolescent boys' participation in sports in the association between internalization of the muscular body and BD is highly understudied. Thus, the aim of the present study was to test the mediating role of muscular and athletic body ideal internalization in the association between perceived media pressures and BD in adolescent boys. A secondary aim was to test the moderating effect of different sports practices (none, leisure and competitive sports) in the associations listed above.

Research methods. In 2020, 570 adolescent boys from Lithuanian gymnasiums 11th grade (mean age 17.0 ± 0.4, age range 15–19 years) completed the online survey form containing Sociocultural Attitudes towards Appearance Questionnaire 4 (SATAQ-4) and Body Dissatisfaction from Eating Disorder Inventory 3 (EDI-3) (Baceviciene, Jankauskiene, & Balciuniene, 2020). Cronbach's alphas for the current study were as follows: for the Pressures – Media subscale from the SATAQ-4 0.92, for the Internalization – Muscular/Athletic subscale 0.91, and Body Dissatisfaction subscale from the EDI-3 was 0.72. In addition, study participants were asked to indicate their participation in sports status as none, leisure sports (for recreational purposes) or competitive sports (participation in competitive sport). All study participants provided informed consent before filling in the survey. The Social Research Ethics Committee by Lithuanian Sports University approved the study (protocol No. SMTEK-32, 27-09-2019). Moderated mediation analysis was conducted with the Mplus software version 7.8 (Muthen & Muthen, Los Angeles, CA, USA).

Results and discussion. Mean body mass index (BMI) of the study participants was 22.0 ± 3.0 kg/m^2 (range 15.4–40.6 kg/m^2). Out of 570 boys, 94 (16.5%) declared no participation in sports, 298 (52.3%) participated in leisure-time sports, while 178 (31.2%) in competitive sports. No significant differences in mean BMI and media pressures scores across participation in sports groups were found. Mean scores of the internalization of muscular body were higher in leisure ($M = 2.71$, $SD = 1.23$) and competitive sports groups ($M = 3.00$, $SD = 1.25$) compared to no participation in sports group ($M = 2.26$, $SD = 1.01$, $p < 0.001$). On the contrary, mean BD score was the highest in the group not participating in sports ($M = 1.42$, $SD = 0.75$) compared to leisure ($M = 1.11$, $SD = 0.69$) and competitive sports groups ($M = 1.14$, $SD = 0.69$, $p < 0.01$). Higher BMI correlated with media pressures and BD ($r = 0.11$ and $r = 0.24$, $p < 0.01$, accordingly). Next, media pressures increased muscular body internalization and BD in adolescent boys ($r = 0.13$ and $r = 0.17$, $p < 0.001$). Moreover, internalization of muscular and athletic body did not mediate the association between media pressures and BD in boys (effect = -0.02, SE = 0.02, p = 0.33). Finally, the moderated mediation analysis revealed that participation in sports moderated the association between internalization of muscular body and BD in adolescent boys. The conditional effects in the levels of the moderator were as follows: in the group of boys not participating in any sports muscular body internalization increased BD (effect = 0.16, SE = 0.07, p = 0.02), in the group of leisure sports had no effect (effect = 0.03, SE = 0.03, p = 0.35), while surprisingly in the competitive sports group internalizing muscular body reduced BD in adolescent boys (effect = -0.13, SE = 0.04, p = 0.002) suggesting that participation in sport has protective role for body image of adolescent boys and might be used as effective component of the intervention programs that aim to promote positive body image in boys.

Conclusions. Promoting participation in sports could serve as an effective tool to prevent body dissatisfaction in adolescent boys.

References

Baceviciene, M., Jankauskiene, R., & Balciuniene, V. (2020). Validation of the Lithuanian version of the sociocultural attitudes towards Appearance Questionnaire-4 (SATAQ-4) in a student sample. *International Journal of Environmental Research and Public Health, 17*(3), 932. https://doi.org/10.3390/ijerph17030932

Jankauskiene, R., & Baceviciene, M. (2021). An exploration of the tripartite influence model of body image in Lithuanian sample of young adults: Does body weight make a difference? *Eating and Weight Disorders, 26,* 1781–1791. https://doi.org/10.1007/s40519-020-00996-3

Neumark-Sztainer, D., Wall, M. M., Chen, C., Larson, N. I., Christoph, M. J., & Sherwood, N. E. (2018). Eating, activity, and weight-related problems from adolescence to adulthood. *American Journal of Preventive Medicine, 55*(2), 133–141. https://doi.org/10.1016/j.amepre.2018.04.032

Rodgers, R. F., Slater, A., Gordon, C. S., McLean, S. A., Jarman, H. K., & Paxton, S. J. (2020). A biopsychosocial model of social media use and body image concerns, disordered eating, and muscle-building behaviors among adolescent girls and boys. *Journal of Youth and Adolescence, 49*(2), 399–409. https://doi.org/10.1007/s10964-019-01190-0

Sabistona, C. M., Pilab, E., Vania, M., & Thogersen-Ntoumani, C. (2019). Body image, physical activity, and sport: A scoping review. *Psychology of Sport and Exercise, 42,* 48–57. https://doi.org/10.1016/j.psychsport.2018.12.010

Keywords: media pressures, internalization of body ideals, body dissatisfaction, leisure sports, competitive sports.

STUDENTS ENJOYMENT OF PHYSICAL EDUCATION, PERCEIVED ATHLETIC COMPETENCE AND LEARNING ENVIRONMENT IN PHYSICAL EDUCATION

Laura Batutytė-Gudžiauskė, Sniegina Poteliūnienė
Vytautas Magnus University, Lithuania

Background. Teacher interaction with students influences students' perceptions of competence (Nicaise, Cogerino, Bois, & Amorose, 2006). In the context of physical education (PE), the importance of a high level of perceived competence is particularly emphasized (Ntoumanis, 2001), as the more competent a student feels in the field of PE, the more likely he or she will be to participate in PE. The purpose of this study was to examine the perceived athletic competence and enjoyment in PE of 7th–10th grade students and to investigate associations between perceived athletic competence, enjoyment and teaching dimensions during PE classes.

Research methods. The study sample consisted of 801 7th–10th grade students of Vilnius city (Lithuania) schools: 51% (n = 400) were males and 49% (n = 395) were females. For data collection questionnaire surveys was used. The Perceived Athletic Competence subscale (Self perception profile for adolescents; Harter, 2012) and ESE Model Student Feedback Survey (short version) were applied.

Results and discussion. Analysis of the data showed that males report higher feelings of athletic competence ($p = 0.005$) and enjoyment of physical education ($p = 0.001$) when compared to females. Boys rated all dimensions of teacher activity related to both teaching and content, planning, and evaluation with statistically significantly higher scores ($p = 0.001$) compared to females. Students in grades 9–10 had higher level of perceived competence compared to students in grades 7–8 ($p = 0.014$). Older students rated the dimensions of teacher activity related to content, planning and evaluation better than younger ones ($p = 0.005$). The indicators of athletic competence have a moderate relationship with enjoyment ($r = 0.432$), as well as with the dimensions of teacher content, planning, assessment, and teaching ($r = 0.307–0.311$).

Conclusions. Our results indicate that lower rates of student perceived athletic competence are associated with lower enjoyment of physical education and lower rates of teacher performance in terms of content and teaching. Finding suggest the importance of the learning environment created by the teacher in shaping students' perceptions of their sporting competence.

References

Harter, S. (2012). *Self-perception profile for adolescents: Manual and Questionnaires. Revision*. Denver, CO: University of Denver.

Nicaise, V., Cogerino, G., Bois, J., & Amorose, A. (2006). Students perceptions of teacher feedback and physical competence in physical education classes: Gender effects. *Journal of Teaching in Physical Education, 25,* 36–57. https://doi.org/10.1123/jtpe.25.1.36

Ntoumanis, N. (2001). A self-determination approach to the understanding of motivation in physical education. *British Journal of Educational Psychology, 71,* 225–242.

Keywords: athletic competence, learning environment, physical education, student, teaching.

EFFECTS OF A COMPETENCE-BASED INTERVENTION IN PHYSICAL EDUCATION ON ENHANCING STUDENTS' PHYSICAL ACTIVITY LEVEL: AN ACCELEROMETER-BASED STUDY

Amir Dana[1], Sheida Ranjbari[1], Tayebeh Baniasadi[2], Sedighe Khajeaflatoon Mofrad[3]

[1]Islamic Azad University, Iran; [2]Indiana University, School of Public Health, USA; [3]Farhangian University, Iran

Background. Regular physical activity is associated with positive consequences for physical and mental health of children. Previous studies used self-determination theory, mostly based on the need for autonomy, for creating interventions in the physical education class for improving the level of physical activity among students. The purpose of this study was to further investigate this issue by designing an intervention based on the need for competence. Thus, we examined the aim of a competence-based intervention in the physical education class on improving the level of physical activity in high-school students.

Research methods. Participants included 198 high-school students (mean age of 16.87 years) who studied in regular schools in Iran. Participants were randomly assigned into intervention and control groups. Physical education teachers of the intervention group attended in a training course consisting of several strategies to support need for competence within physical education class. The experimental procedure consisted of the pretest and posttest. Intervention program lasted for four months. We used accelerometers to assess PA pattern during the physical education class. Other variables such as perceived competence support, needs satisfaction, and motivation were measured by using standard questionnaires. Structural equation modelling by using Lisrel software was employed to analyze the data.

Results and discussion. Results showed that competence-based intervention enhanced significantly perceived competence support, basic needs satisfaction, and autonomous motivation from pretest to posttest and follow-up. Moreover, moderate-to-vigorous PA was significantly increased from pretest 15.49%) to posttest (27.74%) in the intervention group. Finally, no significant improvements were observed in the control group regarding all research variables.

Conclusions. School-based interventions might be an appropriate strategy for enhancing motivation and PA among students.

References

Cheon, S. H., Reeve, J., & Song, Y. G. (2016). A teacher-focused intervention to decrease PE students' amotivation by increasing need satisfaction and decreasing need frustration. *Journal of Sport and Exercise Psychology, 38*(3), 217–235. [PMID: 27385730]. doi:10.1123/jsep.2015-0236

Holt, A., Smedegaard, S., Pawlowski, C. S., Skovgaard, T., & Christiansen, L. B. (2019). Pupils' experiences of autonomy, competence and relatedness in 'Move for Well-being in Schools': A physical activity intervention. *European Physical Education Review, 25*(3), 640–658. doi:10.1177/1356336X18758353

Meng, H. W., Whipp, P. R., Dimmock, J. A., & Jackson, B. (2013). The effects of choice on autonomous motivation, perceived autonomy support, and physical activity levels in high school physical education. *Journal of Teaching in Physical Education, 32*(2), 131–148. doi:10.1123/jtpe.32.2.131

Sevil-Serrano, J., Aibar, A., Abós, A., Generelo, E., & García-González, L. (2020). Improving motivation for physical activity and physical education through a school-based intervention. *The Journal of Experimental Education, 32*(8), 942–975. doi:10.1080/00220973.2020.1764466

Sfandyari, B., Ghorbani, S., Rezaeeshirazi, R., & Noohpisheh, S. (2020). The effectiveness of an autonomy-based exercise training on intrinsic motivation, physical activity intention, and health-related fitness of sedentary students in middle school. *International Journal of School Health, 7*(1), 40–47. doi:10.30476/intjsh.2020.84678.1046

Keywords: school-students, physical activity, physical education, competence, accelerometer.

THE DUPLICATED BODY: A NEW FORM OF DUALISM AMONG PREADOLESCENTS

Simone Digennaro, Alice Iannaccone
University of Cassino and Southern Lazio, Italy

Background. The use of social media is widespread among preadolescents, regardless the age restrictions that many providers and platforms have set. On these platforms, the massive representation of their bodies – often vehiculated as filtered images and/or altered videos – is negatively impacting their body image. Many of them experience feelings of insecurity and rejection during a time when their bodies are changing rapidly. This phenomenon is causing a new form of dualism between the perceived body and the representative body, and between the body as a given of nature and its virtual and artificial representation (Digennaro, 2021).

Research methods. The authors carried out a research study to investigate the impact of this new form of dualism on preadolescents' life and their personal wellbeing. To the purpose, a sample of 368 preadolescents (56.51% males) was analyzed through two anonymous and self-administered questionnaires aimed at investigating: what types of social media are used (McLean Paxton, Wertheim, & Masters, 2015); how they use the social media and how they represent their bodies; the relation between the natural and the virtual bodies; the body image (Cash, Fleming, Alindogan, Steadman, & Whitehead, 2002); the level of physical activity. The 89.5% of the respondents (n = 323) declared to frequently use social networks whereas 99% use messaging apps.

Results and discussion. Broadly, YouTube, Tik Tok, Instagram and WhatsApp are the most used social media/apps. The 64.5% of the Tik Tok's users spent more than 2 hours per day on this social media. Results showed that a massive use of social media as platforms where to vehiculate altered copies of the body and constantly exposing bodies of both peers and celebrities is leading to a misperception of the perceived body. Higher use of social media platforms, particularly Instagram, Snapchat, and WhatsApp, corresponded to greater body image concerns, especially among the girls ($p < 0.005$). Moreover, frequent users with a low level of daily physical activity tend to have a distorted body image, with negative influences on their physical and psychological health. They often describe themselves in extreme negative terms with a related body dissatisfaction. The virtual body that they can create on the social media is seen as a model to be pursued and the dualism between the perceived body and the virtual body determines frustration and body disaffection.

Conclusions. The study confirmed the association between social media use, body exposure and wellbeing concerns. It provided evidence on the massive use of the social media/messaging app among the preadolescents regardless the fact that these platforms are not intended for them. Finally, it showed the presence of an inner conflict related to the body that must be further analysed and investigated.

References

Cash, T. F., Fleming, E. C., Alindogan, J., Steadman, L., & Whitehead, A. (2002). Beyond body image as a trait: The development and validation of the Body Image States Scale. *Eating Disorders, 10*(2), 103–113.

Digennaro, S. (2021). *Non sanno neanche fare la capovolta. Il corpo dei giovani e i loro disagi*. Trento: Erickson.

McLean, S. A., Paxton, S. J., Wertheim, E. H., & Masters, J. (2015). Photoshopping the selfie: Self-photo editing and photo investment are associated with body dissatisfaction in adolescent girls. *International Journal of Eating Disorders, 48*(8), 1132–1140.

Keywords: body image, dualism, social network, preadolescents.

CONTENT VALIDITY AND RELIABILITY OF A QUESTIONNAIRE ON TEACHERS' VALUE ORIENTATIONS IN PHYSICAL EDUCATION

Andra Fernate, Zermena Vazne

Latvian Academy of Sport Education, Latvia

Background. Issues related to the values and value orientations as the personal aspect of teachers' professional identity development that dominate in the education of future teachers have become topical in the education policy in the 21st century. Physical education teachers' values highlighted five directions of physical education teachers' value orientations: disciplinary mastery, learning process, self-actualization, social responsibility, ecological integration (Drouet, Roure, Boulley, Pasco, & Lenillon-Kaestner, 2021; Jewett, Bain, & Ennis, 1995). But there was no validated tool to assess Latvian physical education teachers value orientation. The aim of this research is to assess content validity and reliability of the Latvian version of the Questionnaire on Teachers' Value Orientations in Physical Education (VOI-Short Form).

Research methods. The pilot research involved 69 respondents – physical education teachers, including 37 women and 32 men. The following methods were used in the research: the Latvian version of the Questionnaire on Physical Education Teachers' Value Orientations (Chen, Ennis, & Loftus, 1997); expert opinion methods; mathematical statistics (descriptive statistics, Cronbach's coefficient alpha). The adaptation of the questionnaire took place in several stages (International Test Commission, 2017; Zhu & Chen, 2018). The forward–backward translation of the questionnaire was provided by professional English and Latvian philology specialists specializing in sport science. The apparent and content validity was determined. Four experts were invited to determine the content validity. The expert group consisted of 2 scholars, 1 practitioner, and 1 end user.

Results and discussion. Indicators of internal coherence of the questionnaire on physical education teachers' value orientations show a corresponding reliability of the translated Latvian version of the questionnaire, as evidenced by the total Cronbach's coefficient alpha .945 with variation in dimensions from .772 to .884. The highest indicators in terms of arithmetic mean and standard deviation were: disciplinary mastery ($\alpha = .78$). This trend shows the extent to which the traditional approach to the learning programme is being implemented as a priority, where knowledge of the content is extremely important. For teachers who prioritize this value orientation, the learning programme focuses on skills and performance-related knowledge. Learning process ($\alpha = .803$) this value dimension highlights the acquisition of skills and the understanding of learning related to it. The learning experience emphasizes learning progress so that students would understand the relationship between content, as well as add new knowledge to what they have previously learned.

Conclusions. The Latvian version of the Questionnaire on Teachers' Value Orientations in Physical Education (VOI-Short Form) content is valid for use in the Latvian environment. According to results of this research, one of the main aim of the learning programme for PE teachers should be connected to encourage students to become socially responsible and to consider promoting social change.

References

Chen, A., Ennis, C. D., & Loftus, S. (1997). Refining the value orientation inventory. *Research Quarterly for Exercise and Sport, 68*(4), 352–356. https://doi.org/10.1080/02701367.1997.10608016

Drouet, O., Roure, C., Boulley, G. E., Pasco, D., & Lenillon-Kaestner, V. (2021). Development and validity evidence of a Questionnaire on Teachers' Value Orientations in Physical Education. *Measurement in Physical Education and Exercise Science, 25*(3), 250–265. https://doi.org/10.1080/10911367X2021.1876067

International Test Commission (2017). The ITC Guidelines for Translating and Adapting Tests. 2nd edition. Retrieved from www.InTestCom.org

Jewett, A. E., Bain, L. L., & Ennis, C. D. (1995). The curriculum process in physical education. *Psychometrika, 16,* 297–334. doi:10.1007/BF02310555

Zhu, W., & Chen, A. (2018). Value orientation inventory: Development, applications, and contributions. *Kinesiology Review, 7*(3), 206–210. https://doi.org/10.1123/kr.2018-0030

Keywords: value orientation, physical education, content validity and reliability of a questionnaire, Latvian, physical education teacher.

THE CHANGES OF SELF-REGULATION ABILITIES OF LITHUANIAN SPORTS GYMNASIUM COACHES DURING COVID-19 PANDEMIC PERIOD: THE MENTORING PROGRAM EFFECT

Donatas Gražulis[1], Stanislav Sabaliauskas[2], Nelė Žilinskienė[1], Tomas Kaukėnas[1]

[1]Vytautas Magnus University, Education Academy; [2]Vilnius University, Lithuania

Background. Last few years were challenging times for everybody, when it was needed to adopt to changing environment. A learning, as well as coaching, turned hybrid (contact and distance) and coaches were forced to watch the training process in a different way. Self-regulation as a psychological ability is not stable and can fluctuate depending on various circumstances and conditions, so the role of a coach in educational practice during pandemic period is greatly increasing. Researchers (Elferink-Gemser & Hettinga, 2017) recommend coaches in educational practice to encourage athletes to think, regularly plan, monitor, and evaluate their performances in competitions in order to create activity patterns and thus improve athletic performance. In order to change the training environment, coaches need to adopt themselves. The aim of this study was to evaluate how the mentoring program affects self-regulation abilities of Lithuanian sports gymnasium coaches during the COVID-19 pandemic period.

Research methods. During the study period, a program focused on the development of self-regulatory skills was implemented (basing on SMART principles, U theory etc.). To assess coaches' self-regulatory abilities before and after the study, a self-regulatory questionnaire (Brown, Miller, & Lawendowski, 1999) was used, consisting of 63 items divided into seven subscales describing the elements of self-regulation. Nine coaches from sport gymnasiums two times answered the SRQ questionnaire: first in December 2020 and second in March 2021. The level of self-regulation was assessed by calculating the sum of the questionnaire items. The self-regulatory indicator can be: low (up to 213 points or less); average (214 to 238 points); high (239 and above points). The efficiency of research methods was calculated according to the Cohen methodology. A correlation coefficient was calculated to determine the relationships between the subscales.

Results and discussion. At the end of the mentoring program, the coaches' self-regulation capacity increased from 234.0 ± 13.0 to 248.8 ± 17.5 points ($p < 0.05$) (capacity rose from Intermediate (moderate) to High (intact) self-regulation capacity). A statistically significant difference was found in the subscale "Searching for Options" ($p < 0.05$). Medium, high and very high effect size was found in five (out of seven) subscales. More significant correlations between subscales were found in the end of the program.

Conclusions. The mentoring program had a positive effect on the self-regulatory abilities of the coaches. Self-regulated learning stimulates self-monitoring and allows coaches to reflect on how they plan their activities or analyze what has been done and this helps to search for options, find new opportunities how to improve the educational process.

References

Brown, J. M., Miller, W. R., & Lawendowski, L. A. (1999). The self-regulation questionnaire. In L. VandeCreek & T. L. Jackson (Eds.), *Innovations in clinical practice: A source book* (Vol. 17, pp. 281–292). Professional Resource Press/Professional Resource Exchange.

Elferink-Gemser, M. T., & Hettinga, F. J. (2017). Pacing and self-regulation: Important skills for talent development in endurance sports. *International Journal of Sports Physiology and Performance, 12*(6), 831–835. https://doi.org/10.1123/ijspp.2017-0080

Keywords: self-regulation, self-regulated learning, coaching.

PECULIARITIES OF PSYCHOLOGICAL WELL-BEING OF STUDENTS

Paula Grikietė, Audronė Dumčienė
Lithuanian Sports University, Lithuania

Background. According to Ryan and Deci (2000), people inherently desire a lot of subjective well-being, with high subjective well-being providing more opportunities than those with low subjective well-being. Active participation in social activities and involvement in one's community are associated with a higher level of life satisfaction (Helliwell & Putnam, 2005). In this study, we use Ryff's (Ryff & Keyes, 1995) multidimensional model of psychological well-being, encompassing six different components of positive psychological functioning – self-acceptance, personal growth, purpose of life, positive relationship with others, environmental mastery, and autonomy. Students 'psychological well-being is a very important aspect as students' lives are often tense and full of psychological stress (Sharma, Singh, Sharma, Dhaka, & Bharti, 2022).

Research methods. Quantitative research and a survey questionnaire method were used in the study. The Ryff Psychological Well-Being Questionnaire (Ryff & Keyes, 1995) was used and 32 first- and 32 third-year students were interviewed. Respondents were also asked demographic information. All subjects participated in the study voluntarily, and all of them obtained oral consent to participate in the study, providing them with information about the purpose of the study and the use of the results, and the right to withdraw from the study at any time. The research data were processed by the computer program SPSS for Windows 22.0. The level of statistical confidence was $p < 0.05$.

Results and discussion. Our results do not contradict the data of Ludban and Gitimu (2014) that female rated themselves significantly ($p < 0.05$) higher than male in same components of psychological well-being.

Conclusions. Third-year students rate their psychological well-being significantly higher than freshmen, while female students rate their psychological well-being significantly better than male students.

References

Helliwell, J. F., & Putnam, R. D. (2005). The social context of well-being. *The Science of Well-being,* 435–459. https://doi.org/10.1093/acprof:oso/9780198567523.003.0017

Ludban, M., & Gitimu, P. N. (2014). Psychological well-being of college students. *Undergraduate Research Journal for the Human Sciences, 14,* 1–4.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68–78.

Ryff, C., & Keyes, C. (1995). The structure of psychological well-being revisited. *Journal of Personality and Social Psychology, 69,* 719–727.

Sharma, A., Singh, T. P., Sharma, R., Dhakar, J. S., & Bharti, A. (2022). Psychological well-being among college students: A study from Central India. *Asian Journal of Medical Sciences, 13*(1), 46–51.

Keywords: psychological well-being, freshmen, third-year student.

SELF-DETERMINATION THEORY PREDICTING CHANGE IN STUDENTS' MOTIVATION IN PHYSICAL EDUCATION: A ONE-YEAR LONGITUDINAL STUDY

Andre Koka, Hanna Kalajas-Tilga, Henri Tilga, Vello Hein, Lennart Raudsepp

Institute of Sport Sciences and Physiotherapy, University of Tartu, Estonia

Background. According to self-determination theory (SDT) (Deci & Ryan, 2000), for students to be optimally motivated for physical education (PE), it is essential that their basic psychological needs for autonomy, competence, and relatedness in PE lessons are satisfied. A promising way for teachers to foster this is by being autonomy-supportive towards their students, the claim that has received substantial empirical support in a context of PE (Vasconcellos et al., 2020). This study aimed to contribute to the existent literature by testing the long-term predictive validity of SDT in accounting for variance in students' different types of motivation in PE.

Research methods. Secondary school students (n = 265) aged 11 to 15 years (M age = 13.23, SD = .96) from Estonia completed questionnaires on two occasions in time, spinning a one-year interval, measuring perceived autonomy support from PE teachers, perceived psychological need satisfaction for autonomy, competence, and relatedness, and different types of motivation such as intrinsic motivation, identified regulation, introjected regulation, and external regulation in PE. A variance-based structural equation model (SEM) using residualized change scores was used to analyze the data.

Results and discussion. Results of the well-fitting SEM revealed that change in perceived autonomy support from PE teachers positively predicted the change in perceived satisfaction of the needs for autonomy ($\beta = .58$, $p < .001$), competence ($\beta = .47$, $p < .001$), and relatedness ($\beta = .42$, $p < .001$). The change in the need for competence positively predicted the change in intrinsic motivation ($\beta = .37$, $p < .001$), identified regulation ($\beta = .35$, $p < .001$), and introjected regulation ($\beta = .13$, $p < .02$). The change in the need for autonomy positively predicted the change in intrinsic motivation ($\beta = .29$, $p < .001$) and identified regulation ($\beta = .12$, $p < .03$), but negatively the change in external regulation ($\beta = -.24$, $p < .001$). Finally, the change in perceived autonomy support from PE teacher was positively and indirectly related to the change in intrinsic motivation ($\beta = .38$, $p < .001$), identified regulation ($\beta = .26$, $p < .001$), and introjected regulation ($\beta = .11$, $p < .05$), but negatively and indirectly related to external regulation ($\beta = -.13$, $p < .02$), mediated by the change in the need for autonomy and competence.

Conclusions. Results supported main predictions of SDT over a one-year period. Results suggest that giving students the opportunity to choose between activities (autonomy satisfaction), providing them with tasks which are optimally challenging (competence satisfaction), and showing interest in what they are doing (relatedness satisfaction), all behaviors that are characterized as autonomy-supportive, are essential antecedents to optimal motivation of students in PE over time.

References

Deci, E. L., & Ryan, R. M. (2000). The 'what' and 'why' of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01

Vasconcellos, D., Parker, P. D., Hilland, T., Cinelli, R., Owen, K. B., Kapsal, N., Lee, J., Antczak, D., Ntoumanis, N., Ryan, R. M., & Lonsdale, C. (2020). Self-determination theory applied to physical education: A systematic review and meta-analysis. *Journal of Educational Psychology, 112*(7), 1444–1469. https://doi.org/10.1037/edu0000420

Keywords: autonomy-supportive teaching, psychological needs satisfaction, motivational regulations, physical education, residual change score.

MODERATE-TO-VIGOROUS PHYSICAL ACTIVITY GAME DESIGN AND USE IN PHYSICAL EDUCATION CLASSES: JOYMVPA PROJECT

Aušra Lisinskienė[1], Marc Lochbaum[1], Jarek Mäestu[2], Gregor Jurak[2], Jaka Kramaršič[3], Harto Hakonen[4], Jouni Kallio[4], Janne Kulmala[4], Hermanni Oksanen[4], Henri Tilga[2], Andre Koka[2], Evelin Mäestu[2], Maret Pihu[2]

[1]Vytautas Magnus University, Education Academy, Lithuania; [2]University of Tartu, Estonia;
[3]University of Ljubljana, Slovenia; [4]JAMK University of Applied Sciences, Finland

Background. According to World Health Organization (WHO), 82% of children worldwide do not meet physical activity guidelines of at least 60 minutes per day to be physically active (Guthold, Stevens, Riley, & Bull, 2020; Lisinskiene & Juskeliene, 2019; World Health Organization, 2016, 2020). In addition, students spend only 30% of physical education time in classes in moderate to vigorous physical activity. Therefore, the aim of our educational research project was to develop moderate-to-vigorous physical activity-based games that are enjoyable for children during physical education class and communicate this process in our presentation.

Research methods. The research team across different European countries tested many different skill-based games using heart rate sensors and played in 10 min blocks during regular physical education lessons or in similar situations (e.g., a group of children from a sports club). Heart rate was measured with Polar heart rate sensors with the criteria for MVPA was set as 140 beats or higher. In total, the research team tested and analyzed 100 games.

Results and discussion. The outcome of our work is a usable product for PE teachers and coaches with a video and PDF explanation of the teaching game.

Conclusions. The final result of this educational research is multi-lingual videos and PDF format games. 100 games were designed and tested across four different European countries. Foundation: Erasmus+: 2019-1-EE01-KA201-051595.

References

Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2020). Global trends in insufficient physical activity among adolescents: A pooled analysis of 298 population-based surveys with 1· 6 million participants. *The Lancet Child & Adolescent Health, 4,* 23–35.

Lisinskiene, A., & Juskeliene, V. (2019). Links between adolescents' engagement in physical activity and their attachment to mothers, fathers, and peers. *International Journal of Environmental Research and Public Health, 16*(5), 866. https://doi.org/10.3390/ijerph16050866

World Health Organization (2020). *WHO Guidelines on Physical Activity and Sedentary Behaviour*. Switzerland, Geneva: WHO.

World Health Organization, Regional Office for Europe (2016). *Physical Activity Strategy for the WHO European Region 2016–2025*. Switzerland, Geneva: WHO. Retrieved from http://www.euro.who.int/en/publications/abstracts/physical-activity-strategy-for-the-whoeuropean-region-20162025 https://www.euro.who.int/data/assets/pdf_file/0014/311360/Physical-activity-strategy-2016-2025.pdf

Keywords: physical education, moderate to vigorous activity, enjoyment, games.

DID COVID-19 PANDEMIC CHANGE PEOPLE'S HEALTH, LIFESTYLE AND BODY MASS INDEX?

Aušra Lisinskienė[1], Albertas Skurvydas[1, 2], Marc Lochbaum[1, 3], Daiva Majauskienė[1, 4], Dovilė Valančienė[1, 4], Rūta Dadelienė[2], Natalja Fatkulina[5], Asta Šarkauskienė[6]

[1]Vytautas Magnus University, Education Academy, Lithuania; [2]Vilnius University, Lithuania; [3]Texas Tech University, United States of America; [4]Lithuanian Sports University, Lithuania; [5]Vilnius University, Lithuania; [6]Klaipėda University, Lithuania

Background. Research showed that that the COVID-19 pandemic reduced opportunities to participate in sport or exercise in club. But at the same time, many individuals were able to spend more time in regular PA (Kite et al., 2021). Research showed that the isolation associated with COVID-19 had worsened the quality of sportsman training, reduced their daily PA, prolonged the duration of sleep, and worsened their mental health (Ding, del Pozo Cruz, Green, & Bauman, 2020). During COVID-19 episodes, snacking and alcohol consumption increase (Bakaloudi, Jeyakumar, Jayawardena, & Chourdakis, 2021). Study aimed to evaluate whether COVID-19 had an impact on people's Physical Activity Distribution, Eating, and Alcohol Consumption Habits as Well as Body Mass Index.

Research methods. We interviewed 6369 people (4545 women and 1824 men) in Lithuania before the COVID-19 pandemic started and 2392 during COVID-19 (1856 women and 536 men). The subjects were included to represent the Lithuanian population, and participation was anonymous, so data collection and handling were confidential. We used an online survey application to collect information (https://docs.google.com/forms/ (accessed on 6 March 2021)). The following instrument have been used Danish Physical Activity Questionnaire in conducting this study.

Results and discussion. Our findings show that women and men had not stopped PA completely because of lockdown limitations during the COVID-19 (for example, prohibition from attending sport clubs), but they started doing different physical exercises independently, instead of undertaking PA at sport clubs. Despite the increase in independent PA during COVID-19 and the quantity of light PA, the amount of total energy used per day decrease significantly for both genders irrespective of age, although the distributions of SB, MPA, VPA, and MVPA did not change significantly. COVID-19 reduced the duration of sleep for elderly women and increased their VPAextra METs. However, VPAextra decreased for men because of COVID-19. Both genders reported overeating less during COVID-19 than before it, but neither started consuming more alcohol. Thus, to our knowledge, our research showed for the first time how energy usage changed because of the COVID-19 (sleeping, SB, LPA, MPA, VPA, and VPAextra) depending on age and gender.

Conclusions. Women and men had replaced their form of PA at sport clubs with different PA because of the limitations of the COVID-19. The quantity of energy used per day and the quantity of light PA decreased for both genders, although the METs used in SB, MPA, VPA, and MVPA did not change significantly. COVID-19 reduced the duration of sleep for elderly women (the duration of sleep of other subjects did not change) and increased the amount of VPAextra, whereas this measure decreased for men.

References

Bakaloudi, D. R., Jeyakumar, D. T., Jayawardena, R., & Chourdakis, M. (2021). The impact of COVID-19 lockdown on snacking habits, fast-food and alcohol consumption: A systematic review of the evidence. *Clinical Nutrition.* S0261-5614(21)00212-0.

Ding, D., del Pozo Cruz, B., Green, M. A., & Bauman, A. E. (2020). Is the COVID-19 lockdown nudging people to be more active: A big data analysis. *British Journal of Sports Medicine, 54*(20), 1183–1184.

Kite, C., Lagojda, L., Clark, C. C., Uthman, O., Denton, F., McGregor, G., ... & Randeva, H. S. (2021). Changes in physical activity and sedentary behaviour due to enforced COVID-19-related lockdown and movement restrictions: A protocol for a systematic review and meta-analysis. *International Journal of Environmental Research and Public Health, 18*(10), 5251.

Keywords: physical activity, sleep, eating, alcohol consumption, Body Mass Index.

WEIGHT AND OBESITY IN YOUNG ADULTS EXTREMELY INCREASED, BUT THE EXPRESSION OF STRESS AND DEPRESSION DECREASED, THE HEALTH ASSESSMENT DID NOT CHANGE: WHY?

Aušra Lisinskienė[1], Albertas Skurvydas[1, 2], Marc Lochbaum[1, 3], Daiva Majauskienė[1, 4], Dovilė Valančienė[1, 4], Rūta Dadelienė[2], Natalja Fatkulina[5], Asta Šarkauskienė[6]

[1]Vytautas Magnus University, Education Academy, Lithuania; [2]Vilnius University, Lithuania; [3]Texas Tech University, United States of America; [4]Lithuanian Sports University, Lithuania; [5]Vilnius University, Lithuania; [6]Klaipėda University, Lithuania

Background. The aim of this study is to examine adult people (aged 18–74) physical activity, expression of stress, depression, emotional intelligence, logical thinking, and overall health assessment. Hypotheses: 1. Overweight and obesity in young adults (18 to 34 years) females and males, should increase and this should be associated with decreased physical activity, deteriorating subject health, increased stress, depression, and poorer emotion management and EI. 2. The better people's reflective thinking, the more they should live a healthier life (e.g., exercise more and eat healthier), their overweight and obesity should be small or none. We aimed to confirm or reject these two hypotheses.

Research methods. The participants were 6369 research participants (females = 4545 and males = 1824) between the ages of 18 and 74-year-old. The participants were included from Lithuania country to represent the Lithuanian sample. Measures: Danish Physical Activity Questionnaire, Assessment of emotional intelligence, Assessment of impulsivity and The Cognitive Reflection Test

Results and discussion. Our primary hypothesis was only partially confirmed then, as we expected, overweight and obesity in young adults – from 18 to 34 years – increased and especially in the male, and at the same time the lifespan interval decreased in MVPA (consistent with data from other researcher (Bennie, De Cocker, Teychenne, Brown, & Biddle, 2019). Contrary to expectations, subjective health assessment did not change, and feelings of stress and depression decreased (for impulsiveness did not change with age). EI increased at that age and up to 74 years. Research results completely reject the second hypothesis, where increasing BMI with age, logical thinking even decreased. In our case, with a sharp increase in BMI from 18–24 to 25–44 years and a decrease in PA, it would appear that people are about to make an explicit decision to combat the severity of a very important chronic disease (obesity) (Chooi, Ding, & Magkos, 2019). Study results showed that the structure of PA is different in males and females: males have a higher VPA and females have a higher LPA.

Conclusions. Research study showed that18–24 and 25–34 was increase in overweight and obesity, a decrease in PA, while research participants felt less stress and depression, subjective assessment of health did not change, and EI increased steadily with age. We established that females and males who have the highest EI also have the highest MVPA, although LT is not associated with MVPA. So can be said that females and males prefer PA "with a hot heart rather than a cold mind."

References

Bennie, J. A., De Cocker, K., Teychenne, M. J., Brown, W. J., & Biddle, S. J. (2019). The epidemiology of aerobic physical activity and muscle-strengthening activity guideline adherence among 383,928 US adults. *International Journal of Behavioral Nutrition and Physical Activity, 16*(1), 1–11.

Chooi, Y. C., Ding, C., & Magkos, F. (2019). The epidemiology of obesity. *Metabolism, 92,* 6–10.

Keywords: physical activity, mental health, logical thinking, emotional intelligence, adults.

PROFESSIONAL COMPETENCES OF PERSONAL TRAINERS

Artur Litwiniuk[1], Juris Grants[2], Oscar Romero Ramos[3], Bogusz Suchecki[1]

[1]Josef Pilsudski University of Physical Education, Poland; [2]Latvian Academy of Sport Education, Latvia; [3]University of Malaga, Spain

Background. Nowadays, good health and physical fitness are treated as a condition of basic professional and social competences of every human being, as well as a means to achieve a better quality of his life. The links between physical activity and health clearly show that undertaking the WHO-recommended physical activity is an obligation and an integral part of the daily rhythm of human life (Lemura, von Duvillard, & Mookerjee, 2000). This is where an expert personal trainer will be helpful. So far, he has been associated with a recreation or fitness instructor, but when we are talking about an expert, i.e. a person with thorough knowledge in various fields, i.e. substantive and methodological preparation to conduct various activities in the room and outdoors, with various accessories and using various devices, biological regeneration and supplementation and dietetics, controlling the health, motor, somatic and mental effects of the training work done based on the devices (Litwiniuk, Waldzinski, & Grants, 2020). The aim of this research was to define the competences that should be acquired in order to meet the criterion of complementary preparation for work with a potential client.

Research methods. The research was given to 100 personal trainers with at least 4 years of work experience in the profession. Modified interview questionnaire based on the "Test 360" (360-degree feedback) tool, used to obtain multilateral, in-depth information about personal trainers from themselves and their clients, allowing to precisely determine their development and training needs and define the so-called "Competency model" (Kalina, 2020). Additionally, it contains social information as well as lifestyle and dietary information and other.

Results and discussion. The respondents agreed (among the detailed variables) that they are the most important universal features of TP. Whereas 62% of them considered that physical fitness is not the most important. Among the specific features, only two (full availability 98% and pedagogical talent 97% are not recognized by the respondents as significant, the remaining identification variables are recognized by everyone. One of the very important criteria of TP's professional competences is the ability to combine various disciplines of knowledge and practical experience. It is not only about the knowledge of stimulating somatic (biological) human development, but also about combining this knowledge with optimal influence on the mental sphere and social interactions.

Conclusions. It has been observed that a personal trainer must have knowledge about the selection of content and resources for practical classes and information about a healthy lifestyle, the impact of exercise on the body and mind, including the elimination or reduction of stress. The acquired didactic skills can pass this knowledge to people and influence their way of thinking and understanding physical activity as an important element of life.

References

Kalina, R. M. (2020). Language and methods of innovative agonology as a guide in interdisciplinary research on interpersonal relationships and people with the environment – from micro to macro scale. *Archives of Budo, 16,* 271–280.

Lemura, L. M., von Duvillard, S. P., & Mookerjee, S. (2000). The effects of physical training of functional capacity in adults. Ages 46 to 90: A meta-analysis. *The Journal of Sports Medicine and Physical Fitness, 40,* 1–10.

Litwiniuk, A., Waldzinski, T., & Grants, J. (2020). Professional competences of personal trainers. *Archives of Budo Science of Martial Arts and Extreme Sports, 16,* 73–78.

Keywords: personal trainer, professional competences, health, physical fitness.

CAN INJURIES OR DISEASES ENHANCE ATHLETE'S AWARENESS?

Lluc Montull, Silvia Fernández, Natàlia Balagué
National Institute of Physical Education and Sport, Spain

Background. Traumatic experiences as injuries or diseases seem that may increase athlete's awareness of previous ignored internal and external information (Gray, 2015; Montull, Slapsinskaite-Dackeviciene, Kiely, Hristovski, & Balagué, in press; Slapšinskaitė, Hristovski, Razon, Balagué, & Tenenbaum, 2017). It is underexplored but may have important applications to improve self-regulation of health and performance. For that reason, this study aims to prove whether athletes who have suffered traumatic experiences have higher awareness and perception of their organismic changes compared with those who have not suffered this type of experiences.

Research methods. A questionnaire, in current process of validation, was applied to 203 athletes of different levels. It consisted in 19 questions aiming to inform about the perceptive level of the organismic and environmental changes (1-to-5 scale). The results were compared between two groups, those who reported that have suffered a traumatic injury or disease (TG, n = 63), and those who did not (NTG, n = 139). A Kruskal–Wallis ANOVA was used to compare both groups.

Results and discussion. The main findings showed that TG compared with NTG perceived more the: a) psychosomatic disorders ($X2 = 4.24$, $p = 0.04$), b) the physiological dysfunctions ($X2 = 4.04$, $p = 0.04$), and c) the inflammatory states of their organism ($X2 = 6.97$, $p < 0.01$). Traumatic experiences as injuries or diseases seem to enhance athlete's awareness and the value of subjective perceptions. In particular, increasing the capacity to perceive better the psychobiological changes of their organism. It was not significantly proved that this capacity also permits to perceive better the environmental changes, despite the embodied property between the organism and the environment (Balagué, Hristovski, & García-Retortillo, 2019).

Conclusions. This study suggests that such awareness enhancement may have practical implications to improve self-regulation and self- monitoring for preventing injuries and promoting performance (Saw, Main, & Gastin, 2015). Future research is warranted in this sense, but also to investigate how educative strategies may develop athlete's awareness without suffering traumatic experiences (Montull et al., in press).

References

Balagué, N., Hristovski, R., & García-Retortillo, S. (2019). Perceived exertion – dynamic psychobiological model of exercise-induced fatigue. In G. Tenebaum and R. Eklund (Eds), *Handbook of Sport Psychology*. 4th ed. New York: John Wiley & Sons.

Gray, R. (2015). Differences in attentional focus associated with recovery from sports injury: Does injury induce an internal focus? *Journal of Sport & Exercise Psychology, 37*(6), 607–616. https://doi.org/10.1123/jsep.2015-0156

Montull, L., Slapsinskaite-Dackeviciene, A., Kiely, J., Hristovski, R., & Balagué, N. (in press). Integrative proposals of sports monitoring: Subjective outperforms objective monitoring. *Sports Medicine-Open*.

Saw, A. E., Main, L. C., & Gastin, P. B. (2016). Monitoring the athlete training response: Subjective self-reported measures trump commonly used objective measures: A systematic review. *British Journal of Sports Medicine, 50*(5), 281–291. https://doi.org/10.1136/bjsports-2015-094758

Slapšinskaitė, A., Hristovski, R., Razon, S., Balagué, N., & Tenenbaum, G. (2017). Metastable pain-attention dynamics during incremental exhaustive exercise. *Frontiers in Psychology, 7,* 2054. https://doi.org/10.3389/fpsyg.2016.02054

Keywords: self-regulation, self-monitoring, organism, environment, health.

EXPRESSION OF PROSOCIAL AND ANTISOCIAL BEHAVIORAL SKILLS OF YOUNG ATHLETES IN LITHUANIA

Eimantas Pocius, Romualdas Malinauskas
Lithuanian Sports University, Lithuania

Background. Prosocial reasoning is said to begin to regress during late adolescence (Eisenberg, Hofer, Sulik, & Liew, 2014), so prosocial adolescent behavior observed during this period is a more controlled ability than an impulsive skill (Bergin et al., 2018). However, the expression of impulsive behavior (skills) is very important in team sports. Thus, it is likely that it is important to develop prosocial behavior skills in late adolescence, but before developing skills development programs, it is important to answer the problematic question: are there differences in prosocial and antisocial behavior between cadets and junior athletes in Lithuania?

Research methods. The study involved 64 cadets (aged 15–16) and 70 junior basketball players (aged 17–18) from 8 sports schools. To assess prosocial and antisocial behavior skills, the Kavussanu and Boardley (2009) Questionnaire on Prosocial and Anti-Social Behavior in Sport (PABSS) adapted by Šukys (2010) was used in Lithuania. Unlike other, prosocial and antisocial behavior questionnaires, this questionnaire is designed exclusively for the sports context. Each statement in the questionnaire was rated on a 5-point Likert scale. The questionnaire consists of 4 subscales: antisocial opponent; antisocial team-mate; prosocial opponent; prosocial team-mate.

Results and discussion. The results of the study revealed statistically significant results on three scales. On the scale of antisocial behavior with teammates, cadets athletes showed higher rates ($t(132) = 2.05$; $p < 0.05$), which means that younger team sports players tend to be more antisocial towards their teammates compared to older junior athletes. On the scale of prosocial behavior skills with opponents ($t(132) = -2.84$; $p < 0.01$) and on the scale of prosocial behavior skills with teammates ($t(132) = -4.86$; $p < 0.01$), junior athletes showed better skills. No statistically significant results were found on the scale of antisocial behavior of opponents. The results of this study partly coincide with the results of a study conducted by Juodsnukis (2018) with cadets and junior footballers: junior athletes have better prosocial skills with the team compared to cadets skills.

Conclusions. A comparative analysis of the prosocial and antisocial behavior of Lithuanian cadets and junior basketball players revealed that junior athletes have better prosocial skills with teammates and opponents, and are more likely not to behave antisocially with teammates.

References

Bergin, C. C., Bergin, D. A., Walker, S., Daniel, G., Fenton, A., & Subban, P. (2018). *Child and adolescent development for educators*. Cengage AU.

Eisenberg, N., Hofer, C., Sulik, M. J., & Liew, J. (2014). The development of prosocial moral reasoning and a prosocial orientation in young adulthood: Concurrent and longitudinal correlates. *Developmental Psychology, 50*(1), 58. doi:10.1037/a0032990

Juodsnukis, D. (2018). *Sporto mokyklų mokinių socialinės atsakomybės ugdymas*. Doctoral dissertation. Kaunas: LSU.

Kavussanu, M., & Boardley, I. D. (2009). The prosocial and antisocial behavior in sport scale. *Journal of Sport and Exercise Psychology, 31*(1), 97–117. doi:10.1123/jsep.31.1.97

Šukys, S. (2010). Prosocialaus ir antisocialaus elgesio skalės bei jaunimo vertybių sportinėje veikloje klausimyno adaptavimas lietuviams. *Ugdymas. Kūno Kultūra. Sportas, 3*(78), 97–104.

Keywords: prosocial behavioral, antisocial behavioral, young athletes.

PSYCHOPHYSIOLOGICAL ASSESSMENT OF ELITE ATHLETE'S MENTAL STATE DURING STRESS TESTS AND PRE-COMPETITIVE CONDITION

Kristina Poderienė[1], Aistė Žemaitytė[2], Kristina Motiejūnaitė[1], Liepa Bikulčienė[3]

[1]Lithuanian Sports University; [2]Lipse; [3]Kaunas University of Technology, Lithuania

Background. Elite athletes require an extraordinary physiological performance combined with good mental functioning. Their decisions must be accurate and fast. However, psychophysiological state may influence the performance of athletes and the individual corrections of certain physiological states during which the athlete achieves his best results and the control of the aforementioned states is the issue. There various methods to assess the mental peculiarities of athletes, and galvanic skin response (GSR) is concerned as the most informative parameter indicating this physiological state. On the other hand, the practical application of GSR has some difficulties why this the need to have more methods for operational assessment and monitoring of athletes mental state are still in agenda. The task of this study was to verify the developed digital program integrating psychophysiological parameters for operational assessment and monitoring of athlete's mental state. Acknowledgement. This research was funded by a grant (No. 1.2.2-MITA-K-702) from the Agency for Science, Innovation and Technology (MITA) regarding the project "Stimulate continuous monitoring in personal and physical health" ITEA-2019-19008-Inno4Health.

Research methods. This research aimed to compare the changes in GSR and in other psychophysiological data of elite athletes in short-time period before the start in the competition (Covassin, Elbin, & Nakayama, 2010) and after the artificially developed pre-stress state (Mondéjar, Hervás, Johnson, Gutiérrez-López-Franca, & Latorre, 2019). The 8 athletes, i.e. the members or candidates of the Lithuanian national Olympic team take part in this study. The GSR and indices of heart rate (HR), heart rate variability (HRV), respiration (R) and EMG parameters was registered at 30–60 minutes before the start in the competition. The correlation between the changes of GSR and integrated value of registered physiological parameters was considered.

Results and discussion. We observed significant changes of registered psychophysiological parameters while comparing the states of a state without pre-competition excitement and during the precompetitive stress or the artificially developed pre-stress state. The strong correlation ($r = 0.89$, $p < 0.01$) was found between the changes in GSR and integrated value of chose psychophysiological parameters (HR, HRV, R and EMG). The results obtained during this study are promising, i.e. the simpler way to obtain the valuable information about the pre-competitive athlete's mental reaction is available.

Conclusions. The strong correlation between the psychophysiological parameters registered in the pre-competition and the artificially induced stress states indicate that the developed digital programs integrating psychophysiological parameters could be more simple way to assess, monitor and to train mental abilities of elite athletes.

References

Covassin, T., Elbin, R. J., & Nakayama, Y. (2010). Tracking neurocognitive performance following concussion in high school athletes. *Physician and Sportsmedicine, 38*(4), 87–93.

Mondéjar, T., Hervás, R., Johnson, E., Gutiérrez-López-Franca, C., & Latorre, J. M. (2019). Analyzing EEG waves to support the design of serious games for cognitive training. *Journal of Ambient Intelligence and Humanized Computing, 10*(6), 2161–2174.

Scharfen, H. E., & Memmert, D. (2019). Measurement of cognitive functions in experts and elite athletes: A meta-analytic review. *Applied Cognitive Psychology, 33*(5), 843–860.

Keywords: athlete's mental state, stress, pre-competitive conditioning.

EXPRESSION OF COMPETITIVE PSYCHOLOGICAL SKILLS OF U16 YOUNG BASKETBALL PLAYERS DURING TRAINING AND COMPETITION

Aurimas Puodžiūnas, Šarūnas Šniras
Lithuanian Sports University, Lithuania

Background. Recently, more and more attention is paid to psychological skills of young athletes. Basketball like other sports requires competitive psychological skills which may affect athletes' effectiveness (Nanda & Dimyati, 2019; Sheldon, Zhaoyang, & Williams, 2013). Psychological skills are an important component of athletes' preparation and have a major impact on the success of basketball players (Landkammer, Winter, Thiel, & Sassenberg, 2019). Athletes who have appropriate competitive psychological skills feel more satisfied with sports activities, interpersonal relationships, trust coach's decisions, they are able to overcome negative emotions faster as well as adapt more easily during both training and competitions. However, researches has not yet shown how psychological competitive skills of young basketball players manifest themselves during training and competition.

Research methods. A questionnaire on competitive psychological skills was applied (Tokunaga & Hashimoto, 1998). The questionnaire consists of 35 statements with 7 statements for each of the five competitive psychological skills. This questionnaire allowed to assess the following skills: the ability to strengthen competitive motivation, the ability to stabilize the emotional state, self-confidence, the ability to anticipate further actions, the ability to cooperate. The average score for each skill shows their level: 1–1.4 points – very bad skills, 1.5–2.4 points – bad skills, 2.5–3.4 – satisfactory skills, 3.5–4.4 score – good, 4.5–5 points – very good skills. The study involved U16 young boys from two Basketball sports schools (n = 51), who have competed in the championship of Lithuanian Students' Basketball League Division A. Prior to the survey, verbal consent was obtained from each team coach to conduct a questionnaire survey. The purpose of the survey was explained to each young basketball player and the anonymity of the data was ensured. The survey was conducted 30 minutes in advance to training and competition.

Results and discussion. The obtained data of the research shows that young basketball players evaluate competitive psychological skills statistically more favorably during training than competitions. The results of young basketball players allow to state that in training they do better to increase competitive motivation (4.11 + 0.49 and 3.58 + 0.25), to be self-confident (3.76 + 0.39 and 3.24 + 0.31), stabilize the emotional state (3.87 + 0.48 and 3.43 + 0.39), communicate more effectively (4.28 + 0.44 and 3.66 + 0.37) and anticipate further actions (3.64 + 0.58 and 2.98 + 0.44). The fact that young basketball players rate competitive psychological skills with higher scores may be explained by that they are not overwhelmed by a sense of responsibility in training than participating in competitions.

Conclusions. Comparing the expression of competitive psychological skills of U16 young basketball players during trainings and competitions, it is revealed that they excite their inner forces better during trainings, are able to manage enhanced emotional experiences better, more rationally understand the set goals, which are able to perform, more efficiently exchange information with teammates or a coach, more quickly predict actions of teammates or competitors in competitive situations.

References

Landkammer, F., Winter, K., Thiel, A., & Sassenberg, K. (2019). Team sports off the field: Competing excludes cooperating for individual but not for team athletes. *Frontiers in Psychology,* 2470.

Nanda, F. A., & Dimyati, D. (2019). Psychological skills of Indonesian basketball athletes in Asian Games 18. *Journal of Physical Education, Sport, Health and Recreation, 8*(1), 37–43.

Sheldon, K., Zhaoyang, R., & Williams, M. (2013). Psychological need-satisfaction, and basketball performance. *Psychology of Sport and Exercise, 14*(5), 675–681.

Tokunaga, M., & Hashimoto, K. (1988). A study on the training of psychological competitive ability for athletes: On making the diagnostic inventory. *Journal of Health Science, 10,* 73–84.

Keywords: young basketball players, competition psychological skills, ability to strengthen competition-related motivation, ability of self-confidence, ability to stabilise emotional state, ability to communicate, ability to anticipate.

EXPRESSION OF EMOTIONAL INTELLIGENCE AMONG ATHLETIC AND NON-ATHLETIC STUDENTS

Egle Raim, Audronė Dumčienė

Lithuanian Sports University, Lithuania

Background. Emotional intelligence (EI) is a set of skills that help you accurately assess and express your own and others' emotions, effectively regulate your own and others' emotions, and use feelings in your life to motivate, plan, and pursue (Salovey & Mayer, 1990). Ability models measure a person's ability to solve emotional problems (Magrum, Waller, Campbell, & Schempp, 2019). Research in the field of sport shows that EI has a positive effect on the performance of athletes. EI influences sport-related variables such as psychological skills, training, athletes' performances, reinforces various psychological skills such as pre-competition anxiety, self-confidence, and psychological strength (Magrum et al., 2019).

Research methods. Emotional intelligence was measured using The Assessing Emotions Scale (Schutte, Malouff, & Bhullar, 2009). The scale evaluates four emotion management abilities: perception of emotions, managing one's emotions, and using other people's emotions. Respondents were also asked demographic information. All subjects participated in the study voluntarily, and all of them obtained oral consent to participate in the study, providing them with information about the purpose of the study and the use of the results, and the right to withdraw from the study at any time. 80 athletic and non-athletic students' were surveyed. The level of statistical confidence was $p < 0.05$.

Results and discussion. The estimates of EI components of managing one's emotions and using emotions in athletic students were statistically significantly ($p < 0.05$) higher than in non-athletic students. The score of the EI component managing other people's emotions was statistically significant ($p < 0.05$) higher in non-athletic students than in athletic students. Estimates of the component of the perception of emotions differ non-significant ($p > 0.05$). Most EI components of students athletic have higher scores than those non-athletic. Our results are confirmed by Ubago-Jiménez, González-Valero, Puertas-Molero and Garcia-Martínez (2019) view that EI may be related to the motivation of athletes to play sports.

Conclusions. Athletic students have a higher level of emotional intelligence than non-athletic students. It is likely that higher levels of emotional intelligence motivate students to play sports.

References

Magrum, E. D., Waller, S., Campbell, S., & Schempp, P. G. (2019). Emotional intelligence in sport: A ten-year review (2008–2018). *International Journal of Coaching Science, 13*(2).

Salovey, P., & Mayer, J. D. (1990). Emotional intelligence. *Imagination, Cognition and Personality, 9*(3), 185–211.

Schutte, N. S., Malouff, J. M., & Bhullar, N. (2009). The Assessing Emotions Scale. *Assessing Emotional Intelligence The Springer Series on Human Exceptionality,* 119–134.

Ubago-Jiménez, J. L., González-Valero, G., Puertas-Molero, P., & Garcia-Martínez, I. (2019). Development of emotional intelligence through physical activity and sport practice: A systematic review. *Behavioral Sciences, 9*(4), 44–54.

Keywords: athletic student, non-athletic student, emotional intelligence.

YOUNG BASKETBALL PLAYER'S CHARACTER DEVELOPMENT AS A TOOL FOR ATHLETIC GROWTH VALUE EDUCATION IN BASKETBALL

Jānis Šults, Andris Rudzītis, Andra Fernāte
Latvian Academy of Sport Education, Latvia

Background. In Latvia's sports practice we see that coaches attention is mostly focused on the development of the athlete physical characteristics, performance indicators, team statistics, success, while leaving athlete personality – character, will, attitude development in the background. As European Sports Charter indicates, the main thing is the athlete and only then is the results. Researchers reveals sport has become as part of pedagogy, cultural aspect and also as a mass product for consumption. Other study indicates that university graduates who have been involved in sports are more likely paid 18 percent more than others, but Kavussanu research concludes that sport can develop both positive and negative character traits. International Olympic Committee Code of Ethics defines that the main purpose of doing sports is to achieve harmoniously developed man. In the same time EU institutions provides statements for growing unfairness in sport. Now World Anti-Doping Agency (WADA) have developed preventive measures for drawing attention to the causes of unfairness in sport and prevent the effects of cultivating negative character traits while training young athletes. Programs like, sport values in every classroom, true sport materials, etc. However, current experience shows that achievement of sport results as fast and as high as possible for most youth coaches is a priority of their work. Basketball, sports games, are no exception. Such a training attitude is determined by many factors, both objective and subjective. Also there are many different examples in team sports practice where players with higher intellectual, educational and moral qualities achieve higher athletic performance results. Question arises, how to implement value education in basketball practice and have to train positive character, personality traits to ensure a successful training process and long-term personality development in basketball and life. Aim of the study is to develop psychological training content for youth basketball players.

Research methods. Literature review: summarize specific research questions and existing knowledge in a subject area. Questionnaires and interviews. Pedagogical observation. Mathematical statistics (Multinominal regression model). Examine relations between participant reported answers. Multi-factor predictive correlation design will be used to examine relationships between variables.

Results and discussion. From anatomical point of view professor Aboltiņa (1998) points out that the movement analyzer not only participates in development of complex movement skills and abilities, but also improves the development of the central nervous system, that affects the childs' intelligence growth. Therefore, it is necessary to provide childs' activity by participating in sports. Accordingly for practicing a successful training process we need to admit, that central nervous system is ahead of other systems in its development at all ages. CNS regulates the growth, development and function of other organs. Author concludes that rationally organized extracurricular work can make a purposeful adjustment in the development of adolescents personalities and teacher's activity includes a continuous and quite diverse effect on the students psyche. Tomasuna (1993) also emphasize that teacher activity includes diverse effects on students psyche: on feelings, perceptions, memory, thinking, emotions, feelings, will, on character and personality in general. Educators work usefulness depends on what these effects are and how they are perceived by students. Bogolovska (1978) indicates that feelings are the basic course of our consciousness, which provides the basis for perception, memory, etc. Goleman concludes that emotional competence is taught ability that is based on emotional intelligence and is reflected in outstanding performance of professional field. Question arises about the aim of sports pedagogy practice – victories, motivation, skills, achievement goals, ego and social goals. As long time practitioner in theory and pedagogical work, doctor Spona (2004) indicates, that the unity of upbringing and teaching first of all is determined by the set of goals and the whole development of children. All upbringing, education, teaching is aimed at fostering the development of harmonious and well-developed personality, characterized by progressive value orientation, free consciousness, independence and responsibility. The objective aspect of teaching process is characterized by the aim, principles, means, content, methods and forms that are developed in theory and practice. The most important is the subjective aspect or improvement of the child development, goals, needs, emotional experiences, interests, character. This aspect is less studied both in theory and practice, as it is individual for each student. Essence of education are relations between these objective and subjective components of upbringing process. We need to admit that in practice the subjective aspect of education process has not become as aim in the family or in the teaching activities. Knowledge, goal orientation still dominates as aim, not values and attitudes towards others and the world. Promoting confidence, inspiration and passion in everyday activities and building attitudes have been left behind. Spona (2004) recalls, that Karl Deken (1866–1942) have admitted that further development of the whole child depends on how fast the will grows, because the skills of children with stronger will develop faster, and also refers to russian teacher Danilov, who indicates that true teaching is one that successively causes children to need to invest their talents, abilities in activities, that forms their ideal and independent judgments, teaching that continues in self-education.

Conclusions. Physical education and sports is in itself an area which generates and stimulates human behavior, being capable of giving value to the whole pack of human competences. Intellectual development is related to emotional and will development. Prolonged emotional processes, sports practices form feelings. Their formation is related to the development of the will, ability to consciously regulate activities and mental processes, subjecting them to conscious

decisions, related to motivation, lasting confidence in special actions and situations. Attitudes that are entrenched in systematic action form personality traits. Teaching methods are one of the most important factors in organizing upbringing and promoting self-education. The aim of teaching activity is to promote the formation of student attitudes. The subject of upbringing is always the diverse attitudes of students. Jansone (2016) emphasize ideas of Michel Monten (1533–1592) – we raise not the body, but a human being, it is not necessary to make two of them. I agree to his ideas to combine physical education activities, mental education and moral development in a unified pedagogical process. That's why in basketball coaching practices it is necessary to aim not only on skilled basketball player, victory achievement, but overall on right value, attitude development as a team and individually. Theoretical basis provides a necessity for collecting psychological training content for youth basketball players.

References

Āboltiņa, M. (1998). *Kā aug mūsu bērns*. SIA: Datorzinību centrs.

General Secretariat of the EU Council (2017). *Draft conclusion on combating corruption in sport*. Retrieved from https://www.consilium.europa.eu/nl/documents-publications/public-register/public-register-search/results/?AllLanguagesSearch=False&OnlyPublicDocuments=False&DocumentLanguage=EN&ImmcIdentifier=ST%2013349%202019%20INIT

IOC (International Olympic Committee) Executive Board (2015). *Code of Ethics*. Retrieved from https://stillmed.olympic.org/media/Document%20Library/OlympicOrg/IOC/What-We-Do/Leading-the-Olympic-Movement/Code-of-Ethics/EN-IOC-Code-of-Ethics-2016.pdf

Jansone, R., Fernāte, A., Bula-Biteniece, I. (2016). *Sporta pedagoģija vakar, šodien, rīt*. SIA: Izdevniecība RaKa.

Špona, A. (2004). Audzināšanas process teorijā un praksē. "Izdevniecība RaKa", SIA.

Tomašūna, I. (1993). Psiholoģisko likumsakarību izmantošana uztverē.

World Anti-Doping Agency (WADA) (2021). *The sport values in every classroom*. Retrieved from https://www.wada-ama.org/en/sport-values-every-classroom

Keywords: attitude, values, self-education, will, success.

NON-RELATIONSHIP BETWEEN FEAR OF FAILURE AND RUNNERS PERFORMANCE

Mabliny Thuany, Douglas Vieira, Beat Knechtle, Thayse Natacha Gomes
University of Porto, Portugal

Background. Fear of failure (FoF) has been reported to be related to worry, anxiety psychological stress, and a reduced sense of accomplishment, which is strongly linked to dropout in sport. However, no information about FoF in runners of different competitive levels is available. The purpose of the present study was to investigate the FoF in Brazilian runners of different competitive levels and age categories; and to verify the relationship between economic level and FoF.

Research methods. A total of 916 runners (41.9% women; 58.6% men) were sampled. Age, sex, body height, body weight, socioeconomic level (SES) and running pace variables were self-reported by the participants. The Multidimensional Questionnaire of FoF was applied in an online platform. Running pace (≤4 min/km; >4–5 min/km; >5–6 min/km; and >6 min/km), age (18–20 yrs., 21–30 yrs., 31–40 yrs., 41–50 yrs., 51–60 yrs., and >60 yrs.) and SES (in '≤1 minimum wage', '1–3 minimum wage', '>3–5 minimum wage', '5–10 minimum wage' and '>10 minimum wage') were categorized. Data normality was checked using the Kolmogorov–Smirnov test. To identify differences in FoF components between performance level and age categories, a multivariate analysis of variance was conducted by sex, and Pillai's trace values were considered, given that variance and covariance homogeneity was not observed. Eta squared (n^2) was used as a measurement of the effect size. Spearman correlation (r) was performed to relationship between SES and FoF, stratifying by sex. SPSS software was used for statistical analysis, considering $p < 0.05$.

Results and discussion. Mean age was 37.7 ± 9.6 years, and athletes covered ~33.5 ± 24.9 km/week. 9.4% of athletes were classified as high-performance level runners (1.8% women and 14.7% men). For women, runners with a better performance level (≤4 min/km) and those aged 21–30 years presented the highest mean values for FoF. For men, runners with worse performance and older than 60 years presented the highest values for FoF. The multivariate analysis showed for both sexes non-significant differences according to sex and performance level. For woman, SES was negatively linked with FoF (r = -0.144; 95%CI = -0.24– -0.04). For men, a positive and significant association between performance level and SES was observed (r = 0.290; 95%CI = 0.204–0.368). These results can be related to the competitive level of the sample studied, where most of them can be named as recreational runners (Thuany, Gomes, & Almeida, 2020). In the contrary, for the competitive high-performance sports, athletes feel a greater pressure to demonstrate their skills/abilities, since their performance is being judged by others, with the expectation of probable success, making the FoF manifest more intensely (Gómez-López, Chicau Borrego, Marques da Silva, Granero-Gallegos, & González-Hernández, 2020; Molenaar, Willems, Verbunt, & Goossens, 2021). The inverse relationship between SES and FoF in women can be related to social aspects, whereas commitment in running can be related to social ascension/social prestige which has been shown in African runners (Onywera, Scott, Boit, & Pitsiladis, 2006), Brazilian players' soccer (Uehara et al., 2021). However, the sample size and the lack of information regarding motivation limit the generalization.

Conclusions. Non-professional Brazilian runners present the lowest FoF. Women aged 21–30 years with a better performance, and men aged >60 years with a worse performance presented the highest FoF values. A negative relationship was verified for SES and FoF in women runners.

References

Gómez-López, M., Chicau Borrego, C., Marques da Silva, C., Granero-Gallegos, A., & González-Hernández, J. (2020). Effects of motivational climate on fear of failure and anxiety in teen handball players. *International Journal of Environmental Research and Public Health, 17*(2), 592. https://doi.org/10.3390/ijerph17020592

Molenaar, B., Willems, C., Verbunt, J., & Goossens, M. (2021). Achievement goals, fear of failure and self-handicapping in young elite athletes with and without chronic pain. *Children (Basel, Switzerland), 8*(7), 591. https://doi.org/10.3390/children8070591

Onywera, V., Scott, R. A., Boit, M. K., & Pitsiladis, Y. P. (2006). Demographic characteristics of elite Kenyan endurance runners. *Journal of Sports Science, 24*(4), 415–422. https://doi.org/10.1080/02640410500189033

Thuany, M., Gomes, T. N., & Almeida, M. B. (2020). Is there any difference between "amateur" and "recreational" runners? A latent class analysis. *Motriz, Rio Claro, 26*(4). https://doi.org/10.1590/S1980-65742020000400140

Uehara, L., Falcous, M., Button, C., Davids, K., Araújo, D., de Paula, A. R., & Saunders, J. (2021). The poor "wealth" of Brazilian football: How poverty may shape skill and expertise of players [original research]. *Frontiers in Sports and Active Living, 3*. https://doi.org/10.3389/fspor.2021.635241

Keywords: running, fear of failure, endurance.

EXPRESSION OF YOUNG ATHLETES' SELF-REGULATION ABILITIES, PERCEIVED SPORTS COMPETENCIES AND SATISFACTION WITH SPORTS ACTIVITIES DURING THE COVID-19 PANDEMIC

Nelė Žilinskienė, Stanislav Sabaliauskas, Donatas Gražulis, Tomas Kaukėnas

Vytautas Magnus University, Lithuania

Background. The pandemic period of COVID-19 caused significant challenges, difficulties, limitations, anxiety. The restrictions imposed have had a significant impact on physical activity and sports. It should be noted that self-regulated learning (SRL) strategies help to better meet the challenges of a pandemic (Huber & Helm, 2020). SRL learning focuses on how learners actively manage their learning. Therefore, self-regulated athletes take responsibility for their training process, fully comprehending what activities are important for their growth and they are motivated to improve as well as take any appropriate action needed (Elferink-Gemser & Hettinga, 2017). Self-regulation is influenced by perceived competence. A better valued perceived competence is associated with a better academic performance. Research shows that students, who consider themselves competent, are more likely to use SRL strategies as well as are more motivated (Pelikan et al., 2021). Objective – to evaluate the effectiveness of self-regulation skills development methodology as well as changes in the perceived competence and satisfaction of young athletes with regards to sports activities during the COVID-19 pandemic.

Research methods. The study was conducted in 2021 during January – April. The study involved 445 sports gymnasium students (270 boys, 175 girls). The participants were randomly divided into control and experimental groups. Those ones of the experimental group participated in 12-week educational activities, in which the skills of concentration, self-reflection and self-monitoring were developed. The study was conducted using Self-Regulated Learning in Sport Practice (McCardle, Young, & Baker, 2018), Perceived Competence Scale (Williams, Freedman, & Deci, 1998), Sport Satisfaction Instrument Adapted to Physical Education (Baena, Granero-Gallegos, Bracho-Amador, & Pérez-Quero, 2012). Data analysis was performed using descriptive (x, SX) and multivariate (Cronbach Alpha, RMSEA, CFI, and TLI) statistical methods, and the magnitude of the impact of the methodology was assessed (d).

Results and discussion. A statistically significant difference was found in the analysis of the self-esteem abilities of the experimental group of athletes ($p = 0.01$; $d = 0.26$) during the study period. The identified improvement trend of self-regulation indicators such as challenge recognition, goal setting, planning, evaluation, effort ($p > 0.05$). The indicators of perceived sports competencies and satisfaction with sports activities of the experimental group also improved ($p > 0.05$). The analysis of the causal relationships between the scales used showed that after the study, the coherence and closeness of the scales between all the components of self-regulated learning, perceived competence and satisfaction with sports activities increased. Meanwhile, no statistically significant differences were found in the analysis of the control group indicators, as well as trends in the study period ($p > 0.05$).

Conclusions. The effectiveness of the self-regulation skills development methodology has been determined, when its content includes the development of concentration, self-reflection and self-monitoring skills. The effectiveness of the methodology is confirmed by the significant improvement in the athletes' self-monitoring skills. The improvement of the research skills influenced the coherence and closeness of the elements of self-regulation, perceived competence and satisfaction indicators in sports activities.

References

Baena, A., Granero-Gallegos, A., Bracho-Amador, C. & Pérez-Quero, F. J. (2012). Spanish version of the Sport Satisfaction Instrument (SSI) adapted to physical education (in Spanish: Versión española del "Sport Satisfaction Instrument (SSI)" adaptado a la Educación Física). *Revista de Psicodidáctica, 17*(2), 377–395. http://dx.doi.org/10.1387/Rev.Psicodidact.4037

Elferink-Gemser, M. T., & Hettinga, F. J. (2017). Pacing and self-regulation: Important skills for talent development in endurance sports. *International Journal of Sports Physiology and Performance, 12*(6), 831–835. https://doi.org/10.1123/ijspp.2017-0080

Huber, S. G., & Helm, C. (2020). COVID-19 and schooling: Evaluation, assessment and accountability in times of crises – reacting quickly to explore key issues for policy, practice and research with the school barometer. *Educational Assessment, Evaluation and Accountability, 32,* 237–270. doi:10.1007/s11092-020-09322-y

McCardle, L., Young, B. W., & Baker, J. (2018). Two-phase evaluation of the validity of a measure for self-regulated learning in sport practice. *Frontiers in Psychology, 9,* 2641. https://doi.org/10.3389/fpsyg.2018.02641

Pelikan, E. R., Lüftenegger, M., Holzer, J., Korlat, S., Spiel, C., & Schober, B. (2021). *Learning during COVID-19: The role of self-regulated learning, motivation, and procrastination for perceived competence*. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7846229/

Williams, G. C., Freedman, Z. R., & Deci, E. L. (1998). Supporting autonomy to motivate patients with diabetes for glucose control. *Diabetes Care, 21*(10), 1644–1651. https://doi.org/10.2337/diacare.21.10.1644

Keywords: self- regulation, self-regulated learning, physical education, sport.

SPORT MANAGEMENT AND SOCIOLOGY

THE USE OF SMART TECHNOLOGIES FOR ENGAGING PEOPLE IN PHYSICAL ACTIVITY

Silvija Baubonytė, Irena Valantinė
Lithuanian Sports University, Lithuania

Background. With the rapid development and increasing attention to physical activity, the use of smart technologies has become extremely important in recent years. So far, some people have been looking for innovative ways to increase their physical activity and track its results, but the global COVID-19 pandemic and the resulting severe movement restrictions have closed people at home. Such closure has negative consequences for their physical and emotional well-being in the long term, so it was important to find a way to stay physically active in the face of changed living conditions, and this forced a return to smart technologies, even for those who had little experience with it. As a result, it is becoming relevant and important to analyze the ways in which physical activity and its tracking are provided by smart technologies, the benefits of technologies, and the demand for use. The aim of this research is to find out the use of smart technologies for engaging people in physical activity.

Research methods. Analysis of scientific literature and quantitative research.

Results and discussion. The results of the survey revealed that people use sports apps to engage in physical activity. The main reasons for this are self-improvement, good physical fitness, and health issues. 64.4% of respondents indicated that they have 1–2 applications on their smartphones, and even 30% have 3–4, which they use once a day (36.8%) or at least 1–3 times a week (40.7%). According to the subjects, the biggest benefits of the apps are information about physical activity, control, monitoring, and fitness programs. An analysis of the scientific literature was conducted to supplement the research data by extending the alternatives to physical activity offered by smart technologies. Sources show that people choose a physical activity at home using special sports applications, and at the same time, exercise through platforms such as YouTube, Facebook, Twitter, or other video conferencing applications (Dwyer, Pasini, De Dominicis, & Righi, 2020). Proponents of various types of physical activity have also contributed to the routine monitoring of physical activity through sports apps – yoga, meditation, and various exercises that involve people of all ages (Son et al., 2021). The biggest advantage of technologies – it is convenient and effortless – does not require going anywhere, saving a lot of time and there is an opportunity to engage in activities at any time (Dwyer et al., 2020). It is currently difficult to say what long-term effects the COVID-19 pandemic will have on behavioral patterns when life returns to normal (Hall, Laddu, Phillips, Lavie, & Arena, 2021), but increased public confidence in technology during this period is expected to have influence their further use (Garfin, 2020) and that this is a reality for the nearest future (Son et al., 2021). However, while this is seen as a viable tool, questions remain about equal access to smart technologies. Even the number of older people using smart technologies is increasing, but younger consumers are adapting more quickly (Harrington, Koon, & Rogers, 2020).

Conclusions. Quantitative research revealed that the use of smart technologies for engaging people in physical activity is a great alternative during a pandemic, as well as an innovative way to track and improve one's physical fitness in the future. However, in order to use them effectively, it is also necessary to analyze the exploitation challenges faced by consumers.

References

Dwyer, M. J., Pasini, M., De Dominicis, S., & Righi, E. (2020). Physical activity: Benefits and challenges during the COVID-19 pandemic. *Scandinavian Journal of Medicine & Science in Sports, 30*(7), 1291.

Garfin, D. R. (2020). Technology as a coping tool during the COVID-19 pandemic: Implications and recommendations. *Stress and Health,* 1–5.

Hall, G., Laddu, D. R., Phillips, S. A., Lavie, C. J., & Arena, R. (2021). A tale of two pandemics: How will COVID-19 and global trends in physical inactivity and sedentary behavior affect one another? *Progress in Cardiovascular Diseases, 64,* 108.

Harrington, C. N., Koon, L. M., & Rogers, W. A. (2020). Design of health information and communication technologies for older adults. *Design for Health,* 341–363.

Son, J. S., Nimrod, G., West, S. T., Janke, M. C., Liechty, T., & Naar, J. J. (2021). Promoting older adults' physical activity and social well- being during COVID-19. *Leisure Sciences, 43*(1–2), 287–294.

Keywords: smart technologies, physical activity, engagement.

THEORETICAL ASPECTS OF SPORTS BRAND MANAGEMENT (IN LATVIAN FOOTBALL HIGHERLEAGUE)

Aleksandrs Iljins, Signe Liuka
Latvian Academy of Sport Education, Latvia

Background. The aim of this study is brand management of the football clubs, the connection between fans and sports organizations. The main goal of sports clubs is to win the game. It must be a success in sport, is at the heart of European clubs, that the foundation (Aaker, 1991; Jarosz, Kornakov, & Soderman, 2018; Keller, 2015). Today, however, business and management components have grown exponentially and are increasing their impact on the success of the field (Beech, Chadwick, & Sullivan, 2004). Basic of Latvian sports consumers, their wishes, and meanings of fans to purchase sport product, what is called brand management (Ross, 2016).

Research methods, results and discussion. Fan's high attachment to their favorite sports team with brand management. More for significantly and functionally products.

The findings also demonstrated fan identity for brands from other European and American practices, which can we use also for our sports industry. Great possibilities for sports teams, for the sports industry, who are willing to invest in selling sports products. And with all results that we get from our research – build the model for our day fans and their wishes.

Conclusions. This study is one of the first for Latvia in sports management research, focusing on sports brand management. Latvian professional sports teams unite to produce a league product that is produced to provide entertainment for fans, their wishes, which support leagues by attending games, following games/event on television or other media, and purchasing league and team-related merchandise.

References

Aaker, D. A. (1991). *Managing brand equity*. New York: The Free Press.
Beech, J., Chadwick, S., & Sullivan, M. (2004). *The business of sport managment*. London: Pearson Education Limited.
Jarosz, O., Kornakov, K., & Soderman, S. (2018). *ECA Club managment guide*. Nyon.
Keller, K. L. (2015). *Strategic brand management*. India, Tamil Nadu: Pearson India Education Services Pvt. Ltd.
Ross, S. (2006). A conceptual framework for understanding spectator-based brand equity. *Journal of Sport Management, 20*, 22–38.

Keywords: sports brand management, brand management, Latvian football management, Latvian football brand, brand management model.

DETERMINANTS OF SOCIAL INNOVATIONS IN SPORT

Gintarė Jaciūnė, Vilija Bitė Fominienė
Lithuanian Sports University, Lithuania

Background. The scientific literature suggests that social innovations can very often be an innovation of services, regardless of whether it occurs in the service sector or civil society and in social movements (Gallouj, Rubalcaba, Toivonen, & Widrum, 2018). Social innovations are often seen as a response to the failures of the state, linking them only to the reduction of material resources (Repo & Matschoss, 2020). For sport sector organization like and any others types it is important to understand which determinants of social innovations in sport have a greater capacity to innovate and in order to make appropriate decisions if necessary. For this purpose, various observations, studies and their analyses are carried out. The research object: determinants of social innovation in sport. The aim of this analysis is to discuss theoretically about the determinants of social innovations in sport.

Research methods. This analysis is prepared by using the methods of analysis, interpretation and generalisation of scientific literature on the topic of the research.

Results and discussion. In the scientific literature social innovations define differently and the concept of social innovation is constantly evolving. In most cases the benefits of social innovations are reduced public spending by eliminating a specific social problem and creating some added value for the group of people targeted by social innovation. Managerial approach to social inclusion and transformational management determines the implementation of both types of social initiatives: technical and administrative and social initiatives significantly. In line of the research into the determinants of social innovations in sport managerial, organizational and environmental levels produce to exert a significant influence (Corthouts et al., 2020).

Conclusions. For the creating and development of social innovations in sport, basic determinants are manageral determinants (transformational management, social inclusion, health), organizational determinants (facilities, financial resources, volunteers and paid staff, organisation age, size and membership) and environmental determinants (local competition, community size).

References

Corthouts, J., Thibaut, E., Breuer, C., Feiler, S., James, M., Llopis-Goig, R., ... Scheerder, J (2020). Social inclusion in sports clubs across Europe: Determinants of social innovation. *Innovation: The European Journal of Social Science Reserch, 33*(1), 21–51.

Gallouj, F., Rubalcaba, L., Toivonen, M., & Windrum, P. (2018). Understanding social innovation in services industries. *Industry and Innovation, 25*(6), 551–569.

Repo, P., & Matschoss, K. (2020). Social innovation for sustainability challenges. *Sustainability, 12*(1), 319.

Keywords: sport, social innovation, determinants of innovation.

MULTI-CLUB OWNERSHIP – NEW MODEL OF SUCCESS IN FOOTBALL?

Adam Metelski
Poznań University of Economics and Business, Poland

Background. With growing commercialization and broadcast appeal, professional football is an increasing investment and diversification opportunity. A key tenet of why people are investing in football is that clubs are still undervalued (Massey, 2021). In times of advanced internationalization of sports, football clubs are developing new business models and adopting strategies borrowed from other industries to expand their network and maximize their income (Pastore, 2018). Multi-club ownership (MCO) has become a popular topic in the world of football, and by many claimed to be a business model that may dominate the future of this sport. However, while multi-club portfolios offer much appeal, such complex ownership structures also pose specific risks (KPMG, 2020). It also has to be added that although MCO are becoming more and more popular in football, there are only few scientific publications dealing with this topic (Breuer, 2018).

Research methods. Clubs perform several activities at their core. There are three such core activities identified: sport, business and community (Jarosz, Kornakov, & Soderman, 2018). In this paper, we aim to analyze the benefits of the MCO from a sports, business and community perspective. We list the values of the clubs, budgets, community activities, sustainability, and sports results in national and international competitions (UCL, UEL, and UECL) as the main indicators of success. An additional aim of the study is to estimate the optimal size of the MCO by analyzing all the existing MCO groups, rating them for success and then correlating success with the relative size. The study also analyzes the differences between individual MCOs. Results shows some differences between the City Football Group, Red Bull group and the feeder club model.

Results and discussion. In 2017 there were at least 26 first-division clubs across Europe involved in cross-ownership, in which a private person, club or entity had control of or a decisive influence over more than one club (KPMG, 2020). In 2021 there were already 156 clubs from around the world as part of 60 MCO groups (Menary, 2021). The City Football Group is mentioned by many as the best example of the MCO (Pastore, 2018). City football group is a group of the following clubs: Girona FC, Lommel SK, Manchester City FC, Melbourne City FC, Montevideo City, Torque, Mumbai City, New York City FC, Troyes AC and Yokohama F. Marinos. Another top MCO is Red Bull, which is one of the biggest brands in the world, and owns some of the best and the biggest football teams around the world (Ambille, 2021). The Red Bull group consists of the following clubs: New York Red Bulls, RB Leipzig, Red Bull Bragantino and Red Bull Salzburg. The City Group model is based on the idea of establishing a single club in each major territory and attempting to make them the dominant force (Keech, 2020). The Red Bull model is based around owning multiple clubs with a single group-wide philosophy. The Feeder Club model usually involves one dominant partner using another club to fulfill their needs.

Conclusions. All this information, described above, may make a person wonder what will happen next in the world of football? Will we begin to see more single-owner models? Is it a trend or temporary fashion? Will we see a consolidation of the most successful groups becoming bigger and dominating the market (Massey, 2021)? Is it an alternative to creating their own leagues and being out of monopolized system owned and controlled by the governing bodies? Also, if multi-club models work for clubs, then what does this mean for leagues? Examples such as the MLS demonstrate the benefits of a single-owner franchise model.

References

Breuer, M. (2018). Multi-club ownerships. In M. Breuer & D. Forrest (Eds.), *The Palgrave handbook on the economics of manipulation in sport* (pp. 115–134). Palgrave Macmillan. https://doi.org/10.1007/978-3-319-77389-6_7

Jarosz, O., Kornakov, K., & Soderman, S. (2018). *Club management guide*. European Club Association.

Keech, T. (2020). Multi-club networks. Retrieved from https://mrktinsights.com/index.php/2020/05/20/multi-club-networks/

KPMG. (2020). Multi-club ownerships – Is it the future of football? Retrieved from https://footballbenchmark.com/library/multi_club_ownerships_is_it_the_future_of_football

Pastore, L. (2018). Third party ownership and multi-club ownership: Where football is heading for. *Rivista Di Diritto Ed Economia Dello Sport, XIV,* 24–58.

Keywords: football, multi-club ownership, sports management.

RELATION BETWEEN PHYSICAL EXERCISE PATTERNS AND REPORTED WELL-BEING IN EXPERIENCED ADULT EQUESTRIANS DURING COVID-19 PANDEMIC

Anastasija Ropa

Latvian Academy of Sport Education, Latvia

Background. During COVID-19, the lifestyles and exercise patterns have changed due to restrictions, changed working conditions, limited possibilities to travel and compete, etc. As equestrian training can be conducted outdoors as well as indoors and is often individual, the initial hypothesis was that equestrians are less likely to reduce exercise as a result of the pandemic. It was also suggested that stability of exercise patterns would be linked to reported emotional well-being, resulting in more resilience in terms of well-being due to sustainable exercise habits.

Research methods. The study used quantitative analysis combined with qualitative research: an anonymous survey of equestrians from all around the world was conducted using social media in February 2022, and the results of the survey were supplemented by information gained from comments by the respondents within the survey and micro-blogging (comments made to the survey on social media).

Results and discussion. It was found that there was little change in the level of exercise before and after the pandemic, which proved hypothesis 1. The statistics of reported emotional well-being was less uniform: while a large group of respondents reported no change in emotional well-being, a considerable number of respondents noted more frequent occurrence of depressive moods, while another significant group claimed an improvement of emotional well-being, with less frequent occurrence of depressive symptoms.

Conclusions. The study found that equestrian activities, which can be conducted outdoors, are relatively sustained among experienced adult equestrians. It was also found that the pandemic had little effect on the physical activities overall, correlating with the tendency to report little change in emotional well-being, albeit certain percentages of respondents noted some increase and decrease in the frequency of depressive moods.

References

Kravalis, I., Ciekurs, K., & Ropa, A. (2021). Offer of outdoor recreational activities in Latvia during COVID-19 Pandemic. *LASE Journal of Sport Science*, 86–100.

Ropa, A., & Malahova, L. (2021). History of riding therapy and recreational riding with special reference to the Baltic Region. *Cheiron, The International Journal of Equine and Equestrian History 1*.

Keywords: equestrian sports, physical activities, Covid-19, emotional well-being.

IMPLEMENTATION OF FAIR PLAY PRINCIPLES IN THE MANAGEMENT OF OLYMPIC SPORTS IN LATVIA

Baiba Veisa, Agita Abele

Latvian Academy of Sports Education, Latvia

Background. Principles of Fair Play especially such as solidarity, tolerance, friendship have obtained valuable meaning now days. Values of Fair Play learned through sports have become fundamental in relations between individuals as well as in relations between nations and countries. Through Fair Play we improve the characters, strengthen the personalities. Meanwhile improving the responsibility towards society and our countries. Sports federations has tools to improve the understanding of Fair Play however the question is about the efficiency of using these tools to achieve the best results?

Research methods. Analysis of scientific information as well as content analysis of documentary materials were used methods at this research. Qualitative research method such as structured interview was used in second part of study to understand the results in some cases however last were not assessed as a key component of the study.

Results and discussion. The research results shows that only 10 from 38 Olympic sports federations in Latvia have implemented and published code of ethics. In second part of analyzing federations that did not implement the code of ethics results showed they admit importance of Fair Play in their sports and educating young generation teaching them. The lack of resources have been mentioned as a reason of not taking action. Sports take significant role in education of young generation and society. However, without taking real action these are just words and sports doesn't use all abilities it has.

Conclusions. Code of ethics is one of opportunities of implementing Fair Play principles through sports. Despite the regulations in force, federations haven't implemented tools available to promote Fair Play values in sports. It's worth considering the opportunities of sports federations in pedagogical process to promote the ethical values through sports.

References

Bronikowska, M., Korcz, A., Pluta, B., Krzysztoszek, J., Ludwiczak, M., Lopatka, M., Wawrzyniak, S., Kowalska, J. E., & Bronikowski, M. (2019). Fair Play in physical education and beyond. *Sustainability, 11,* 7064. doi:10.3390/su11247064

Chatziefstathiou, D. (2012). Olympic education and beyond: Olympism and value legacies from the Olympic and Paralympic games. *Educational Review, 64*(3), 385–400. doi:10.1080/00131911.2012.696094

Ludwiczak, M., & Bronikowska, M. (2022). Fair Play in a context of physical education and sports behaviours. *International Journal of Environmental Research and Public Health, 19,* 2452. https://doi.org/10/3390/ijerph19042452

Simon, R. L., Torres, C. R., & Hager, P. F. (2018). *Fair Play. The Ethics of Sport* (4th ed.). USA, New York: Routledge.

Waegeneer, W. D. (2015). *Fair play in sports organizations: Effectiveness of ethical codes*. Belgium: Ghent University.

Keywords: Fair Play, code of ethics, values, solidarity, tolerance.

COACHING AND PERFORMANCE

A SYSTEMATIC REVIEW OF THE EFFECT OF PLYOMETRIC TRAINING ON VERTICAL JUMP PERFORMANCE IN YOUNG BASKETBALL PLAYERS

Mohammed Amine Azzouzi, Mustafa Söğüt
Middle East Technical University, Turkey

Background. Plyometric training is one of the widely used training methods for the development of the jumping ability of basketball players. The purpose of this systematic review was to provide an overview of the studies analyzing the effect of plyometric training on the vertical jump performance of young basketball players.

Research methods. Following the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines (Ardern et al., 2022), studies were collected by searching four electronic databases; Web of Science, Scopus, PubMed, and SPORTDiscus with full-text. Intervention studies investigating the influence of plyometric training on the vertical jump performance of young basketball players (<18 years old) were included.

Results and discussion. Out of 1045 studies, 6 met the inclusion criteria and were included in the review. The duration of the interventions was between six to eight weeks. The age of the included children ranged from 10 to 18 years. The results of the four reviewed studies showed that young basketball players participating in plyometric training had significantly improved their vertical jump height regardless of gender and competition level. On the contrary, the results of other studies indicated decreases or no significant changes in jump height.

Conclusions. Although the majority of the reviewed studies suggest that plyometric training may be an effective method to develop the vertical jump performance of young male and female basketball players, further studies are needed to better understand its influence.

References

Ardern, C. L., Büttner, F., Andrade, R., Weir, A., Ashe, M. C., Holden, S., ... & Winters, M. (2022). Implementing the 27 PRISMA 2020 Statement items for systematic reviews in the sport and exercise medicine, musculoskeletal rehabilitation and sports science fields: The PERSiST (implementing Prisma in Exercise, Rehabilitation, Sport medicine and SporTs science) guidance. *British Journal of Sports Medicine, 56*(4), 175–195.

Keywords: plyometric training, vertical jump, jump training, young basketball players, team sport athletes.

A SET OF NATIONAL ARMED FORCES PHYSICAL READINESS CONTROL EXERCISES

Oskars Blaus, Uģis Ciematnieks
Latvian Academy of Sports Education, Latvia

Background. The modern geopolitical situation in the world, especially in Eastern Europe, obliges every soldier to be ready for battle, and thus to be comprehensively physically prepared, developing all physical qualities and, in the alternative, testing all physical qualities. Leading NATO members, as well as the armed forces of other countries, have changed their physical fitness systems in recent years and, in the meantime, Army physical fitness tests (APFT) (Foulis et al., 2017; Kirknes & Aandstad, 2016). APFT are designed in such a way that the most typical battlefield activities are simulated and the obtained results of control exercises facilitate the task of unit commanders to assess the true combat capabilities of their units (Harman et al., 2008; Knapik et al., 2004). It is possible to make sure that a soldier is comprehensively physically trained by performing various physical fitness tests, and the wider the range of these tests, the more objective results can be obtained by assessing the soldiers' physical fitness (Foulis et al., 2017; Harman et al., 2008; Robson et al., 2017). Physical fitness standards may serve a wide range of goals, including improving general well-being, boosting unit morale, increasing productivity, reducing injuries and lost workdays, and eliminating stress. Depending on the goal, the standards could be the same for everyone or applied differentially, e.g., by age or sex. Standards developed for specific occupational tasks would be applied to all who perform those tasks (Robson et al., 2017). According Robson et al. (2017), process of creating a set of control exercises requires: 1. Conducting a job analysis to identify the physical demands of key criterion tasks (e.g. mass of objects, distance of movement, physiological strain). 2. Developing simulations of these tasks that are representative of the actual job but sufficiently controlled to be safe and reliable (i.e. criterion tests). 3. Establishing the efficacy of using selection tests and/or generic fitness tests to assess personnel and establish whether training conducted between point of selection and taking up a qualified role influences criterion task performance. 4. Proposing evidence-based performance standards. Another problem, the need to create a new APFT, should be mentioned the low level of physical readiness of the army recruits.

Research methods. The current Latvian APFT, which includes sit-ups, push-ups, and a 1.5 km/3 km run for women/men (in accordance with AM 6NOT) has long been used to determine a soldier's and recruit's physical readiness. Each exercise in APFT is evaluated on a 100-point scale, where the evaluation "satisfactory" can be obtained by presenting the result on 10 points, "good" on 20, "very good" on 30, "excellent" on 40 and "brilliant" on 60 points. The APFT overall score "satisfactory" can be obtained by presenting a 10-point score in each of the exercises.

Results and discussion. In 2014, the NAF recruited 369 new recruits, in 2017 575 and in 2020 747 new recruits (18–39 years old). In 2014, 13% of new recruits showed a "weak" result in APFT, 14% "satisfactory", 13% "good", 21% "very good", 19% "excellent" and 20% "brilliant" in physical fitness tests. In 2017, 28% of new recruits showed a "weak" result in APFT, 24% "satisfactory", 13% "good", 10% "very good", 12% "excellent" and 13% "brilliant" in physical fitness tests. In 2020, 45% of new recruits showed a "weak" result in APFT, 17% "satisfactory", 11% "good", 8% "very good", 10% "excellent" and 9% "brilliant" in physical fitness tests.

Conclusions. Testing the physical readiness of soldiers, with using the most objective APFT – aimed at comprehensive physical fitness and true assessment of combat capabilities, would be a priority for the NAF.

References

Foulis, S. A., Sharp, M. A., Redmond, J. E., Frykman, P. N., Warr, B. J., Gebhardt, D. L., & Zambraski, E. J. (2017). U.S. Army physical demands study: Development of the Occupational Physical Assessment Test for Combat Arms soldiers. *Journal of Science and Medicine in Sport, 20*(4), 74–78. Retrieved from https.//doi.org/1016/j.jsams.2017.07.018

Harman, E. A., Gutekunst, D. J., Frykman, P. N., Sharp, M. A., Nindl, B. C., Alemany, J. A., & Mello, R. P. (2008). Prediction of simulated battlefield physical performance from field-expedient tests. *Military Medicine, 173*(1), 36–41. Retrieved from https.//doi.org/10.7205/milmed.173.1.36

Kirknes, J., & Aandstad, A. (2016). *New physical fitness tests and employment standards in the Norwegian Armed Forces*. Retrieved from https://puolustusvoimat.fi/documents/1951253/3350831/TUTKIMUS_+MNILK+symposium_Jon+Kirknes_Anders+Aanstad.pdf.pdf

Knapik, J. J., Bruce, H. J., Sharp, M. A., Darakjy, S., Jones, S., Hauret, K. G., & Piskator, G. (2004). The case for pre-enlistment physical fitness testing: Research and recommendations. *U.S. Army Center for Health Promotion and Preventive Medicine, 12*(04), 8–17. Retrieved from https://apps.dtic.mil/sti/pdfs/ADA426848.pdf

Robson, S., Lytell, M. C., Sims, C. S., Pezard, S., Manacapilli, T., Anderson, A., Bohusch, T., & Haddad. A. (2017). Fit for duty? Evaluating the physical fitness requirements of battlefield airmen. Retrieved from https://bootcampmilitaryfitnessinstitute.com/elite–special–forces/us–elite–special–forces/afsoc–us–air–force–special–operations–command/us–air–force–battlefield–airmen–fitness–assessment–bafa/

Keywords: military, physical qualities, physical activities, standard.

ASSOCIATION OF STRENGTH AND CARDIO-VASCULAR ENDURANCE AMONG VOLLEYBALL PLAYERS

Yogesh Chander

Institute of Teacher Training & Research, BPS Women University, India

Background. This paper aims to see the relationship between strength and cardio-vascular endurance among school girl volleyball players. The physical fitness in volleyball is one of the key factors of successful teams (Chander 2010, 2018; Chander & Mukherjee, 2012). Especially explosive power and jumping abilities are required in all sports with appropriate technique of performance measurement (Clark, 1970; Starzynski & Sozanski, 1999).

Research methods. The age of players ranges from sixteen to nineteen years from northern Indian states/units. Seventy-two school level players, who took part in the school national championship held at Jhansi (Uttar Pradesh), were part of the study and purposive sampling was used for the present research. The collection of data was completed while pre-national coaching camps and school national championship. The measurement tools for strength were overhead medicine ball throw, softball throw, standing broad jump, and running spike jump. Cardio-vascular endurance was measured through 880-yard run and one-mile run. Data was analyzed through IBM's software SPSS Statistics, version 20.

Results and discussion. The quantitative analysis of data revealed a positive relationship between standing broad jump and cardio-vascular endurance among school girl volleyball players at 0.01 level of significance.

Conclusions. Further, this research may help in talent identification while selecting volleyball teams and designing fitness programmes during periodization. The paper has its practical application for school physical education teachers, players, volleyball coaches and researchers working for brilliance in volleyball.

References

Chander, Y. (2010). *Motor fitness variables as predictors of playing ability in volleyball*. Unpublished doctoral thesis. India: LNIPE Gwalior.

Chander, Y. (2018). Physical fitness and vertical jumping ability among women volleyball players. *Vyayam Setu, 4*(2), 8–16.

Chander, Y., & Mukherjee, S. (2012). Physical fitness determinants of girls volleyball attackers. *Indian Journal of Physical Education, Sports Medicine & Exercise Science, 12*(1), 71–78.

Clark, H. H. (1970). *Application of measurement to health and physical education*. Englewood Cliffs: N.J. Prentice Hall Inc.

Starzynski, T., & Sozanski, H. (1999). *Explosive power and jumping ability for all sports*. Champaign: Human Kinetics.

Keywords: strength, cardiovascular endurance, quantitative analysis.

BICEPS BRACHII MORPHO-MECHANICAL PROPERTIES AND PERFORMANCE DIFFERENCES BETWEEN STRENGTH-TRAINED ATHLETES AND PROFESSIONAL ARM-WRESTLERS

Francesco Coletta, Leonardo Cesanelli, Daniele Conte

Lithuanian Sports University, Lithuania

Background. Arm-wrestling is a strength and power-oriented sport (Podrihalo et al., 2020; Podrihalo et al., 2021). However, despite its growing popularity, it does not have a sound scientific background, warranting further studies to understand the critical aspects of the performance. This study aims to characterize the morpho-mechanical properties, maximal strength and explosive strength of the biceps brachii muscle in professional arm-wrestlers, comparing them with strength-trained athletes and evaluating if there is a correlation between the morphological characteristics and the strength/power outcomes.

Research methods. Biceps-brachii muscle and tendon thickness were evaluated by B-mode ultrasonography in 18 athletes (9 International level arm-wrestlers, 9 strength-trained). Tendon thickness was measured at the insertion on the radial tuberosity. Each athlete performed maximal explosive isometric biceps flexion on a Biodex Isokinetic dynamometer comprising three 3 s maximal voluntary isometric contraction (MVIC) tests with 1 min of recovery between each trial. MVIC torque and rate of torque development at different time intervals (RTD 0–100 ms, RTD 0–200 ms, RTD 0–300 ms) were extrapolated from the test. The student t-test for independent samples was used to compare the difference between the biceps-brachii muscle and tendon thickness, peak torque, and RTD between arm-wrestlers and strength-trained athletes. Pearson correlational analysis was used to identify significant relationships between the Biceps-brachii muscle thickness, peak torque, and RTD. A correlation was also tested between Tendon thickness, peak torque and RTD.

Results and discussion. The results showed a statistically significant greater values in arm-wrestlers in the tendon thickness ($p = 0.04$), Peak torque ($p = 0.03$), and RTD 0–100 ms ($p = 0.03$), 0–200 ms ($p = 0.04$), 0–300 ms ($p = 0.03$) compared to the strength trained athletes. No significant difference was found for the muscle thickness between the two groups, although it correlated strongly with Peak torque and moderately with RTD 0–300 ($r = 0.76$; $p < 0.001$; $r = 0.49$; $p < 0.05$). The correlation was moderate between tendon thickness and peak torque ($r = 0.65$; $p < 0.05$), and between tendon thickness and RTD 0–100 ms ($r = 0.63$; $p < 0.05$), RTD 0–200 ms ($r = 0.66$; $p < 0.005$); RTD 0–300 ms ($r = 0.59$; $p < 0.05$). Previous research analyzing arm-wrestling performance found positive correlation between forearm length, force expression and the maximum internal rotation vector value of the shoulder joint rate (Hirai, Miyahara, & Otuka, 2021; Rovnaya, Podrigalo, Iermakov, Yermakova, & Potop, 2019). This study also showed that higher performance indexes for the arm-wrestler group seems to be affected by the greater biceps-brachii tendon thickness.

Conclusions. These findings suggest significant morphological differences in the bicep-brachii tendon between arm-wrestlers and strength-trained athletes. The higher tendon thickness in the arm-wrestling group seems to correlate better with the rate of torque development at each time frame. To the authors' knowledge, this represents the first study aiming to characterize the morpho-mechanical aspects and performance variables of high-level arm-wrestlers. Additional studies are needed to clarify better the possible implications of arm-wrestling training on tendon adaptations and explosive strength outcomes and to infer the causal effect directly.

References

Hirai, H., Miyahara, S., & Otuka, A. (2021). Physical factors affecting the strength of arm wrestling. *International Journal of Medical Science and Clinical Invention, 8*(11), 5816–5821. http://doi.org/10.18535/ijmsci/v8i11.010

Podrihalo, O. O., Podrigalo, L. V., Bezkorovainyi, D. O., Halashko, O. I., Nikulin, I. N., Kadutskaya, L. A., & Jagiello, M. (2020). Analysis of grip strength and somatotype features of armwrestling athletes of different skill levels. *Physical Education of Students, 24*(2), 120–126. http://doi.org/10.15561/20755279.2020.0208

Podrihalo, O. O., Podrigalo, L. V., Kiprych, S. V., Galashko, M. I., Alekseev, A. F., Tropin, Y. M., … Nasonkina, O. Y. (2021). The comparative analysis of morphological and functional indicators of armwrestling and street workout athletes. *Pedagogy of Physical Culture and Sports, 25*(3), 188–193. http://doi.org/10.15561/26649837.2021.0307

Rovnaya, O., Podrigalo, L., Iermakov, S., Yermakova, T., & Potop, V. (2019). The application of the index method to assess the condition of armwrestling athletes with different levels of sports mastery. *Revista Romaneasca Pentru Educatie Multidimensionala,* 242–256. http://doi.org/10.18662/rrem/187

Keywords: arm-wrestling, biceps brachii, tendon, strength, power.

THE DIVERSITY OF STRENGTH MANIFESTATIONS AND VERTICAL SPEED OF HIGHLY QUALIFIED WEIGHTLIFTERS OF CLEAN AND JERK

Leonīds Čupriks[1], Edgars Getmančuks[1], Aleksandra Ķeizāne[1], Valentins Oleško[2]

[1]Latvian Academy of Sport Education, Latvia; [2]National University of Physical Education and Sport, Ukraine

Background. The main components of the structure of rational technique of performing competitive exercises of weightlifters is a manifestation of a certain dynamic force and high speed of the projectile in space, which allows athletes in the process of competitive activity to successfully lift optional trajectory the maximum burden, spending on this technical action as little effort as possible. Some authors (Medvedev, 1986; Антонюк, 2012) believe that the greater the departure amplitude and speed movement of the bar, the better the exercise will be performed. Other authors (Campos, 2004; Dvorkin, 1992) consider that the amount of movement of the projectile and the vertical speed of its movement should be optimal and correspond to the boundaries of the weight categories of athletes. The aim: the dynamics of the structure of weightlifting clean and jerk movements and the dependence of its regularity on gender and weight categories.

Research methods. The following methods were used in our research: theoretical analysis and compilation of special scientific research literature, compilation of practical work experience and analysis of documentary materials, pedagogical experiment, mathematical statistical methods. Video-computer shooting of competitive activity of weightlifters carried out throughout 2017–2019. At international competitions with use of the hardware and computers complex "Weightlifting Analyzer 3.0" (Germany). This complex allows you immediately after video recording of motor actions athlete to get on spatio-temporal motion characteristics systems "athlete-bar".

The studies took part 102 of the strongest weightlifts of the world 26 ± 6 years old. Total analyzed 306 lifts in the system of "athlete-rod" performed by athletes in intensity zone 92–100%. Research activities were carried out during the Latvian weightlifting training process (Dobele, Ventspils), Latvian championships (Dobele, Ventspils), UNFKSU, Weightlifting Center Kamjaneca-Podilsk (Ukraine), as well as international competitions in European championships. In order to compare technical skills of weightlifters different weight categories were analyzed by a clean and jerk technique in three different groups: men's first group – up to 55–67 kg; the second is up to 73–89 kg; third – over 96–109 kg; women respectively: the first is 45–55 kg; the second is 59–71 kg and the third – over 76–87 kg. The distribution of shock technique on the phases was carried out according to the phase structure movement.

Results and discussion. The results of a comparative analysis of the changes in biodynamic effort during the first clean and jerk exercise of both sexes show that in all three groups women work hardest, especially in the two phases of final acceleration (F3) and damping (F2 AF) compared to men in these phases. In the weight category 1. group, the technical performance differs by 14.8% and 5.2% in the first effort phase ($p < 0.005$); in the weight category 2. group by 11.3% and 11% ($p < 0.005$); 3. in the group of weight categories in the differences remain only in the amortization phase (F2 AF) they differ by 20.4% ($p < 0.001$). In other phases of support of the bar movement, it is observed that women put less effort than men in interacting with the tool. This is mainly found among women in weight group 3. in initial acceleration (F1 SPF) and support squat phase (F4 APF). When interacting with the tool, the effort of these women, in these phase is 7.6% and 9.5% smaller ($p < 0.005$) than the effort of men in the same group. Campos, Poletaev, Cuesta, Pablos and Trebar (2004), Drechler (1998), Urso (2011) argue, not without reason, that the rational technique clean and jerk is characterized by low rates of maximum values of force, speed and amplitudes of movement achieved in the main support phases. Significant differences can also be observed between men and women in the changes in the speed of movement of the first clean and jerk technique.

Conclusions. An analysis of the specialized literature shows that so far there are different opinions on the problem of using rational rhythmic-temporal and spatial structure of the clean and jerk performance technique by athletes of different sexes and groups of weight categories, which requires further study and justification.

The results of studying the rhythmic-temporal characteristics of the technique of lifting the barbell on chest in weightlifters of different sexes of three groups of weight categories revealed a common trend of changes in the structure of movement: with an increase in weight categories most of the speed indicators of movement increase. Characteristic feature of this technique is that between the groups of weight categories standing next to this the difference is not so significant, while the performance of heavy weight athletes categories increase significantly.

Significant differences in the speed characteristics of the movement of the rod in different phases of lifting the bar to the chest in men and women. For example, women in the moment of the first maximum application of efforts to the bar (v F1) develop a higher movement speed than men – by 41.0%. The same trend is observed at the time the second maximum extension of the legs in the knee joints (v max KS), in women the value the vertical speed of the rod in this phase is much higher – by 4.2% ($p \leq 0.05$). Also, women show a higher maximum speed rods in the final acceleration phase (v max) – by 4.7% ($p \leq 0.05$), which can be explained as follows. Male weightlifters have higher technical skills because that they develop not the maximum, but the optimal speed of the bar, which allows them to lift weights to the required height at a lower cost. Women, despite the lower weight of the barbell, still develop a greater speed of it movement.

References

Campos, J., Poletaev, P., Cuesta, A., Pablos, C., & Trebar, J. (2004). Estudio del movimiento de arrancada en Halterofilia durante ciclos de repeticiones de alta intensidad mediante analisis cinematicos. *Motricidad: European Journal of Human Movement, 12,* 37–51.

Drechler, A. (1998). *The weightlifting encyclopedia: A guide to world class performance*. USA: New York.

Dvorkin, L. (1992). Weightlifting and Age. Scientific and Pedagogical Fundamentals of a Multi-Year System of Training Junior Weightlifters. *Sportive Press,* 145.

Medvedev, A. (1986). *System of long term training in weightlifting*. Learning material for coaches. Moskva: Fizkultura i sport.

Urso, A. (2011). *Weightlifting. Sport for all sports*. Copyright: Calzetti & Mariucci Publishers. Topografia Mancini. 06089 Torgiano (PG). Roma.

Антонюк, О. (2012). *Удосконалення технічної підготовленості важкоатлетів високої кваліфікації різних типів будови тіла*: автореф. дис. на здоб. вчен. ступ. к. н. фіз. вих. і спорту. Kiiv.

Keywords: weightlifters of different gender, clean and jerk, phases, weightlifting bar.

THE INFLUENCE OF ATHLETIC TRAINING ON THE PHYSICAL PERFORMANCE OF YOUNG SAILORS DURING SAILING SEASON

Rytis Dikšaitis, Antanas Juodsnukis, Eugenijus Trinkūnas
Lithuanian Sports University, Lithuania

Background. Dinghy sailing is a multifaceted sport where most factors such as morphology, physical fitness and well-trained technical and tactical skills determine results (Bojsen-Møller, Larsson, Magnusson, & Aagaard, 2007). Sailing requires muscle strength, muscle endurance, aerobic and anaerobic capacity, agility and balance (Bojsen-Møller, Larsson, & Aagaard, 2015). Athletic training is necessary to increase the physical capacity of athletes (Suchomel, Nimphius, Bellon, & Stone, 2018). Sailing season in Lithuania is 6–7 months. For this reason, athletic training during this period of time is not happening. Our goal is to asses athletic training impact during sailing season.

Research methods. The study involved young sailors aged 11–13 years. The subjects were divided into two groups (control and experimental). The physical performance of the subjects was assessed by EUROFIT test battery. The first test was performed in early April (before the sailing season began) and the last test was performed at the end of October (after the sailing season was finished). During this time four tests were completed and four main sailing competitions happened. Both groups were sailing 3 times a week, experimental group also was participating twice per week in the athletic training practice.

Results and discussion. For the analysis of the results EUROFIT tests were selected. They represent the most important physical fitness characteristics of young sailors. Tests were Flamingo balance test – balance, Bent arm hang – static strength, Sit-Ups in 30 seconds – strength endurance, and 20 m endurance shuttle-run (bleep test) – endurance. The experimental group achieved the best results of these tests just before the most important competition (second test). Flamingo balance test results improved for girls from 13.7 ± 0.7 to 12.0 ± 0.5 number of trials, for boys from 15.0 ± 1.3 to 12.0 ± 1.3 number of trials. Bent arm hang test results improved for boys from 8.0 ± 1.9 to 16.1 ± 3.3 s, for girls from 3.0 ± 0.8 to 5.7 ± 1.8 s. Sit-Ups in 30 seconds test results improved for girls from 19.7 ± 1.2 to 26.5 ± 1.5 times, for boys from 26.3 ± 3.0 to 27.7 ± 1.5 times. Endurance shuttle-run improved for boys from 31.5 ± 1.8 to 37.5 ± 2.4 mL/(kg·min), for girls from 24.5 ± 0.6 to 28.6 ± 1.3 mL/(kg·min). The young sailors of the experimental group won 6 prizes in the main competition of the year, which we could not say about the successful performance of the control group in the sailing competition.

Conclusions. For young sailors, in addition to sailing training, two extra-weekly athletic training exercises had a positive effect on their physical fitness characteristics and successfully compete in the main sailing competitions. Additional athletic training exercises had a positive effect on the following physical characteristics: balance, limb movement speed, flexibility, strength and overall endurance as assessed by EUROFIT tests.

References

Bojsen-Møller, J., Larsson, B., & Aagaard, P. (2015). Physical requirements in Olympic sailing. *European Journal of Sport Science, 15*(3), 220–227.

Bojsen-Møller, J., Larsson, B., Magnusson, S. P., & Aagaard, P. (2007). Yacht type and crew-specific differences in anthropometric, aerobic capacity, and muscle strength parameters among international Olympic class sailors. *Journal of Sports Sciences, 25*(10), 1117–1128.

Suchomel, T. J., Nimphius, S., Bellon, C. R., & Stone, M. H. (2018). The importance of muscular strength: Training considerations. *Sports Medicine, 48*(4), 765–785.

Keywords: EUROFIT test battery, athletic training, sailing competition.

BULGARIAN UNIVERSITY LEVEL LONG JUMP (MEN AND WOMEN) – STATUS AND TREND OF DEVELOPMENT

Iva Dimova, Petya Petkova

National Sport Academy "Vasil Levski", Bulgaria

Background. University sport is one of the main pillars of sport development at national level (Бъчваров, 2003; Миладинов, 2004). This led us to analyze in detail the status and trends of development in the long jump discipline on university level in the Republic of Bulgaria. Long jump is athletic discipline acquiring skilled athletes with good speed-power abilities (Gutev & Njagin, 2012; Маринова, Пеев и Митова, 2019; Стойков и др., 2015). Our study is based on several information sources – numbers of participants on national Universiades, detailed sport result analysis and in-depth analysis of Bulgarian universities contribution to the development of long jump discipline at national level. Based on research results we can point out in details the influence of university sport at national level, as well as to adjust or keep good practices for the future development for all athletic disciplines.

Research methods. The main aim of our study is to reveal the status and development perspectives of university sport long jump discipline for men and women. For our study we gathered, systematized, and analyzed the data applying the following statistical methods – frequency analysis, variance analysis, sigmal scale evaluation. The study is based on sport result (m) from national Universiade, number of participants in long jump events, and data regarding represented universities. Studied period is with duration of 8 years (2014–2021). The total number of cases is 122 (61 men and 61 women athletes).

Results and discussion. University sport at national level is showing rise in recent years. Due to this fact we analyze the period from 2014 to 2021 (last season). The number for female jumpers is constantly increasing (from 8 to 11–13 participants). On the other hand, male athletes show retreat in the total number of participants from 12 to 7 in the last two seasons (2020 and 2021). But in-depth analysis reveals constant improvement of sport results among male long jumper regarding the decreasing number of participants – increase of quality and decrease in quantity. The increased number of female long jumpers lead to decreased sport results quality on average bases – opposite to the tendency presented above. The best results for men is registered in 2019 – 7.42 m, which is comparable to sport results for club athletes. Variance analysis shows big range of results for men (R = 4.60 m) This is grave difference for men level, nevertheless the university level. Women's best results is 6.00 m. The scope for the group is 3.18 m, also deemed as big difference. The two groups are relatively homogeneous, indicated by variance above 10%. We composed assessment tables, based on the results during the studied period, that can be of practical use for university coaches and teacher, who do not specialize in athletics. Tables would give orientation for prospective performance. We can point out that there are only three universities with tradition in this discipline leading us that their sport programs, and especially long jump academies work efficient.

Conclusions. A detailed analysis of long jump for men and women at national university level reveal positive and negative tendencies, but also is a standpoint for development of sport result evaluation tables for sport performance control. Also we can reveal that long jump discipline excellence is a priority for three universities including National Sports Academy, University of Plovdiv and UNWE.

References

Gutev, G., & Njagin, P. (2012). Research on the Bulgarian U14 track and field status and tendency of development. *Book of abstracts ISC "Effects of physical activity application to anthropological status with children, youth and adults"* (pp. 183). Beograd, Serbia, 11th–12th of December.

Бъчваров, М. (2003). Спортология. София: Болид Инс.

Маринова, Т., Пеев, П., Митова, П. (2019). Сравнителен анализ на скоростно-силовите показатели между половете във възраст 7–11 год. при подрастващи лекоатлети. *Лекая атлетика и наука, 1*(19), 54–57.

Миладинов, О. (2004). Лекоатлетически скокове. Онлайн ръководство за студенти. Retrieved from https://drive.google.com/drive/my-drive [accessed 2021-11-11].

Стойков, С. и др. (2014). Лека атлетика – техника, методика на обучение и преподаване, правилознание. София НСА Прес.

Keywords: long jump, university sport, performance, men and women.

PHYSIOLOGICAL RESPONSES AND TECHNICAL-TACTICAL PERFORMANCE OF YOUTH BASKETBALL PLAYERS – A BRIEF COMPARISON BETWEEN 3vs3 AND 5vs5 BASKETBALL

Bruno Figueira, Nuno Mateus, Pedro Esteves, Jaime Sampaio, Rūtenis Paulauskas

Vytautas Magnus University, Education Academy, Lithuania

Background. With the recent introduction into the Olympic program of the 2020 Summer Olympics, 3vs.3 basketball has enjoyed a notorious growth in popularity and started to be played in various competitive professional and amateur leagues (Montgomery & Maloney, 2018). Although several findings provide an important comprehensive understanding of the 3vs.3 basketball (Conte, Straigis, Clemente, Gomez, & Tessitore, 2019; Erculj, Vidic, & Leskosek, 2020; McGown, Ball, Legg, & Mara, 2020), to the best knowledge, there is no research exploring the differences between 5vs.5 and 3vs.3 basketball in youth players both at the physiological and technical-tactical levels. Considering 3vs.3 specific features and young players' less experience to accurately perceive environmental information different technical-tactical profiles might emerge (Willberg, Wellm, Behringer, & Zentgraf, 2022). Therefore, this study aimed to examine youth players' physiological responses and technical-tactical performance differences when playing 3vs.3 and 5vs.5 simulated basketball games.

Research methods. Fifteen well-trained male basketball players (16.6 ± 0.2 years old) who regularly play in 3vs.3 and 5vs.5 basketball competition events participated in scrimmage basketball games under two different conditions: 3vs.3 (half-court) and 5vs.5 (full-court). Players' heart rate, muscle oxygen saturation and total haemoglobin were collected and computed to describe physiological responses, while video analysis was used to characterize their technical-tactical performance. Data were analysed using a Bayesian ANOVA.

Results and discussion. Results exposed that different game conditions slightly influence players' physiological responses, inasmuch only total haemoglobin sample entropy decreased between the 3vs.3 and 5vs.5 game scenarios, 83.33 times more likely to occur under the game condition model (null model: BF10 = 0.012, BF01 = 1/0.012 = 83.33). Concerning the technical-tactical variables, moderate evidence for the game condition was observed for <6.75-m FGM (null model: BF10 = 0.123, BF01 = 1/0.123 = 8.13) while moderate evidence for the null hypothesis was observed in STL (game model: BF10 = 0.227, BF01 = 1/0.012 = 4.41) and ball screen (game model: BF10 = 0.314, BF01 = 1/0.314 = 3.18). The analysis also ascertained decisive evidence (i.e., BF10 > 100) supporting a relationship between the game condition and all the remaining technical-tactical indicators. Overall, this study emphasizes that playing 3vs.3 and 5vs.5 basketball games lead to relatively negligible differences in the players physiological response but pronounced variations in their technical-tactical performance.

Conclusions. Therefore, we recommend coaching staff to not negligence specific technical-tactical tasks when preparing for 3vs.3 or 5vs.5 basketball games.

References

Conte, D., Straigis, E., Clemente, F. M., Gomez, M. A., & Tessitore, A. (2019). Performance profile and game-related statistics of FIBA 3 × 3 Basketball World Cup 2017. *Biology of Sport, 36*(2), 149–154. doi:10.5114/biolsport.2019.83007

Erculj, F., Vidic, M., & Leskosek, B. (2020). Shooting efficiency and structure of shooting in 3 3 basketball compared to 5v5 basketball. *International Journal of Sports Science & Coaching, 15*(1), 91–98. doi:10.1177/1747954119887722

McGown, R., Ball, N., Legg, J., & Mara, J. (2020). The perceptual, heart rate and technical-tactical characteristics of 3 × 3 basketball. *International Journal of Sports Science & Coaching, 15*(5–6), 772–782. doi:10.1177/1747954120930916

Montgomery, P. G., & Maloney, B. D. (2018). 3 × 3 basketball: Performance characteristics and changes during Elite Tournament Competition. *International Journal of Sports Physiology and Performance,* 1–8. doi:10.1123/ijspp.2018-0011

Willberg, C., Wellm, D., Behringer, M., & Zentgraf, K. (2022). Analyzing acute and daily load parameters in match situations – a comparison of classic and 3 × 3 basketball. *International Journal of Sports Science & Coaching, 0*(0), 17479541211067989. doi:10.1177/17479541211067989

Keywords: youth basketball competitions, performance analysis, technical-tactical skills, physiological response.

THE ANALYSIS OF ATTACK PERFORMANCES OF VOLLEYBALL PLAYERS AT THE U-20 WORLD CHAMPIONSHIP IN WOMEN'S COMPETITIONS

Greta Folmer, Aurelijus Kazys Zuoza, Gerda Grudzinskaitė
Lithuanian Sports University, Lithuania

Background. Volleyball is one of the most popular but at the same time the most challenging sports in the world. In order to manage it purposefully, it is not enough to just have the ball, but you need to have some technical, tactical and especially physical preparation (Fernández-Echeverría, Mesquita, González-Silva, & Moreno, 2021). Physical preparedness, good technical and tactical skills of the game are the key to unlocking the door to play success as in personal as in team level. These skills are closely related to the main skills of the volleyball technique – defense and attack, when an attack smash is made or a bloc is built (Montuori et al., 2019). When team is defending or attacking, a lot of attention is paid to the reaction time, the power of muscle contraction. When performing a jump for attacking or blocking in defense, the muscles must be able to contract as sharply as possible, but in the shortest possible time. And if we want that players do this, a lot of attention must be paid to improving these skills during the preparation period. Each volleyball player has their own goals and purpose in the team. The setter must set the ball to the hitter accurately as possible. The goal of a hitter is to earn points for the team by making an offensive shot (attack) so that the players of the opposing team cannot defend themselves. The players in the defense zone must defend themselves as accurately as possible and start their team's counterattack. Libero is a player who plays only in the defense line and the main work done by the players in this position is to dig the ball to the setter accurately as possible and pass the ball after the opponents serve. Each position (or function of players) is extremely important and very depends on each other. Only smooth teamwork allows to achieve high results for the team (Vute & Krpač, 2000). Nowadays smart technologies allow to get qualitative and accurate competitive analysis for coaches and sportsmen, therefore, coaches have the possibility of better organizing the preparation of sportsmen (Bellinger, Newans, Whalen, & Minahan, 2021). Having better performance analyses allows for coaches easier to monitor the mistakes produced by athletes and allows more time to correct them. The focus is on the effectiveness of the technical and tactical skills in the game because it is the way to win. So in this case is very important to collect the data and accurately calculated it during the competition (match). Analyzing these data and observing the trends of their changes, young volleyball players, striving for the best possible results and knowing their mistakes, will be able to achieve their goals and further increase the popularity of this sport not only in the World but also in Lithuania. The problem question in our investigation is: what technical skills are more important in competition if we want to win the championship? Hypothesis: It is assumed that the teams that attack most efficiently during the competition will take higher places? The aim of the investigation is the analyzing of performance of volleyball players at the U-20 World Championship in women competitions Research tasks: 1. To investigate the effectiveness of the attack skills of the teams in the U20 World Women's Volleyball Championship in pool games 2. To compare the effectiveness of the volleyball attack skills between the U20 World Championship teams. 3. Establish a relationship between the attack and the final ranking in the Championship.

Research methods. The object of this research was a performance analysis of the women's teams in the U20 World Volleyball Championship. The 16 teams participating in the tournament were examined. At the first stage of the championship, all teams were divided into 4 pools (A, B, C, and D) with four teams in each pool. After pool games, the two best teams from each pool were divided into two pools (E and F) with four teams in each. The two best teams from these pools play for 1–4 places in the championship, the remaining teams played for 5–8 places. In this investigation, we used the following methods: analysis of references, data collecting, mathematical statistical analysis. Empirical data were collected from the International Volleyball Federation (FIVB) competition protocols published on the federation's websites. The performance was determined based on the statistics of the competition conducted during the entire World Championship. The main elements of the competition that were analyzed were: the effectiveness and efficiency of the serve, the block, and the attack. A total of 64 matches were analyzed. The performance of the technical skills of the teams was calculated using absolute data, that is, how many points the team scored from the attack, blocking, and serving. The effectiveness of the same technical elements was calculated by determining the total number of attacks, blocks, and serve technical skills during the match. Multiplying the effective action by 100 and dividing by the total number of cases yielded percentages that indicate the effectiveness of the team's technical action during the match. The main mathematical statistics were calculated using the volleyball technique actions of the teams that took 1–8 places in the championship. The references analysis was based on the literature, which was related to the conduct of the investigation, to choice of methods, and the possibility to formulate conclusions. The data and actions that will be analyzed during the investigation were theoretically analyzed, and the main concepts related to the study were described. Statistical analysis was processed by mathematical statistical methods using descriptive analysis, calculating the mean (X), standard deviation (δ), mean error (Sx), and correlation (r) using Pearson's correlation coefficient. The significance of the obtained data was checked by calculating the F-criterion for all analyzed indicators using one-way analysis of variance – ANOVA. The difference was statistically significant at $p < 0.05$. Statistical calculations were performed using Microsoft Excel 365.

Results and discussion. The highest attack performance in pool A was in the Italian team (44.33 ± 4.10 points) and the lowest in Cuba (28.67 ± 4.33 points). However, it should be noted that the attack performance in pool A did not differ statistically significantly between teams ($F = 1.77$, $p > 0.05$). In pool B, the highest attack performance was in the

Chinese team (55.33 ± 8.65 points) and the lowest in the Egyptian team (26.67 ± 3.38 points). However, the impact of the attack in pool B also did not differ statistically significantly ($F = 3.87$, $p > 0.05$). The highest attack performance in pool C was shown by the Serbian team (57.00 ± 2.89 points) and the lowest by Turkey (45.00 ± 1.53 points) and Argentina (45.33 ± 8.19 points). However, in pool C, the attack performance did not differ statistically significantly ($F = 1.22$, $p > 0.05$). In pool D, the highest performance was shown by the Japanese team (37.67 ± 3.84 points) and the lowest by the Rwandan girls (16.00 ± 4.00 points). In this pool, the impact of the attack did not differ statistically significantly ($F = 3.48$, $p > 0.05$). After the competition in the group stage, the two best teams from each pool were divided into two more pools of four teams (pool E, F). The teams that played in the E and F pools, which took the first two places, had the opportunity to play in the semifinals and the finals for the top places, and the third and fourth places had to play for the 5–8 places in the tournament. In pool E, the Brazilian team showed the highest attack performance (44.67 ± 6.89 points), and the Chinese girls showed the lowest (40.67 ± 5.36 points). However, it should be noted that there was no statistically significant difference in attack performance between these teams ($F = 0.07$, $p > 0.05$). In pool F, the highest attack performance was in the Japanese team (53.33 ± 7.51 points) and the lowest in the United States (34.33 ± 2.96 points). However, in this pool, attack performance also did not differ statistically significantly between teams ($F = 3.37$, $p > 0.05$). The correlation analysis performed at the end of the first stage competition shows that a strong direct relationship was found between the final ranking of the Championship and the serves performance ($r = -0.78$), and there was also a strong correlation between the attacking impact performance and the final ranking of the Championship ($r = -0, 77$), a moderately strong relationship ($r = -0.63$) was found between the block performance and the final ranking of the Championship. At the end of the second stage of the Championship (between teams playing for 1–8 places), the correlation analysis showed that the mean direct relationship was found between the final ranking of the Championship and the attacking performance ($r = -0.66$), and the mean correlation was between serve efficiency and the final ranking of the Championship ($r = -0.55$), a very weak relationship ($r = -0.19$) was found between block efficiency and the final ranking of the Championship.

Conclusions. 1. It was investigated that the efficiency of the attack skills between the teams in the U20 World Women's Volleyball Championship differed statistically significantly in different stages of the championship ($p < 0.05$). 2. It was found that the Championship winners had better attack efficiency results than other teams. 3. It has been investigated that in the different stages of the championship there is a strong direct relationship ($r > 0.7$) between the efficiency of attack skills and the final ranking of the Championship.

References

Bellinger, P. M., Newans, T., Whalen, M., & Minahan, C. (2021). Quantifying the activity profile of female beach volleyball tournament match-play. *Journal of Sports Science & Medicine, 20*(1), 142–148. https://doi.org/10.52082/jssm.2021.142

Fernández-Echeverría, C., Mesquita, I., González-Silva, J., & Moreno, M. P. (2021). Towards a more efficient training process in high-level female volleyball from a match analysis intervention program based on the constraint-led approach: The voice of the players. *Frontiers in Psychology, 12,* 563. doi:10.3389/fpsyg.2021.645536

Montuori, S., D'Aurizio, G., Foti, F., Liparoti, M., Lardone, A., Pesoli, M., Sorretino, G., Mandolesi, L., Curcio, G., & Sorrentino, P. (2019). Executive functioning profiles in elite volleyball athletes: Preliminary results by a sport-specific task switching protocol. *Human Movement Science, 63,* 73–81. https://doi.org/10.1016/j.humov.2018.11.011

Vute, R., & Krpač, F. (2000). Sporting values among Europe's elite sitting-volleyball players. *Acta Gymnica, 30*(1), 33–39.

Keywords: volleyball, women's U-20 World Championship, performance analysis in volleyball competition, the efficiency of attack skills.

DOES THE COUNTERMOVEMENT JUMP TEST PREDICT THE FOSBURY-FLOP HIGH JUMP PERFORMANCE FOR ELITE JUMPERS?

Adrijus Glebauskas, Danguolė Satkunskienė
Lithuanian Sports University, Lithuania

Background. The Fosbury-flop (FFP) high jump technique consists of a free-running in a curved manner and a vertical jump with one leg to overcome the rod. The muscle strength and power of the legs are essential components contributing to successful high jump performance (Bai, Ren, & Ma, 2000). Countermovement jump (CMJ) is a simple and effective means to monitor power output from an individual (Arago' n-Vargas & Gross, 1997; Souza et al., 2020), and it is widely used to monitor neuromuscular function, athletic performance, and training load. A running 1-leg vertical jump test seems to be more predictive for FFP high jump performance (Laffaye, 2011) than a 2-legs CMJ; however, the relationship between a 1-leg CMJ test and FFP high jump performance isn't known. The aim of this study was to find the correlation between FFP high jump performance and 2-legs and 1-leg CMJ parameters to predict high jump performance.

Research methods. Five male Lithuania top-level high jumpers (the range of personal FFP result is 1.99–2.30 m; age 23.4 ± 2.4 years; body mass 82.65 ± 6.48 kg; height 1.92 ± 0.08 m) performed barefoot three 2-legs and three 1-leg CMJ on force plate PODIUM (BTS Bioengineering, Italy) keeping the hands on the hips. All trials were collected using Smart-Performance software (BTS Bioengineering, Italy) at 200 Hz and transferred for analysis to Microsoft Office Excel software. The vertical ground reaction force (GRF) trace was integrated using the impulse method for velocity calculation. The displacement-time record was obtained by numerically integrating the velocity-time record. Finally, the mechanical power for each sample was calculated by multiplying the original force by the vertical velocity of the participant's centre of gravity. Vertical leg stiffness during the eccentric phase was calculated from the regression slope of the linear part of the curve of the vertical GRF versus the centre-of-mass displacement. The reactive strength index was calculated as the ratio between the height jumped and the jump time. The analyses were conducted using IBM SPSS package (Version 28.0.1.0 (142), Statsoft, Inc, Tulsa, OK, USA). The Pearson correlation coefficients were used to determine the relationships between independent variables. Then, a regression analysis was applied to identify the regression coefficients.

Results and discussion. The FFP jump performance correlated with concentric peak power (2-leg jump $r = 0.98$, $p = 0.003$, 1-leg jump $r = 0.90$, $p = 0.037$) and jump height (2-leg jump $r = 0.86$, $p = 0.062$, 1-leg jump $r = 0.99$, $p < 0.001$). Additionally, elite jumpers demonstrated greater eccentric peak force ($r = 0.83$, $p = 0.041$), leg stiffness ($r = 0.79$, $p = 0.057$), mean power (1-leg jump $r = 0.90$, $p = 0.037$) and reactive strength index (1-leg jump $r = 0.90$, $p = 0.037$) during 1-leg CMJ test compare to less skilled jumpers.

Conclusions. The 1-leg CMJ indicates more parameters related to FFP jump performance than the 2-leg CMJ test. For the coacher's practical use, the 1-leg CMJ could be a superior test to predict the FFP jump performance by measuring eccentric peak force, leg vertical stiffness, mean power and reactive strength index.

References

Arago'n-Vargas, L. F., & Gross, M. (1997). Kinesiological factors in vertical jump performance: Differences among individuals. *Journal of Applied Biomechanics, 13,* 24–44.

Bai, E., Ren, W., & Ma, X. (2000). Isokinetic strength of leg flexors and extensor in elite high jumper. *18 International Symposium on Biomechanics in Sports*. Retrieved from https://ojs.ub.uni-konstanz.de/cpa/article/view/2296/2153

Laffaye, G. (2011). Fosbury flop: Predicting performance with a three-variable model. *The Journal of Strength & Conditioning Research, 25*(8), 2143–2150.

Souza, A. A., Bottaro, M., Rocha, V. A. et al. (2020). Reliability and test-retest agreement of mechanical variables obtained during countermovement jump. *International Journal of Exercise Science, 13*(4), 6–17.

Keywords: countermovement jump, high jumpers, testing, force plate.

DYNAMIC HIGH INTENSITY INTERVAL TRINING PROTOCOL EFFECT ON PEAK VO_2 IN CROSS COUNTRY SKIERS, A PRELIMINARY RESULT REPORT

Marcis Jakovics, Inese Pontaga, Voldemars Arnis
Latvian Academy of Sport Education, Latvia

Background. Cross country skiing is an endurance sport, where correlation between result and peak VO_2 has been proven by Sanbakk while analysing differences between Scandinavian elite and national level skiers. He noticed that technique level was similar in both groups, but statistically significant difference was in aerobic power and peak oxygen uptake in elite groups advantage ($p < 0.05$) (Sandbakk et al., 2016). Both Sloth and Bacon with colleagues have conducted meta-analyses of available scientific literature and found strong effects of high intensity interval training on maximum oxygen uptake (VO_2max) (Bacon, Carter, Ogle, & Joyner, 2013; Sloth, Sloth, Overgaard, & Dalgas, 2013). Similar work has been conducted by Gist et al. (Gist, Fedewa, Dishman, & Cureton, 2013). One of more recent works by Wen clearly describes similar findings but also indicates that high intensity interval training (HIIT) scientific scene is wide and not all methods are as effective as others and some even not effective at all (Wen et al., 2019). Considering all of this, a further research is to be conducted.

Research methods. Participants. Female. Last season's overall World cup winner in junior roller skiing and bronze medallist in World championship. Born in 2003. Male. One of highest ranking Latvian roller-skiers, born in 2003. Written consent is obtained from the participants for this study, which is performed according to Helsinki declaration. Design Study consists of two VO_2max tests, between them a laboratory controlled two week training cycle with six (three each week) interval training sessions. VO_2max test Subject warms up for 20 mins on treadmill (Lode valiant Ultra 250, Netherlands) in varying speed, mostly up to 70% of maximum HR (determined before using pulsometry method with polar M400 heart rate monitor and polar H9 chest strap). At the end of warm up treadmill is set to 6% incline and speed at which provokes 90% of maximum HR. This is the starting speed of test. The participant is asked to perform a 10 min "race" with an aim to cover maximum distance and he is to subjectively determine weather to increase or decrease the speed (incline is constant), the test is performed using laboratory provided SkiGo aluminium skate roller skies with nr. 3 wheels and personal ski poles and boots fitted for athlete. Gas analysis preformed with Vyaire Vyntus CPX gas analyser, Netherlands. Lactic acid levels measured at the end of the test using EKF diagnostic biosen C_line, Germany. After the test lowest speed that sustains peak oxygen uptake is determined for interval training. During the interval training equipment used is the same. Speed has been determined in previous test and every session two intervals are performed each up to 10 min (subject can stop at any moment). Warm up and rest between intervals is standardised. Warm up: 20 min around 70% of max HR, between intervals 10–20 min (depends on time of first interval, that is doubled). After two weeks same VO_2max test is performed with an aim to see difference in peak VO_2. For antropometry scales used: Electric scale Tanita MPB 300K100, South Korea.

Results and discussion. Both subjects performed initial VO_2max test. Male reached 59.2 ml/kg/min at 14 km/h and incline of 6%. Both subjects completed all 6 interval training sessions. Final VO_2max test was performed only by male subject. A significant increase of peak VO_2 was observed. It reached 64.4 ml/kg/min. Female could not complete the final VO_2max test because of technical failure. It is planned for her to repeat the experiment within a year.

Conclusions. Considering findings of Wen and colleagues (Wen et al., 2019), the increase of peak VO_2 in male subject by 5.2 ml/kg/min after two weeks of highly precise interval training is significant. Considering previously mentioned findings by Sandbakk et al. (2016) this most certainly can also improve results in competition for cross country and roller skiers. Method used in this first preliminary experiment shows potential and is to be further researched and compared against more traditional interval training methods in order to obtain more concrete evidence.

References

Bacon, A. P., Carter, R. E., Ogle, E. A., & Joyner, M. J. (2013). VO_2max trainability and high intensity interval training in humans: A meta-analysis. *PLoS One, 8*(9), e73182. https://doi.org/10.1371/journal.pone.0073182

Gist, N., Fedewa, M., Dishman, R., & Cureton, K. (2013). Sprint interval training effects on aerobic capacity: A systematic review and meta-analysis. *Sports Medicine, 44*(2), 269–279.

Sandbakk, Ø., Hegge, A. M., Losnegard, T., Skattebo, Ø., Tønnessen, E., & Holmberg, H. C. (2016). The physiological capacity of the world's highest ranked female cross-country skiers. *Medicine and Science in Sports and Exercise, 48*(6), 1091–1100. https://doi.org/10.1249/MSS.0000000000000862

Sloth, M., Sloth, D., Overgaard, K., & Dalgas, U. (2013). Effects of sprint interval training on VO_2max and aerobic exercise performance: A systematic review and meta-analysis. *Scandinavian Journal of Medicine & Science in Sports, 23*(6), e341–e352. https://doi.org/10.1111/sms.12092

Wen, D., Utesch, T., Wu, J., Robertson, S., Liu, J., Hu, G., & Chen, H. (2019). Effects of different protocols of high intensity interval training for VO_2max improvements in adults: A meta-analysis of randomised controlled trials. *Journal of Science and Medicine in Sport, 22*(8), 941–947. https://doi.org/10.1016/j.jsams.2019.01.013

Keywords: peak VO_2, high intensity interval training, VO_2max, roller-skiing, cross-country skiing.

RELATIONSHIP BETWEEN RESPIRATORY SYSTEMS' PARAMETERS AND RESULT IN SWIMMING

Germans Jakubovskis, Anna Zuša, Jeļena Solovjova
Latvian Academy of Sport Education, Latvia

Background. Swimming performance is highly dependent on the underwater phase, which begins with the start and turn, consisting of gliding and dolphin kicking during the first 15 m of the distance. The efficiency of swimming time could have a close relationship with swimming technique as well, as with respiratory system parameters (Wells, Plyley, Goodman, & Duffin, 2005). The condition of the respiratory system can affect the performance of high-level athletes, especially at high intensity (Harms, Wetter, Croix, Pegelow, & Dempsey, 2000).

Research methods. 1. A spirometry test is used to measure the level of physical condition of different characteristics of the respiratory system. 2. The level of readiness for swimming is determined by the result at a distance of 100 m.

Results and discussion. The average competition results in the men's group were 628 FINA points, in the women's group 592 FINA points, in the group of 16–17 year-old athletes men's group is 588 FINA points, in the women's group 574 FINA points. Respiratory system indicators: men's group FVC – 6.47 ± 0.53 l., PIF – 8.55 ± 1.34 l/s, PEF – 9.95 ± 0.40 l/s, in the women's group FVC – 4.86 ± 0.67 l., PIF – 6.15 ± 0.67 l/s, PEF – 7.57 ± 0.43 l/s. According to scientific literature, swimmers, due to the particular nature of breathing during swimming, have a pre-fertilization of the peak inspiratory flow over the peak expiratory flow (Абрамов, 1964). The obtained data show that both the male group (PEF = 9.97 l/m) and the female group (PEF = 7.46 l/m), have a low peak inspiratory flow (male group (PIF = 8.45, female group PIF = 5.94 l/m). The provided findings contradict data from the specialized literature (Солопов, 1988), as well as the complete determination of Latvian pelting groups with effective underwater swimming.

Conclusions. A correlation has been found between certain parameters of the respiratory system and result in swimming. It seems that the results of this examination, apart from having a theoretical function, can be used in practice, as they can help coaches and instructors diagnose, forecast, analyze or plan the training process for young swimmers, especially in relation to shaping of the functional abilities of the respiratory system.

References

Harms, G. A., Wetter, T. J., Croix, C. M. St., Pegelow, D. F., & Dempsey, J. A. (2000). Effects of respiratory muscle work on exercise performance. *Journal of Applied Physiology, 89,* 131–138.

Wells, G. D., Plyley, M., Goodman, S. T. L., & Duffin, J. (2005). Effects of concurrent inspiratory and expiratory muscle training on respiratory and exercise performance in competitive swimmers. *European Journal of Applied Physiology, 94,* 527–540.

Абрамов, М. И. (1964). Мощность вдоха как показатель тренированности пловца. *Материал VII научной конференции по вопросам морфологии, физиологии и биохимии мышечной деятельности* (сс. 3–4). Москва: Физкультура и спорт.

Солопов, Н. Н. (1988). *Дыхание при спортивном плавании*. Волгоград: Волгоградский государственный институт физической культуры.

Keywords: swimming time, respiratory system characteristics, competitive swimmers.

BALANCE IMPROVEMENT FOR SPORT CLIMBERS

Aivars Kaupuzs[1], Inga Liepina[2], Romans Pjahns[2]

[1] Rezekne Academy of Technologies, Latvia; [2]Latvian Academy of Sport Education, Latvia

Background. Sport climbing is relatively new type of sport where the main goal is to ascend an artificial rock climbing wall which has artificial rock holds. The popularity of climbing as a competitive sporting pursuit has raised questions of ideal training regimens (Sheel, 2004). In sport climbing balance is an essential physical quality that can be crucial during competition. However, majority of sport climbers spend far less time on improving their balance during training process than it actually requires to improve balance. Furthermore, if improvement of balance is integrated into the training process, it is hard to tell whether the balance has improved or not due to complexity of measuring the balance.

Research methods. The aim of the research was to define the efficiency of developed exercise program for balance improvement. The participants were 22 sport climbers aged 15 and above with at least 3 years of sport climbing experience. The exercise program was developed based on the review of scientific literature (Friedmann, 2014; Jacobson & Shepard, 2016). The program include 19 exercises for improving of the balance. The climbers performed this exercises three times per week (one session last 30 min) in nine weeks period. The pre and post testing was done by BioSway portable balance system with Test of Sensory Integration and Balance (mCTSIB) protocol. The gained data were analyzed with MS Excel (Shapiro–Wilk test and T-test).

Results and discussion. When repeated balance tests were performed after applying the complex of balance improving exercises for sport climbers for a nine week period, conclusions were made that all balance tests which did not have emphasis on sight sensory system had statistically significant. However, balance tests with Biosway device that included closing eyes, showed improvements, but improvements are not statistically significant. After applying the complex of balance improving exercises it was conclude that mean improvement of statical balance in LOS balance test is 4.2%, in M-CTSIB test by 7 coefficient units (solid surface, eyes open), by 6.3 coefficient units (solid surface, eyes closed), by 13.2 coefficient units (soft surface, eyes open) and by 21 coefficient units (soft surface, eyes closed). Dynamic balance abilities for sample group have increased by 28%. During initial testing only 39% of sample group passed the dynamic balance test, however after applying the complex of balance improving exercises dynamic balance test was passed by 67% of the sample group.

Conclusions. After the conducted experiment conclusion is that balance tests which did not have emphasis on sight sensory system, sample group showed statistically significant improvement of results after applying of the complex of balance improvement exercises. However, balance tests with emphasis on sight sensory system, improvement is present, although it is not statistically significant, what actually approves the hypothesis due to absence of balance exercises with emphasis on sight sensory system, proving that balance ability depends on sight sensory system too.

References

Friedmann, A. J. (2014). *Proprioception and developmental motor training*. MO: St. Louis.

Jacobson, G. P., & Shepard, N. T. (2016). *Balance function assessment and management.* 2nd edition. CA, San Diego: Plural Publishing Inc.

Sheel, A. W. (2004). Physiology of sport climbing. *British Journal of Sports Medicine*. Retrieved from https://bjsm.bmj.com/content/38/3/355

Keywords: balance, sport climbing, vestibular training.

THE EFFECT OF DRILL TYPOLOGY AND LEVEL OF COMPETITION ON INTERNAL AND EXTERNAL LOAD IN VOLLEYBALL PLAYERS DURING THE PRE-SEASON PERIOD

Gilbertas Kerpė, Aurelijus Kazys Zuoza, Daniele Conte
Lithuanian Sports University, Lithuania

Background. In volleyball and many other sports, the pre-season period is based on different type of practice preparing for the rest of the season. It is important to choose right drills, loads and periods to accomplish goals. Furthermore, competition level tends to separate players by their physicality's and express more power (Libs, Boos, Shipley, Peacock, & Sanders, 2019; Sattler, Hadžic, Derviševic, & Markovic, 2015). However, right internal, and external loads to improve physical abilities for upcoming season for different competition level plays important role and was not yet explored in volleyball. Therefore, the aim of the study was to determine the external and internal loads in different drill typologies and level of competition in volleyball players during the pre-season period.

Research methods. Two men's volleyball teams were recruited and categorized as higher and lower level based on the championship they are participating (1st and 2nd Lithuanian Volleyball division). During pre-season period, players wore microsensor technology (Catapult) and heart rate monitor (Polar) to measure internal and external load throughout different type of drills (warm-up, conditioning, technical, tactical, and integral). Percentage of maximal heart rate (%HR max) and summated heart rate zone (SHRZ) data used as internal load, while player load (PL) per minute, low, medium, high, and total inertial movement analysis (IMA) per minute and acceleration, deceleration, jump, and change of direction (CoD) per minute used as external load. Statistical analysis was performed using linear mixed model using drill typology and level of competition as fixed effects and player as random effect.

Results and discussion. Results revealed an effect of drill typology on both %HR max and SHRZ ($p < 0.001$), while no effect were shown for level of competition. An effect of drill typology on all external load measures were found ($p < 0.001$) except IMA CoD Left High per minute and IMA CoD Right High per minute, while no effect was shown for level of competition, except for IMA Jump Low and Medium. Moreover, it was found that players reach highest %HR max and SHRZ values on conditioning type of drills, while warm-up showed highest PL and technical type of drills showed lowest values per minute. IMA Jump bands showed that higher competition level team did more high jumps (> 40 cm) in warm-up and conditioning type of drills, while lover lower competition level team did more high jumps in tactical, technical, and integral drills.

Conclusions. Internal load values showed that conditioning drills had the highest values, while warm-up and technical drills the least in both competition levels. External load values (PL) per minute showed that the intensity was higher in warm-up and conditioning drill in both competition levels, probably due to high displacement in these drill typologies. Moreover, external load value (IMA Jump high) per minute showed that lower division team did more high jumps, probably for the desire to do more, better, and to compensate for technical shortcomings by physical factors.

References

Libs, H., Boos, B., Shipley, F., Peacock, C. A., & Sanders, G. J. (2019). Variability in preseason jump loads and heart rate intensities in division I volleyball. *Journal of Exercise and Nutrition, 2*(2).

Sattler, T., Hadžic, V., Derviševic, E., & Markovic, G. (2015). Vertical jump performance of professional male and female volleyball players: Effects of playing position and competition level. *The Journal of Strength & Conditioning Research, 29*(6), 1486–1493.

Keywords: internal load, external load, volleyball, drill, pre-season.

REPEATED SPRINT ABILITY IN ELITE DEAF BASKETBALL PLAYERS DURING THE PREPARATORY PERIOD

Rūtenis Paulauskas

Vytautas Magnus University, Lithuania

Background. Deaf people are rather active in sports life and participation in basketball competitions is one of the ways for their self-expression (Milašius, Paulauskas, Dadelienė, & Šatas, 2014). Lithuanian deaf athletes are the numerous prize winners in World, European Deaf Championships, as well as in Deaflympics Games. The aim of this research is to assess the repeated sprint ability (RSA) of deaf elite basketball players in order to determine the evolution of the deaf players' muscle power during repeated-sprint exercise.

Research methods. Fourteen deaf male basketball players (28.3 ± 6.3 years) performed two RSA protocols consisting of 5 × 6 s cycling sprints with a 24 s rest interval between sprints (Bishop, Spencer, Duffield, & Lawrence, 2001). RSA was assessed by calculating absolute and relative peak power (PP), total work (TW) performed, fatigue index (FI), and work decrement (WD) (Stapff, 2000).

Results and discussion. The work decrement indices (7.1 ± 3.7%) for deaf players during the first trial were small and after 5-minute rest did not change significantly. The total work (332 ± 42 J) decreased by 6%. During the 5-minute passive rest, deaf basketball players' absolute peak power recovers about 95% of the initial levels.

Conclusions. Therefore, we suggest that such interval of rest is sufficient for deaf basketball players so that they can continue the game showing good capacity potential. We also suggest that when deaf basketball players aim for even greater repeated sprint abilities, they need to reduce work decrement maintaining the capacity of all sprints.

References

Bishop, D., Spencer, M., Duffield, R., & Lawrence, S. (2001). The validity of a repeated sprint ability test. *Journal of Science and Medicine in Sport, 4*(1), 19–29.

Milašius, K., Paulauskas, R., Dadelienė, R., & Šatas, A. (2014). Body and functional capacity of Lithuanian deaf basketball team players and characteristics of game indices. *Baltic Journal of Sport and Health Sciences, 95*(4), 24–30.

Stapff, A. (2000). Protocols for the physiological assessment of basketball players. In C. J. Gore (Ed.), *Physiological tests for elite athletes* (pp. 224–237). Australian Sports Commission. Champaign, IL: Human Kinetics.

Keywords: sprints, muscle power, work decrement, recovery.

INVESTIGATING SPACE PROTECTION DYNAMICS IN NBA AND EUROLEAGUE

Dino Peraica, Daniele Conte
Lithuanian Sports University, Lithuania

Background. Lamas et al. (2011) presented a set of basketball offensive classes corresponding to the possible offensive specifications to create space in the adversary defensive system, which leads to scoring opportunities, the space creation dynamics (SCD). Subsequentially, SCDs were used as a reference to conceive and validate their correspondent defensive classes, the space protection dynamics (SPDs) (Santana et al., 2015). Although SPDs seem an important characteristics of basketball defensive systems, no investigation characterized them in elite basketball. The aim of this study was to determine the differences in SPDs between the two top level basketball leagues – in Europe (Euroleague) and USA (NBA).

Research methods. Using a video analysis method, selected SPDs (2 vs 2 and 3 vs 3) were observed in 32 close matches (no more than 10 points difference) in two top tier leagues: NBA and Euroleague. For each professional league, 16 matches were analysed (8 matches of regular season; 8 matches of playoffs), analysing defence against set offense possessions. None of the teams was analysed more than three times. Video analysis was performed by an experienced video analyst. Chi-square analysis was used to compare SPD distribution between NBA and Euroleague and regular season/playoff games in the same league.

Results and discussion. Significant difference was found in the distribution between 2 vs 2 and 3 vs 3 in SPDs comparing NBA to Euroleague ($p < 0.001$). Previous literature has indicated that there is a difference in the offensive preferences of EL and NBA teams (Jorgensen, Selmanovic, & Thomann, 2021). Differences in offensive strategies subsequentially lead to different distribution of SPDs. Analysis of all subcategories for 2 vs 2 and 3 vs 3 between two leagues showed differences for both groups of SPDs ($p < 0.001$). Comparing regular season with playoff games within the same league showed no significant differences ($p > 0.05$) in distribution between two main groups of SPDs. Analysis of all subcategories showed significant differences between both groups in NBA, comparing regular vs. playoff games [2 vs 2 ($p < 0.001$) and 3 vs 3 ($p < 0.05$)]. However, while EL comparison showed difference between 2 vs 2 subcategories ($p < 0.001$), no difference was found in 3 vs 3 ($p > 0.05$). Pick and roll is possibly the only offensive element that is present as an indicator of performance in all types of matches (Mavridis, Tsamourtzis, Karipidis, & Laios, 2009).

Conclusions. SPDs are used on defence to obstruct opponents offensive SCDs, so obtained data could give insight on how elite teams defend accordingly to opponents style of play. No significant differences found between regular season and playoff games could indicate that selected SPDs could be crucially important in all basketball matches. This research could help coaches in preparation of defensive strategies.

References

Jorgensen, J., Selmanovic, A., & Thomann, K. (2021). Difference of offensive structure between European and American top-level basketball. *Journal of Physical Education and Sport, 21,* 1988–1997. http://dx.doi.org/10.7752/jpes.2021.s3253

Lamas, L., De Rose Jr., D., Santana, F., Rostaiser, E., Negretti, L., & Ugrinowitsch, C. (2011). Space creation dynamics in basketball offence: Validation and evaluation of elite teams. *International Journal of Performance Analysis in Sports, 11,* 71–84. https://doi.org/10.1080/24748668.2011.11868530

Mavridis, G., Tsamourtzis, E., Karipidis, A., & Laios, A. (2009). The inside game in World Basketball. Comparison between European and NBA teams. *International Journal of Performance Analysis in Sport, 9*(2), 157–164. doi:10.1080/24748668.2009.11868473

Santana, F., Rostaiser, E., Sherzer, E., Ugrinowitsch, C., Barrera, J., & Lamas, L. (2015). Space protection dynamics in basketball: Validation and application to the evaluation of offense-defense patterns. *Revista de Educação Física, 21,* 34–44. http://dx.doi.org/10.1590/S1980-65742015000100005

Keywords: performance analysis, team sports, tactical, cooperation.

ANALYSIS OF DIFFERENT SWIMMING ABILITIES IN YOUTH WATER POLO PLAYERS AND ITS COMPARISON IN TWO AGE CATEGORIES

Andrea Perazzetti[1, 2], Milivoj Dopsaj[1], Antonio Tessitore[2]

[1]University of Belgrade, Serbia; [2]University of Rome "Foro Italico", Italy

Background. Water-polo requires prolonged intermittent phases of play, during which high intensity activities are interspersed by lower-intensity ones and by periods of recovery (Meckel et al., 2013). In a water polo game players continuously change position from a vertical to a horizontal one and vice versa (Lupo et al., 2009). To cope with horizontal phases, players perform technically skilled movements with and without ball, which require different swimming abilities, such as crawl, crawl with the head above water, crawl while leading the ball, as well as more variants of the specific water polo crawl (Dopsaj, Madić, & Okičić, 2007). Indeed, different trudgen styles, combining arm-work in front crawl and legwork in breaststroke, are also required (Dopsaj, Manojlović, Bratuša, & Okičić, 2003).

Research methods. Twenty-six male youth water polo players, from U14 (n = 13) and U16 (n = 13) categories of the same club were recruited. Participants performed 2 × 12 trials of 25 m swam at maximum speed with two different swimming styles (crawl and trudgen) and three different variants for each one. In day 1 were performed all crawl styles [Crawl (C), Crawl with head above (CHA), Crawl leading the ball (CLB)], while in day 2 all trudgen styles [Trudgen (T), Trudgen leading the ball (TLB), Trudgen holding the ball (THB)]. All variants were performed with two different starting conditions (with and without pushing from the wall). For each test two trials were attempted, and the best performance times were recorded.

Results and discussion. Descriptive statistics (minimum, maximum, mean and SDs) were calculated for all parameters in both categories. The independent T-Test showed significant differences ($p < 0.01$) between U14 and U16 in all tests performed in both swimming styles and all variants, as well as in both starting conditions. Within each age category, the Paired sample T-Test highlighted in all tests a significant difference ($p < 0.05$) between trials with and without pushing from the wall, except for TLB (U14, $p = .486$; U16, $p = .413$). Furthermore, the percentage of gap between trials performed without and with ball were calculated for both age categories. The tests C vs CHA showed a gap of 8.2% and 6.7% in U14 and U16, respectively. The tests T vs TLB showed a gap of 5.6% for U14 and 1.6% for U16 age category. Finally, a gap of 16.2% and 12.2% between T and THB for U14 and U16 was registered, respectively.

Conclusions. In line with previous findings (De Jesus et al., 2012), our study confirms that for water polo players a specific training for both crawl and trudgen is needed. To increase players' skills, specific swimming abilities with ball should be employed in their training. In fact, our findings demonstrated that over the years of practice, youth water polo players show improvements in their skills to leading the ball, reducing the gap with tests investigating the swimming styles without the ball.

References

Lupo, C., Tessitore, A., Cortis, C., Ammendolia, A., Figura, F., & Capranica, L. (2009). A physiological, time–motion, and technical comparison of youth water polo and Acquagoal. *Journal of Sports Sciences, 27*(8), 823–831.

Meckel, Y., Bishop, D., Rabinovich, M., Kaufman, L., Nemet, D., & Eliakim, A. (2013). Repeated sprint ability in elite water polo players and swimmers and its relationship to aerobic and anaerobic performance. *Journal of Sports Science & Medicine, 12*(4), 738.

De Jesus, K., Figueiredo, P., De Jesus, K., Pereira, F., Vilas-Boas, J. P., Machado, L., & Fernandes, R. J. (2012). Kinematic analysis of three water polo front crawl styles. *Journal of Sports Sciences, 30*(7), 715–723.

Dopsaj, M., Madić, D., & Okičić, T. (2007). The assessment of the acquisition of various crawl style modes in water polo players with respect to age and competitive levels. *Facta universitatis-series: Physical Education and Sport, 5*(2), 109–120.

Dopsaj, M., Manojlović, N., Bratuša, Z., & Okičić, I. (2003). The structure of swimming skills in water polo players at the first level of pre-selection. *Exercise & Society Journal of Sports Science, 34,* 76–80.

Keywords: front crawl, trudgen, swimming styles, ball abilities, team sport.

COMPARATIVE EFFECTIVENESS OF ACTIVE RECOVERY AND STATIC STRETCHING DURING POST-EXERCISE RECOVERY IN ELITE YOUTH BASKETBALL PLAYERS

Marco Pernigoni[1], Julio Calleja-González[2], Inga Lukonaitienė[1], Antonio Tessitore[3], Jūratė Stanislovaitienė[1], Paulius Kamarauskas[1], Daniele Conte[1]

[1]Lithuanian Sports University, Lithuania; [2]University of the Basque Country, Spain; [3]University of Rome "Foro Italico", Italy

Background. A single bout of basketball activity can produce detrimental effects on performance, muscle damage and soreness, range of motion and kinesthetic awareness (Doma et al., 2018), which could have negative consequences on individual and team performance over the course of the competitive season. Therefore, the use of recovery strategies plays a key role to maintain a high level of performance when the time interval between competitive games and/or training sessions is short (Calleja-González et al., 2016).

Research methods. Using a counterbalanced crossover design, 17 elite youth male players completed two 90-min training sessions, followed by active recovery (AR) or static stretching (SS). Differences in jump height (CMJ), heart rate variability (HRV), muscle soreness (VAS), perceived recovery (TQR) and salivary markers (cortisol, testosterone, testosterone:cortisol) between interventions were assessed at 4 time points: pre-session, post-session (except salivary markers), post-recovery and 24 h post-session. Differences in HRV were also assessed upon awakening on training day, and on the following morning.

Results and discussion. No significant differences were found between AR and SS at corresponding time points ($p > 0.05$). However, the time course of recovery within each condition differed, with impaired CMJ performance at post-recovery in SS only ($p < 0.05$, effect size [ES]: moderate to very large). In AR only, HRV was impaired at post-recovery ($p < 0.05$, ES: large to very large), and the same was true for TQR at post-session and post-recovery ($p < 0.05$, ES: moderate to large). No differences were found for the remaining variables ($p > 0.05$). The CMJ decrease after SS is likely due to a decrease in neuromuscular activation (Behm & Chaouachi, 2011), while a "re-warm-up" effect (Silva, Neiva, Marques, Izquierdo, & Marinho, 2018) and clearance of metabolic waste (Van Hooren & Peake, 2018), may be responsible for performance conservation after AR. HRV and TQR differences may be due to higher demands in AR (Van Hooren & Peake, 2018) than SS.

Conclusions. Neither AR nor SS appeared to be a better strategy for improving recovery beyond ~10–20 min post-intervention. However, the absence of changes in any of the investigated variables at 24 h post-session (compared to pre-session) might indicate that session intensity and/or duration were insufficient to elicit lasting fatigue, making it challenging to detect differences between AR and SS.

References

Behm, D. G., & Chaouachi, A. (2011). A review of the acute effects of static and dynamic stretching on performance. *European Journal of Applied Physiology, 111*(11), 2633–2651. https://doi.org/10.1007/S00421-011-1879-2

Calleja-González, J., Terrados, N., Mielgo-Ayuso, J., Delextrat, A., Jukic, I., Vaquera, A., Torres, L., Schelling, X., Stojanovic, M., & Ostojic, S. M. (2016). Evidence-based post-exercise recovery strategies in basketball. *Physician and Sports Medicine, 44*(1), 74–78. https://doi.org/10.1080/00913847.2016.1102033

Doma, K., Leicht, A., Sinclair, W., Schumann, M., Damas, F., Burt, D., & Woods, C. (2018). Impact of exercise-induced muscle damage on performance test outcomes in elite female basketball players. *Journal of Strength and Conditioning Research, 32*(6), 1731–1738. https://doi.org/10.1519/jsc.0000000000002244

Silva, L. M., Neiva, H. P., Marques, M. C., Izquierdo, M., & Marinho, D. A. (2018). Effects of warm-up, post-warm-up, and re-warm-up strategies on explosive efforts in team sports: A systematic review. *Sports Medicine, 48*(10), 2285–2299. https://doi.org/10.1007/S40279-018-0958-5

Van Hooren, B., & Peake, J. M. (2018). Do we need a cool-down after exercise? A narrative review of the psychophysiological effects and the effects on performance, injuries and the long-term adaptive response. *Sports Medicine, 48*(7), 1575–1595. https://doi.org/10.1007/S40279-018-0916-2

Keywords: cool-down, performance, fatigue, salivary markers, team sports.

AN OPTIMISATION MODEL FOR LEARNING THE COMPLEX AND VARIED BASIC TECHNIQUES OF STAND-UP COMBAT IN JUDO AND ITS CONTENT

Einārs Pimenovs, Andra Fernāte, Andris Pimenovs
Latvian Academy of Sport Education, Latvia

Background. The author of the thesis emphasizes that the variety of different and complex basic techniques of standing wrestling and the possibilities of their execution pose many unsolved problems, the ultimate goal of which is to increase the efficiency of the training process, which in turn also determined the choice of the topic of the thesis "Optimization of learning complex and varied basic techniques of standing wrestling in 7–12 year old judo players". Development and validation of a model for optimization of learning basic standing techniques for young judo players and development of recommendations for coaches to improve learning of basic standing techniques (Bompa & Haff, 2009; Illeris, 2007; Бернштейн, 1991).

Research methods. The following scientific and research methods were used to solve the task: 1) study and analysis of literature sources; 2) analysis of video materials; 3) pedagogical observation of the competition activity; 4) expert evaluation method; 5) modelling; 6) the observational experiment; 7) mathematical statistics.

Results and discussion. The application of the optimization model content to the learning of basic judo standing combat techniques had a positive effect on the results. Mann Whitney U-test for 2 independent sets helped to determine that the increase in yellow belt scores was significant for all techniques as $p < 0.01$. The mean increase for all techniques is 1.7 points. The increase in orange belt score is reliable in 6 cases due to $p < 0.01$ or 0.05, but not reliable in 3 cases. The average increase for all techniques is 2.16 points. The increase in Green Belt scores is reliable for all techniques at $p < 0.01$ or 0.05. The average increase for all techniques is 1.59 points. After processing the results, it can be concluded that the use of the Judo Standing Martial Basic Technique Optimization Model content has improved the technical preparation results for all three grades of students (kyo – yellow, orange, green belt) by an average of 1.82 points. This is due to the increased attention paid to the biomechanics of teaching the elements of judo and the principles of executing the technical techniques accurately. Consequently, the basic principles of the execution of the techniques were identified and the appropriate tools for their acquisition were selected.

Conclusions. The optimization of learning the basic techniques of judo standing includes planning the work, determining the needs of the judoka, setting goals and objectives, choosing appropriate means and methods, evaluating the achieved learning results (Fernāte, 2008). Optimization of learning is possible if the basic principles of technique performance are understood and briefly explained (Inogai & Habersetzer, 2002). The learning process can also be improved by accurate evaluation of the basic techniques of judo standing. As well as judo it is necessary to develop all physical qualities with emphasis on coordination.

References

Bompa, T. O., & Haff, G. (2009). *Periodization: Theory and methodology of training*. Leeds: Human Kinetics.
Fernāte, A. (2008). *Trandisciplināra pieeja ķermeniskās izpratības izpētē*. Promocijas darbs. Rīga: Latvijas universitāte.
Illeris, K. (2007). *How we learn. Learning and non-learning in school and beyond*. New York: Routledge.
Inogai, T., & Habersetzer, R. (2002). *Judo pratique*. Paris: Amphora.
Бернштейн, Н. А. (1991). *О ловкости и ее развитии*. Москва: Физкультура и спорт.

Keywords
judo's complex basic standing techniques, judo's complex basic standing techniques learning optimization, judo's complex basic standing techniques learning optimization model.

PULSE WAVE PARAMETERS OF RADIAL ARTERY PRESENT INFORMATION ABOUT THE CHANGES IN FUNCTIONAL STATE OF ATHLETES

Jonas Poderys[1], Živilė Kairiūkštienė[1], Kristina Poderienė[1], Kristina Motiejūnaitė[1], Eugenijus Trinkūnas[1], Deivydas Velička[2]

[1]Lithuanian Sports University; [2]Lithuanian University of Health Sciences, Lithuania

Background. In accordance with a holistic principle, human body is seen as a complex multi-level functional system, consisting of a large number of interrelated subsystems participating in rhythmic and periodic processes. The problem is based on the idea that measurements of the pulse wave parameters in some points of radial artery may present the information about the changes in functional state of athletes. The aim of this study was to compare the dynamics of parameters of pulse wave of radial artery and ECG parameters as to use method of pulsometry for feedback information during the training process.

Research methods. The first study was designed to establish the dynamics of pulse wave parameters while the athletes (n = 10) performed the warm-up and after that performed the stepwise incremental exercise up to inability to continue the task. The second study has the task to compare the dynamics of pulse wave parameters and the dynamics of ECG parameters when the group of athletes (n = 16) performed hard training session designed to develop muscular power. The recovery of athletes was assessed by the registration the same indices on the next day, i.e. 24 hours after the training session. Arterial blood pressure (ABP) measurements, pulse wave parameters and 12-leads ECG were recoded and analyzed. Pulse is measured at six points on both hands by the computerized devise "PULS-AS". The computer technique of pulse diagnosis is based on the analysis of pulsogram by mutual location of specific points and in comparison with a normalized pulsogram healthy person, showing one graph at beating pulse. This takes into account the characteristic features of the amplitude and the time shift of these points and deviations from the normalized pulsogram. Computerized system "Kaunas-load" was employed for register of ECG signals. The algebraic data cointegration method (Berškienė et al., 2009; Navickas & Bikulčienė, 2008; Venskaitytė, Poderys, Balagué, & Bikulčienė, 2009; Vainoras, Ašeriškytė, Poderys, & Navickas, 2005) was used for analysis of ECG parameters.

Results and discussion. First study. We observed the small increase of integral index of pulse wave parameters after the warm-up and the significant decrease a lot of pulse wave parameters after a fatigue-inducing workload. The analysis of results obtained during this study reveal a lot of correlations between dynamics of pulse wave parameter and concatenation between ECG parameters. The results obtained during the second study showed that hard training session impacted the fatigue all of athletes and the individual peculiarities in body systems recovery during the 24 hours. It is worth to note that the athletes who during the testing after the 24 hours rated their subjectively perceived fatigue to a greater degree where still in state of fatigue according the ECG, ABP and pulse wave indices. Physical exercise stimulates the activity of various functional systems, activating all levels of the body's composition: sub-cellular, cellular, tissues, organs, and systems (Girard, Willis, Purnelle, Scott, & Millet, 2019; Vainoras et al., 2005; Veneziani, 2006). The interaction of morphological, physiological, and psychological peculiarities during exercising along with the influence of the environment create unique combinations of physiological reactions, which cannot be evaluated using only statistical analysis techniques (Venskaitytė et al., 2009; Vainoras et al., 2005; Veneziani, 2006).

Conclusions. The obtained results suggest that the technique of measurements of pulse wave parameters of radial artery makes it possible to examine in more detail the impact of training workloads on body systems or to investigate and analyze the training relevant situations and to discuss about their origin.

References

Berškienė, K. et al. (2009). Analysis of dynamical interrelations of electrocardiogram parameters. *Electronics and Electrical Engineering, 7*(95), 95–98.

Girard, O., Willis, S. J., Purnelle, M., Scott, B. R., & Millet, G. P. (2019). Separate and combined effects of local and systemic hypoxia in resistance exercise. *European Journal of Applied Physiology,* 2313–2325.

Navickas, Z., Bikulčienė, L. (2008). Antros eilės matricų informatyvieji dėstiniai. *Matematika ir matematinis modeliavimas,* 26–33.

Venskaitytė, E., Poderys, J., Balagué, N., & Bikulčienė, L. (2009). Assessment of dynamics of inter-parameter concatenation during exercise tests. *Electronics and Electrical Engineering, 6*(94), 89–92.

Vainoras, A., Ašeriškytė, D., Poderys, J., & Navickas, Z. (2005). Fractal dimensions in evaluation of heart function parameters during physical investigations. *Baltic Journal of Sport and Health Sciences,* 61–66.

Veneziani, A. Q. F. (2006). *Complex systems in biomedicine*. Milano: Springer.

Keywords: feedback, fatigue, pulse wave, electrocardiography.

EVALUATION OF THE CONTENT OF THE EQUESTRIAN SPORTS SHOW-JUMPING DISCIPLINES' COMPETITION ACTIVITY

Svetlana Rudmieze, Andra Fernate
Latvian Academy of Sport Education, Latvia

Background. The activities of competitions in different sports are described differently. In equestrian sports, the activity of competitions in the discipline of show-jumping has not been studied and described. There are also very different expressions of theoretical and practical understanding of equestrian coaches, which indicates that the basic principles of the training system, which affect the performance of the competition and the training process, including the choice of appropriate methodological approaches, have not been defined. The aim of the research is to compare the advantages of the assessment methods of the equestrian competitions' activity.

Research methods. Analysis of scientific literature was used to identify the advantages of the assessment methods of the equestrian competitions' activity. In order to compare the assessment methods research was conducted in electronic scientific databases ScienceDirect, Google Scholar (1997–2021). The inclusion criteria for study selection: the article was written in English, Russian languages. The study is based on 34 literature sources and scientific articles, 6 of which are in Russian and 28 – in English. A set of several research methods was compared to obtain conclusions.

Results and discussion. The choice of the most appropriate research method is an integral part of the research process. Often the desired outcome of a process study is unpredictable. The following methods are most often used in the research of competition activities: analysis and generalization of scientific literature; theoretical review of scientific-methodological literature; development of criteria, compilation of tables and video materials; pedagogical observation; video surveillance (recording of technical-tactical activity indicators); analysis of mathematical statistical data; modelling; compilation of best practices of specialists, coaches; testing. Usually qualitative research is concerned with the systematic collection, ordering, description and interpretation of textual data generated from talk, observation or documentation. (Liamputtong & Ezzy, 2005; Lincoln & Guba, 1985; Malterud, 2001; Miles & Huberman, 1994). In contrast, most quantitative research is concerned with measuring the magnitude, size or extent of a phenomenon (Grbich, 1999, 2007).

Conclusions. Delphi method is more effective in determining the activity of equestrian sport competitions and identifying its criteria. It allows to gain reliable expert consensus about of the equestrian competitions' activity content. It allows to promote development unified evaluation system of the equestrian competitive activities.

References

Grbich, C. (1999, 2007). *Qualitative research in health: An introduction*. London: Sage.
Liamputtong, P., & Ezzy, D. (2005). *Qualitative research methods*. Melbourne: Oxford University Press.
Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Newbury Park, Calif: Sage.
Malterud, K. (2001). Qualitative research: standards, challenges, and guidelines. *Lancet, 358,* 483–488.
Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: an expanded sourcebook*. 2nd ed. Thousand Oaks, Calif: Sage.

Keywords: equestrian competitions' activity evolution, Delphi method, observation method, survey method.

COACHES' EXPERTISE EVALUATION ON TECHNICAL SKILLS DEVELOPMENT FOR YOUTH FOOTBALL PLAYERS

Kristaps Slaidiņš, Andra Fernāte

Latvian Academy of Sport Education, Latvia

Background. Issues related to the coach's expertise have become topical in the talent development. Coach's expertise highlighted such directions: large quantities of experience, knowledge, and skills (Martens, 2004). The expert coach – it is both what he/she know and what he/she do. One strategy that could be used to catalogue all the key components of technical skills development for youth football players could be to analyse the experiential knowledge of true experts in sports – coaches (Phillips, Davids, Renshaw, & Portus, 2010). But there was no developed tool to assess the coach's experiential knowledge of technical skills development for youth football players. The aim of the research is to compare the advantages of the evaluation methods of the coach's experiential knowledge of technical skills development for youth football players.

Research methods. To compare the advantages of the evaluation methods of the coach's experiential knowledge of technical skills development for youth football players, a systematic search and review (Booth, Sutton, & Papaioannou, 2016) of scientific articles was conducted in two electronic databases of scientific literature – Science Direct and Google Scholar. The inclusion criteria for study selection: the article was written in English.

Results and discussion. Experiential knowledge is not often associated with research, and even less often with the research methods and methodology. Experiential knowledge is diverse, different terminology is used, such as experiential knowing and knowledge, tacit knowledge, personal knowledge, professional knowledge. The different research methods were compared for the analysis the coach's experiential knowledge to obtain conclusions: methods for observing and reflecting on coaches' practice, for example, unstructured or in-depth interviews, narrative research or focus groups. Discussion is about which of the different research methods are more appropriate for the investigation of coach's experiential knowledge of technical skills development for youth football players.

Conclusions. The Delphi method is more appropriate research method for the investigation of the coach's experiential knowledge of technical skills development for youth football players. It will allow to gain reliable expert consensus about technical skills development for youth football players.

References

Booth, A., Sutton, A., & Papaioannou, D. (2016). *Systematic approaches to a successful literature review*. Los Angeles, CA: Sage.

Martens, R. (2004). *Successful coaching*. Champaign, IL: Human Kinetics.

Phillips, E., Davids, K., Renshaw, I., & Portus, M. (2010). The development of fast bowling experts in Australian cricket. *Talent Development and Excellence, 2*(2), 137–148.

Keywords: coaches' expertise, technical skills development, youth football players.

SHOULDER'S INJURIES IN SWIMMING: REASONS

Jelena Solovjova, Germans Jakubovskis, Ilze Avotina
Latvian Academy of Sport Education, Latvia

Background. Sport swimming requires specific required movements. Shoulder injury is a significant barrier to the training regime and competition experience of swimmers, both male and female (Kennedy, & Hawkins, 1974). The incidence of pain and injury is greater in athletes with poor stroke technique. The correct stroke pattern should be accompanied by correct body roll to reduce the scapular protraction needed to maintain proper alignment of the glenohumeral joint. Incorrect posture and muscle imbalance negatively influence the effectiveness of the training process (Almeida, Meyer, & Oh, 2007; Hill, Collins, & Posthumus, 2015).

Research methods. Sport swimming requires specific required movements. Shoulder injury is a significant barrier to the training regime and competition experience of swimmers, both male and female. The incidence of pain and injury is greater in athletes with poor stroke technique (Rodeo, 2005). The correct stroke pattern should be accompanied by correct body roll to reduce the scapular protraction needed to maintain proper alignment of the glenohumeral joint. Incorrect posture and muscle imbalance negatively influence the effectiveness of the training process (Vasilyeva & Mikhailov, 1995).

Tasks and methods. 1. Determine pain appearance during swimming (use questionnaire). 2. Identify the features of posture. Measuring the changes of 8 sagittal points from the vertical plane along with functional testing of 11 muscle groups. 3. Detect the gross technical errors when swimming freestyle, using underwater video.

Research methods: 1. Questionnaire, to determine pain appearance during swimming. 2. Measuring the changes of 8 sagittal points from the vertical plane along with functional testing of 8 muscle groups, to identify the features of posture. 3. Underwater video, to detect the gross technical errors when swimming.

Results and discussion. 1. In all swimmer's groups, there's evidence indicating the tendency of pain in shoulder areas appearing when: swimming with small or big paddles; using swimming resistance and in fast interval training; when swimming long distances using one stroke; at the beginning of the training season. 2. Swimmers have changes of the musculoskeletal system. Expressed as changes of posture statics parameters; the greatest distance from the body vertical line swimmers has in the shoulder girdle (10.6 ± 0.4 cm). The upper cross syndrome is characteristic for swimmers. The spine hyper-kyphosis of the chest part and the shortening of the small chest and upper trapezius muscles have been shown. 3. Irrational swimming technique, places stress on the shoulder joint: pulling through with a straight arm. Forceful push downwards during the catch. Crossing the center line in front of the head, when breathing in freestyle.

Conclusions. 1. Musculoskeletal injuries in this population usually result from cumulative, repetitive trauma. Careful monitoring of training volume, intensity, and duration will minimize overuse injuries and identify athletes at risk. 2. Changes of the posture can be seen because of professional swimming training. Swimming techniques require multiple movement patterns with a clear interaction of muscles.

References

Almeida, D. F., Meyer, R. D., & Oh, S. J. (2007). True neurogenic thoracic outlet syndrome in a competitive swimmer: A case report of this rare association. *Arquivos de Neuro-Psiquiatria, 65*(4B), 245–248.

Hill, L., Collins, M. & Posthumus M. (2015). Risk factors for shoulder pain and injury in swimmers: A critical systematic review. *The Physician and Sportsmedicine, 43*(4), 412–420.

Kennedy, J. C., & Hawkins, R. J. (1974). Swimmer's shoulder. *Physician Sports Medicine, 2*(4), 34–38.

Rodeo, S. A. (2005). Swimming. In S. G. Krishnan, R. J. Hawkins, R. F. Warren (Eds.), *The shoulder and the overhead athlete* (pp. 350). Philadelphia, PA: Lippincott, Williams & WIlkins.

Vasilyeva, L., & Michailov, V. (1995). Electromyographic substantion of muscle weakness. In *International college of applied kinesiology Europe* (pp. 104–117). London.

Keywords: swimming, shoulder, posture, injury.

EFFECT OF EXERCISE INTENSITY LEVEL ON REACTION TIME

Lukass Edmunds Teteris, Sergejs Saulite
Latvian Academy of Sport Education, Latvia

Background. This study is theoretical, only the analysis of scientific literature was used as a research method. The purpose of this study was performed in the aim of analyzing the influence of physical exertion on decisional processing in sports. The aim of this study was achieved by studying and analyzing the scientific literature, studies on the reaction rate at different intensities of loads (Zemková, 2009; Jin, Eason, & Lofti, 2015; Stuart & Bernard, 2013; Delignieres & Brissvalter, 1994). Reaction time is a measure of how quickly an organism can respond to a particular stimulus (Kosinski, 2010). Two types of reaction time are important for high performance in sports: simple reaction time and complicated reaction time (Liepinš, 2002). In many sports, the athlete must be able to react as quickly as possible at different intensities during exercise. Therefore, it would be important to study the rate of response at different intensities to determine the relationship between load and human functional status on the deterioration or improvement of the rate of response in sport.

Research methods. Analysis and research of scientific literature.

Results. Delignieres and Brissvalter (1994) studying the reaction time in fattening at different intensities in the study (40 subjects), concluded that in better trained athletes, the deterioration of the response rate at load increases is less than in less trained athletes, suggesting that athletes at higher the reaction time of the functional state is better, because the athlete adapts to load situations more efficiently retains larger energy reserves (Delignieres & Brissvalter, 1994).

In the study of Tsorbatzoudis, Barkoukis and Danis (1998) on the effect of physical activity on simple reaction time (68 subjects), the results did not support the opinion that moderate or high intensity exercises significantly affect the cognitive performance of trained or untrained subjects of aerobic endurance. (Tsorbatzoudis, Barkoukis, & Danis, 1998).

Zemkova's study examined the relationship between exercise intensity and reaction time in a group of 16 karate athletes. The results showed that at the onset of exercise, the reaction time was slightly reduced by 19 ms at a heart rate of approximately 120 beats per minute. As the load intensity increased, especially above 160 beats/min, the reaction time at 180 beats/min also increased faster than about 60 ms. It can be concluded that moderate-intensity exercises promote a faster response to visual stimuli, while fatigue caused by intense exercise is associated with an increase in response time (Zemková, 2009).

Stuart and Bernard in a study conducted in 2013 on the effect of exercise on reaction time, concluded that the athlete shows the best reaction time at a heart rate of 115 beats/min, but the reaction time remains longer at a heart rate of 175 beats/min., so the researchers concluded that as the heart rate increases, the response time becomes longer (Stuart, & Bernard, 2013).

The main aim of the study of Jin, Eason and Lofti was to investigate the effect of exercise intensity and duration on the choice response time (15 subjects). The conclusions were the fastest choice response time was 75% of the maximum physical ability. There is a very low relationship between VO_2max and optional response time throughout exercise (Jin et al., 2015).

Athletes with good aerobic abilities can develop a more optimistic reaction time. In order to objectively determine the level of anaerobic ability of each athlete, an effective training method beep test with blood lactate concentration at different intensity of physical activity is used. Based on these data, athletes can create a training program that allows to increase the optimization of performance to improve the choice reaction time (Līcis, Grāvītis, & Luika, 2015).

In general, analyzing the study of the reaction rate at different intensities of loads, it can be concluded that athletes with the best aerobic abilities can develop the reaction speed much more productively. At a heart rate of 115–120 beats/min, the athlete shows the best reaction time. But at a heart rate of 160 beats/min or 3. In the intensity zone, the reaction time remains long, so the researchers concluded that the increase in heart rate response time becomes longer. Fatigue caused by intense exercise is associated with an increase in reaction time. Was found very low relationship between VO_2max and choice reaction time across exercise intensity. Delignières study results showed that the improvement of the experts' performances in decision tasks under high physical exertion was related to an additional resource investment. Athletes with good aerobic abilities can develop a more optimistic reaction time.

Discussion. There are several physiological factors that positively or negatively affect the choice reaction time during exercise, for example, increase of oxidative enzyme activity, and muscle tension during moderate exercise (Gerchman, Edgerton, & Carrow, 1975; Tomporowski & Ellis, 1986). The reaction time decreases and increases as the load intensity increases to a certain threshold (Jin et al., 2015; Stuart & Bernard, 2013; Zemková, 2009). Will the development and application of a set of simple and complex reaction speed development exercises for athletes in the training process contribute to the improvement of the reaction speed according to the intensity of the fighting load?

Conclusions. I agree with the study's findings that better endurance athletes respond faster because they have greater energy reserves. The results of the studies show the differences in the reaction time under different physical intensity loads. It would be necessary to further study the speed of reaction at different intensity loads and its relationship with the level of endurance abilities of the athlete. In the future, it would also be important to study the development of reaction speed for loads of different intensities. In a future study on the rate of reaction time at different intensities, the experimental groups should be such that they account for 10% of the population to give validity of the results.

References

Delignieres, D., & Brisswalter, J. (1994). *Influence of physical exercise on choice reaction time in sports experts: The mediating role of resource allocation*. Retrieved on 9 June 2021 from https://www.researchgate.net/publication/232607885_Influence_of_physical_exercise_on_choice_reaction_time_in_sports_experts_The_mediating_role_of_ resource_allocation

Gerchman, L., Edgerton, V., & Carrow, R. (1975). Effects of physical training on the histochemistry and morphology of ventral motor neurons. *Experimental Neurology, 49,* 790–901.

Jin, S., Eason, B., & Lofti, M. (2015). *Influence of exercise intensity level on optional response time.* Retrieved on January 30, 2022 from https://journals.sagepub.com/doi/full/10.2466/11.03.CP.4.3

Kosinski, R. J. A. (2010). *Literature review on reaction time.* Retrieved from http://biae.clemson.edu/bpc/bp/Lab/110/reaction.htm

Līcis, R., Grāvītis, U., & Luika, S. (2015). *Vispusīgā fiziskās sagatavotības treneru rokasgrāmata*. Rīga: Latvijas treneru tālizglītības centrs.

Liepiņš, I. (2000). *Sports and sports training.* Riga.

Stuart, L., & Bernard, G. (2013). *Multiple choice response time and movement time during exercise.* Retrieved on June 9, 2021 from https://shapeamerica.tandfonline.com/doi/abs/10.1080/10671188.1971.106150 88#.YMEHuqgzbIX

Tomporowski, P. D., & Ellis, N. R. (1986). The effects of exercise on cognitive processes: A review. *Psychological Bulletin, 99,* 338–346.

Tsorbatzoudis, H., Barkoukis, V., & Danis, A. (1998). *Physical exertion in simple reaction time and continuous attention of sport participants.* Retrieved on 30 January 2022 from https://journals.sagepub.com/doi/10.2466/pms.1998.86.2.571

Zemková, E. (2009). *Relationship between intensity of exercise and reaction time on laterally concordant and discordant stimuli*. Retrieved from https://www.researchgate.net/publication/237748390_there_is_a_relationship_between_intensity_of_exercise_and_reaction_time_on_laterally_concordant_and_disco

Keywords: reaction time, physical exertion, heart rate, exercise.

POSITIONAL DIFFERENCES IN HIGH ACCELERATIONS AND DECELERATIONS IN ELITE ACADEMY SOCCER PLAYERS

Jindřich Vampola, Matěj Varjan, Jakub Kokštejn
Charles University, Czech Republic

Background. Purpose of the workload monitoring is to objectively measure the load imposed on players for optimization of the training load and injury prevention (Akenhead & Nassis, 2016). In our article we measured accelerations and decelerations, which were strong contributors to muscle damage (Gastin, Hunkin, Fahrner, & Robertson, 2019). Commonly used threshold for accelerations and decelerations vary between 2.5–3.5 m s^{-2}. But there is no scientific evidence if there are any differences in higher accelerations and decelerations (5 m s^{-2}), which are more demanding. Thus, our study could contribute to better understanding of match demands imposed on players playing in different positions.

Research methods. The variables collected through GPS were high accelerations and decelerations (>5 m s^{-2}). Match data were collected in the autumn of the season 2021/22. Twenty-five football players (19.6 ± 4.7 years) from an elite Czech football academy were part of the study. A total of 104 players recordings of full matches (all played in formation 4-3-3) were collected and divided into positions of central defender (CD), full back (FB), central defensive midfielder (CDM), central midfielder (CM), winger (W) and striker (S). Because of the data normality violation Kruskal–Wallis one-way analysis of variance with Bonferroni correction for multiple comparison was used. Effect size was measured by Hedges *g*.

Results and discussion. Significant differences between playing positions were observed in the study with the highest differences in decelerations. In accelerations we found significant difference between CD and FS ($p < 0.01$; $g = 1.22$) and significant differences between CD and W ($p < 0.05$; $g = 1.31$), CDM and FS ($p < 0.05$; $g = 1.44$), CDM and W ($p < 0.05$; $g = 1.58$). In decelerations there were significant differences between CD and positions of FB ($p < 0.01$; $g = 1.25$), W ($p < 0.01$; $g = 2.11$) and FS ($p < 0.01$; $g = 1.75$). Significantly different demands imposed on every player position exist in high changes of velocity, which are strong contributors to muscle damage. The lowest numbers of accelerations and decelerations for central defenders are consistent with other research that has examined these values at lower speed changes (Vigh-Larsen, Daglas, & Andersen, 2018).

Conclusions. Our results confirm the differences between player positions in accelerations and decelerations, even at higher speed changes, which are more demanding. Therefore, we recommend monitoring these parameters to better individualize the training process and reduce the likelihood of injuries by good preparation of the players for this specific match load prepare the players on the position-specific needs of high accelerations and decelerations imposed in matches.

References

Akenhead, R., & Nassis, G. P. (2016). Training load and player monitoring in high-level football: Current practice and perceptions. *International Journal of Sports Physiology and Performance, 11*(5), 587–593. https://doi.org/10.1123/ijspp.2015-0331

Gastin, P. B., Hunkin, S. L., Fahrner, B., & Robertson, S. (2019). Deceleration, acceleration, and impacts are strong contributors to muscle damage in professional Australian football. *Journal of Strength and Conditioning Research, 33*(12), 3374–3383. https://doi.org/10.1519/jsc.0000000000003023

Vigh-Larsen, J. F., Dalgas, U., & Andersen, T. B. (2018). Position-specific acceleration and deceleration profiles in elite youth and senior soccer players. *Journal of Strength and Conditioning Research, 32*(4), 1114–1122. https://doi.org/10.1519/jsc.0000000000001918

Keywords: soccer, high accelerations and decelerations, workload monitoring, performance, matchload, GPS.

ANALYSIS OF PADDLING FORCE PROFILE AT MAXIMUM PACE IN 200 M DISTANCE OF AN ELITE CANOE SPRINT ATHLETE (WORLD CHAMPIONSHIP MEDALLIST)

Mārtiņš Veispals, Antra Gulbe

Latvian Academy of Sports Education, Latvia

Background. A more extensive analysis of stroke parameters in canoe sprint can be implemented with the development of measuring devices. To date, a large proportion of installations with water-based performance measurements have been experimental and of limited availability (not commercially available). Measurements at the maximum pace distance travelled by top athletes have not yet been published, there have been various attempts to make individual cuts at appropriate speeds or rental frequencies (Gomes et al., 2010; Gomes et al., 2015). Measurements of the actual distances are clearly needed in order to be able to determine the relationship between the stroke parameters and the differences depending on the planned distance of the competition and to further adjust it to the training process.

Research methods. To analyze the stroke parameters by performing the competition distance (200 m) on the water, a field experiment was performed, within which the competition distance (200 m) on the water was performed. The following methods were used: pulsometry, videoanlaysis, dynamometry (on water force measurements with commercially available device – kayak power meter made by "One giant leap") (Bonaiuto et.al., 2020; Hogan, Binnie, Doyle, Lester, & Peeling, 2019; Kong, Tay, & Pan, 2020).

Results and discussion. The average power value of the 20 strokes when paddling at a maximum speed at 200 m was 1171.9 W, but this is less than the values recorded in one individual stroke, which can be explained by the fact that all 20 strokes were not of the same duration. The average values also changed. The two highest average values of these strokes appeared in strokes number 26 and 29 (1389.1 and 1357.6 W, respectively), with strokes lasting the shortest, 0.29 s, respectively, which is 0.05 s less than average duration of burning.

Conclusions. The goal of this study was to measure the force and the power generated on making strokes in canoe sprint at maximum pace in 200 m distance. A second aim was to gain more insights about the other stroke parameters to pay attention in analysing and adjusting the training process.

References

Bonaiuto, V., Gatta, G., Romagnoli, C., Boatto, P., Lanotte, N., & Annino, G. (2020). A pilot study on the e-kayak system: A wireless DAQ suited for performance analysis in flatwater sprint kayaks. *Sensors, 20*(2), 542. https://doi.org/10.3390/s20020542

Gomes, B., Viriato, N., Sanders, R., Conceição, F., Vilas-Boas, J. P., & Vaz, M. (2011). Analysis of the on-water paddling force profile of an elite kayaker. In *ISBS-Conference Proceedings Archive*. Retrieved from: https://ojs.ub.uni-konstanz.de/cpa/article/view/4822/4462

Gomes, B. B., Ramos, N. V., Conceição, F. A., Sanders, R. H., Vaz, M. A., & Vilas-Boas, J. P. (2015). Paddling force profiles at different stroke rates in elite sprint kayaking. *Journal of Applied Biomechanics, 31*(4), 258–263. doi:10.1123/jab.2014-0114

Hogan, C., Binnie, M. J., Doyle, M., Lester, L., & Peeling, P. (2019). Comparison of training monitoring and prescription methods in sprint kayaking. *International Journal of Sports Physiology and Performance, 15*(5), 654–662. doi:10.1123/ijspp.2019-0190

Kong, P. W., Tay, C. S., & Pan, J. W. (2020). Application of instrumented paddles in measuring on-water kinetics of front and back paddlers in K2 sprint kayaking crews of various ability levels. *Sensors, 20*(21), 6317. doi:10.3390/s20216317

Keywords: canoe sprint, stroke force, stroke power, stroke parameters.

SPORTS PHYSIOLOGY, BIOCHEMISTRY, MEDICINE

RELATIONSHIP BETWEEN BASKETBALLERS FUNCTIONAL AND PHYSICAL CONDITION WITH PAIN AND INJURIES BETWEEN GENDERS

Ernestas Barkus, Ligita Šilinė
Lithuanian Sports University, Lithuania

Background. Lower limb injuries, both in male and female, are most common in basketball (Andreoli et al., 2018). It is important not only to be tactful and technically prepared, but also to be in good functional and physical shape to prevent injuries (Potter & Taylor, 2020). The aim of the study is to investigate relationship between basketballers functional and physical condition with pain and injuries between genders.

Research methods. The study included 20 participants – 10 male basketball players competing in the 3rd country division, whose age averages were 20 ± 0.63 and 10 female basketball players, whose age averages were 25.4 ± 4.29 competing in the 2nd country division. There was the evaluation of basketball players' functional (Functional Movement Screen (FMS), Y balance test) and physical ("pendulum", Thomas and Ely's test) conditions. In the FMS, participants were given 7 movements that assess their functional function, Y balance test for balance, Psoas m. flexibility was assessed with Thomas test, Rectus femoris m. flexibility was assessed with Ely's test and spine mobility was assessed with the "Pendulum" test. Participants were given a questionnaire about pain and injuries.

Results and discussion. Male had more injuries and higher pain intensity than females. After evaluating the FMS, the sum averages of the functional movements of male was 17 ± 1.82 points, female – 16.6 ± 1.17 points ($p > 0.05$). The results of the Y balance test of males were higher than females in all directions and both legs ($p < 0.05$). There was a tendency for female to be in better physical condition. The relationship of functional condition with pain was $r = -0.679$, with injuries $r = -0.898$ ($p < 0.05$) in females. In males, the relationship with pain and injuries was $r = -0.460$ ($p > 0.05$) and $r = -0.571$ ($p > 0.05$), respectively. Among males, the correlation between psoas elasticity and pain $r = -0.420$, with injuries $r = 0.102$ ($p > 0.05$). Among females, the correlation between psoas elasticity and pain $r = -0.661$ ($p < 0.05$), with injuries $r = -0.500$ ($p > 0.05$). The relationship between rectus femoris elasticity and pain was $r = -0.687$ between males and $r = -0.887$ between females ($p < 0.05$). The relationship with injuries among males $r = 0.102$ ($p > 0.05$), among females $r = -0.816$ ($p < 0.05$).

Conclusions. A significant relationship between pain and injury was found between females' functional and physical condition, while no significant relationship was found for males.

References

Andreoli, C. V., Chiaramonti, B. C., Biruel, E. P., Pochini, A. D., Ejnisman, B., & Cohen, M. (2018). Epidemiology of sports injuries in basketball: Integrative systematic review. *BMJ Open Sport & Exercise Medicine, 4*. doi:10.1136/bmjsem-2018-000468

Potter, N. D., & Taylor, J. B. (2020). Functional assessment in elite basketball players. In *Basketball Sports Medicine and Science* (pp. 645–655). Springer, Berlin, Heidelberg.

Keywords: basketball, FMS, pain, injury, gender.

EFFECTS OF DIET COMPOSITION ON ENERGY INTAKE, HUNGER AND SATIETY HORMONES DURING AND AFTER WEIGHT LOSS: THE MOUSE MODEL

Saulė Bartkutė, Andrej Fokin, Petras Minderis
Lithuanian Sports University, Lithuania

Background. Caloric restriction (CR) has been proven as a successful strategy for obesity treatment and management of weight category sport athletes (Aragon et al., 2017; Minderis, Fokin, Dirmontas, & Ratkevicius, 2020). However, the majority of individuals do not maintain their weight loss for longer periods (Fothergill et al., 2016). It is suggested that diet composition affects hunger and food cravings leading to increase energy intake (Ludwig & Ebbeling, 2018). Our goal is to examine the role of diet composition on weight maintenance and appetite control mechanisms in the post-dieting period when energy intake is not controlled.

Research methods. 18-month-old males of C57BL/6J mouse strain with the highest body mass were divided into 4 groups: low-fat (LF) (20, 20, 60% of kcal from fat, protein, carbohydrate), low-carb (LC) (60, 20, 20%, respectively), high-protein (HP) (30, 35, 35%, respectively) (n = 21 each) and control (C) (standard rodent chow diet, n = 11). 30% CR was induced for 4 weeks (except for C group) followed by 4 weeks ad libitum post-diet period on the same diets. Energy intake and body mass were monitored each day. Animals were sacrificed and their blood was collected after CR and the rest half after post-diet period. ELISA assay was used to calculate leptin and ghrelin hormone concentrations from the blood samples.

Results and discussion. All groups showed similar weight loss during CR ($p > 0.05$), but LC group regained the biggest amount of weight and significantly exceed the LF and HP in post-diet period ($p < 0.001$) which regained to C levels. LC consumed comparable quantity of food in grams, but ~30% more calories than other two diet groups ($p < 0.001$) during post-diet period. LC had higher leptin values than other groups after post-diet period ($p < 0.05$). Weight gain strongly correlated with consumed calories ($r = 0.95$, $p < 0.001$) and leptin values ($r = 0.69$, $p > 0.001$) but neither leptin nor ghrelin caused the weight gain in LC group as the hormones were not different between groups at the start of refeeding period ($p > 0.05$).

Conclusions. Low-carb diet has the least favourable effects on body composition when energy intake is not controlled in aged and overweight mice. It seems to be caused by the caloric density of the diet rather than hormonal changes in satiety and hunger.

References

Aragon, A. A., Schoenfeld, B. J., Wildman, R., Kleiner, S., VanDusseldorp et al. (2017). International society of sports nutrition position stand: Diets and body composition. *Journal of International Society of Sports Nutrition, 14,* 16. doi:10.1186/s12970-017-0174-y

Fothergill, E., Guo, J., Howard, L., Kerns, J. C., Knuth, N. D. et al. (2016). Persistent metabolic adaptation 6 years after The Biggest Loser competition. *Obesity, 24*(8), 1612–1619. doi:10.1002/oby.21538

Ludwig, D. S., & Ebbeling, C. B. (2018). The carbohydrate-insulin model of obesity: Beyond "Calories in, calories out". *JAMA Internal Medicine, 178*(8), 1098–1103. https://doi.org/10.1001/jamainternmed.2018.2933

Minderis, P., Fokin, A., Dirmontas, M., & Ratkevicius, A. (2020). Hypocalorix low-carbohydrate and low-fat diets with fixed protein lead to similar health outcomes in obese mice. *Obesity Journal, 28*(8), 1494–1502. doi:10.1002/oby.22872

Keywords: obesity, diets, refeeding, macronutrients, calories.

INFLUENCE OF LOCAL VIBRATION ON THE RECOVERY PROCESS FOR CYCLISTS DURING THE PREPARATION PERIOD

Ansis Bremanis

Latvian Academy of Sports Education, Latvia

Background. The use of vibration stimuli has proven its practical application in the field of therapeutic rehabilitation and exercise performance. Most studies have found that local vibration appears to produce beneficial changes in outcome measures such as muscle activation/stimulation, muscle strength, muscle power, and joint flexibility/range of motion (Bouse et al., 2018). Scientists have found that vibration in sport has two forms of exposure: the first is associated with acute or immediate exposure, and the second is a long-term or chronic form of exposure, now called vibration training, which is performed under the same conditions as all other methods realized in sports (Ciekurs, Krauksts, Krauksta, Grants, & Alekrinskis, 2016).

Research methods. 1. Study and analysis of literature sources. 2. Test exercises. 3. Pedagogical experiment. 4. Local vibration manipulations. Test exercises: 3000 m run, long jump, pullups, jumping over the bench.

Pedagogical experiment: 9 students were voluntarily divided into 2 groups, test group of 5 students, control group of 4 students. Students were tested 2 times, before applying local vibration and after 1 month of training.

Local vibration manipulations: were applied every other day for approximately 1 month, 100 Hz frequency, the amplitude of 2 mm and duration of 10 minutes.

Results and discussion. After applying local vibration to one part of the group of students, repeated testing of all students was performed. Examining the average results obtained, it can be concluded that the students in the vibrating group showed better results in all of the test exercises.

Comparing the results between test and control groups, in long jump students from the test group improved results individually by six percent, while students from the control group with similar results in the first testing only by three and four percent. In exercise, jumping over the bench test group improved the first results by almost 10 percent, but the control group only by 5 percent.

In the pullup exercise, both groups showed equal improvement by 2 repetitions, but the test group demonstrated a higher number of repetitions in the first testing. In the 3000 m run, test group ran the distance in the first test at the time of 12:21:48 and the second test improved the result to 11:26:24, while the control group in the first run showed the result of 12:46:00 and in the second testing improved result to 11:34:30.

Conclusions. After the application of local vibration every other day for a month for 16–18 years old cyclists, the recovery time reduces during the preparation period and results improve in the test exercises.

References

Bouse, A. E. et al. (2018). Effects of local vibration therapy on various performance parameters: A narrative literature review. *The Journal of the Canadian Chiropractic Association, 3,* 170–181.

Ciekurs, K., Krauksts, V., Krauksta, D., Grants, J., & Alekrinskis, A. (2016). Lokālās vibrācijas ietekme distanču slēpošanā (klasiskajā stilā). *Sabiedrība. Integrācija. Izglītība,* 434.

Keywords: local vibration, cyclists, recovery time, preparation period.

PERSONALISED AEROBIC EXERCISE PROGRAMS IMPACT ON THE PHYSICAL AND FUNCTIONAL FITNESS PARAMETERS IN BREAST CANCER PATIENTS UNDERGOING NEOADJUVANT CHEMOTHERAPY: A PILOT RANDOMIZED CONTROLLED TRIAL

Martins Campa, Aija Klavina, Rudolfs Ceseiko
Latvian Academy of Sport Education, Latvia

Background. For females with breast cancer (BC) neoadjuvant therapy (NT) is often used to treat cancers that are too big to be removed by surgery. NT is associated reduced cardiorespiratory fitness, fatigue, poor quality of life, fat gain, and muscle loss (Boekel et al., 2016). Exercise interventions have been utilized in BC patients undergoing NT to reduce some of these adverse effects but precious trials often fails to identify optimal type and intensity exercises (Fraser, Bigaran, Selig, & LaGerche, 2017; Courneya et al., 2013; Kraschnewski & Schmitz, 2017). For patients with BC high intensity interval training (HIIT) has been individually prescribed (Mijwel et al., 2017) already shown to have some degree of effectiveness on improving physical fitness (Tsuji, Matsuoka, & Ochi, 2021). This study aims to investigate the effects of individualised adapted HIIT program on physical fitness and quality of life of patients with BC (age 35 to 65 years) during NT. In addition, this study will determine association between multicomponent health risk factors and adherence in intervention program in patients with BC. It is hypothesized that HIIT program improves physical fitness and quality of life, subsequently contributing outcomes of NT treatment.

Research methods. In a pilot study three participants have been recruited in experimental group. Before and after first four cycles of NT European Organisation for Research and Treatment of Cancer questionnaire (EORTC) QLQ-C30 and specific breast cancer module EORTC QLQ-BR23 has been used to access changes in life quality. Daily living activities related physical fitness was measured using 6 MWT, 30 sec Sit-to-Stand test and 5 reps Sit-to-Stand test. Peak oxygen consumption (VO_2peak) was measured with Vyntus CPX gas analyser and the University of Northern Colorado Cancer Rehabilitation Institute (UNCCRI) treadmill protocol which has been chosen as most suitable for specific participants group considering wide age range and different previous physical activities experience and preparedness.

Results and discussion. Since January 2022, when experiment begun, two of the participants underwent HIIT intervention in the direct supervision group under the supervision of a healthcare professional showing 57.9% and 57.1% adherence rate. Third participant was recruited in remote monitoring group where she received personalized HIIT recommendations but underwent intervention independently. Researchers followed exercises results to ascertain do she reach the requirements, she reached 78.9% adherence rate. With this amount of participants, we have been able to only obtain tendency of measured parameters during first four cycles of NT course. Participant No 1, who underwent intervention independently showing decrease of VO_2peak by only -6.5% (from 32.1 to 30.0 ($mL \cdot kg^{-1} \cdot min^{-1}$) respectively), but increased result in 6 MWT (before – 653 m, after – 665 m) and also same tendency in 30 sec Sit-to-Stand test (before – 20 reps, after – 24 reps) and 5 reps Sit-to-Stand test (before – 7.35 sec, after – 6.73 sec). Participants No 2 and No 3 showing greater drop in VO_2peak (by -8.4% and -9.1%) but not drastic changes in 6 MWT (participant No 2 increased her result by 5 meters, but participant No 3 maintained same result). Also Sit-to-Stand test results were increased or maintained (No 2 managed 17 reps before and 18 reps after, but No 3 did 24 reps before and after HIIT program for first four cycles of NT. 5 reps Sit-to-Stand test results No 2 (before – 7.51 sec, after – 7.30 sec), No 3 (before – 5.85 sec, after – 5.90 sec).

Conclusions. Participant with highest adherence rate showing slighter decrease of Peak oxygen consumption and maintained or even increased daily living activities related physical fitness compared with participants with lower adherence rate.

References

Boekel, N., Jacobse, J., Schaapveld, M., Gietema, J., Hooning, M. et al. (2016). Long-term risks of specific cardiovascular diseases associated with contemporary breast cancer treatment in combination with cardiovascular risk factors: A large Dutch cohort study. *European Journal of Cancer, 57,* S142

Courneya, K. S., Segal, R. J., McKenzie, D. C., Don, H., Gelmon, K. et al. (2013). Effects of exercise during adjuvant chemotherapy on clinical outcomes in early stage breast cancer. *Cancer Research,* 73.

Fraser, S., Bigaran, A., Selig, S., & LaGerche, A. (2017). Exercise training during anthracycline-based chemotherapy for breast cancer. *Journal of Clinical Oncology,* 35.

Kraschnewski, J. L., & Schmitz, K. H. (2017). Exercise in the prevention and treatment of breast cancer: What clinicians need to tell their patients. *Current Sports Medicine Reports, 16*(4), 263–267.

Mijwel, S., Backman, M., Bolam, K. A., Jervaeus, A., Sundberg, C. J. et al. (2017). Adding high-intensity interval training to conventional training modalities: Optimizing health-related outcomes during chemotherapy for breast cancer: The OptiTrain randomized controlled trial. *Breast Cancer Research and Treatment, 168*(1), 79–93.

Tsuji, K., Matsuoka, Y. J., & Ochi, E. (2021). High-intensity interval training in breast cancer survivors: A systematic review. *BMC Cancer, 21,* 184. https://doi.org/10.1186/s12885-021-07804-w

Keywords: breast cancer, HIIT, VO_2peak, physical fitness.

MUSCLE-LOCALIZED BIOELECTRICAL CHANGES OVER A GIRO D'ITALIA PRO RACE

Álex Cebrián-Ponce[1], Manuel Vicente Garnacho-Castaño[1], Jorge Castizo-Olier[2], Marta Carrasco-Marginet[1], Javier Espasa-Labrador[1], Zeasseska Noriega[1], Alfredo Irurtia[1]

[1]Universitat de Barcelona; [2]Pompeu Fabra University, Spain

Background. Giro d'Italia is one of the most prestigious and demanding multistage races included in the professional cycling Tour. It is difficult to intervene systematically in this group of subjects to assess the adaptations to such intense competitions (Marra et al., 2014). In this context, muscle-localized bioelectrical impedance vector analysis (ML-BIVA) is a novel methodology for assessing the hydration status and cellular integrity of muscles (Cebrián-Ponce et al., 2021). The purposes of this study were to analyse possible bioelectrical inter-limb differences and to assess the bioelectrical muscle changes over the 3 weeks of Giro d'Italia.

Research methods. 9 professional cyclists (27.9 ± 2.4 years; 181.4 ± 6.1 cm; 70.5 ± 6.1 kg) completed ML-BIVA assessments in both quadriceps, hamstrings and calves at three different checkpoints: one day before the start of Giro (PRE), on the first resting day (MID), and on the final day of the race (POST). A tetra-polar phase-sensitive BIA at 50 kHz was used to measure height-adjusted resistance (R/h), height-adjusted reactance (Xc/h), height-adjusted impedance (Z/h) and phase angle (PhA). Hotelling's T2 test determined differences in the complex vector through the 95% confidence and tolerance intervals.

Results and discussion. There were no significant differences in the complex vector in any of the three muscles analysed, when comparing to the contra-lateral side, in any of the three checkpoints. Therefore, there was a complete bioelectrical inter-limb symmetry in this group of subjects. Neither quadriceps nor hamstrings experienced any significant bioelectrical adaptation in the complex vector over the race. However, the calves did report significant changes all over the race, since there was a significant shortening of the vector at MID ($T2 = 60.4$; $p < 0.001$), and a posterior significant lengthening at POST ($T2 = 11$; $p < 0.001$), but below the baseline values ($T2 = 12.1$; $p < 0.001$). Such vector behaviour could be an indicator that the caves were the most severely affected muscle in the first half of the race, with a fluid gain and a muscle damage, while in the second half they got partially recovered.

Conclusions. ML-BIVA did not detect any intra-limb imbalances, unsurprisingly since it is expected a great symmetry in elite cycling. On the other hand, ML-BIVA in the calves detected adaptations to the strenuous race through complex vector bioelectrical changes. These changes should be further explored along with other methods to assess muscle adaptations to exercise, e.g. with haematological extractions.

References

Cebrián-Ponce, Á., Irurtia, A., Carrasco-Marginet, M., Saco-Ledo, G., Girabent-Farrés, M., & Castizo-Olier, J. (2021). Electrical impedance myography in health and physical exercise: A systematic review and future perspectives. *Frontiers in Physiology, 12*.

Marra, M., Da Prat, B., Montagnese, C., Sgroi, M., Sicilia, G., Caldara, A. et al. (2014). Body composition changes in professional cyclists during the 2011 Giro d'Italia, a 3-week stage race. *Nutritional Therapy & Metabolism, 32*(1), 31–34.

Keywords: dehydration, muscle damage, muscle fatigue, endurance exercise, bioelectric impedance.

EFFECTS OF DIETS WITH DIFFERENT MACRONUTRIENT DISTRIBUTION ON BODY COMPOSITION DURING CALORIC RESTRICTION FOLLOWED BY AD LIBITUM FEEDING IN AGED MICE

Monika Čepaitytė, Petras Minderis, Andrej Fokin

Lithuanian Sports University, Lithuania

Background. Weight loss and body composition improvements pursued by overweight persons and athletes can be achieved with caloric restriction (CR) using different dietary macronutrient distribution (Aragon et al., 2017; Ge et al., 2020). However, a post-diet period is less studied and it is not clear how selected dietary macronutrient distribution sustains these achievements particularly when return to ad libitum feeding (Muhammad et al., 2017). We aimed to examine this issue using the mouse model.

Research methods. 18-month-old naturally overweight males of the C57BL/6J mouse strain were examined. They were matched by body mass into three groups (n = 23 each) and subjected to 30% CR for 4 weeks with either low-fat (LFD; 20, 60, 20% of total kcal for protein, carbohydrate, fat, respectively), low-carbohydrate diet (LCD; 20, 20, 60%) or high-protein (HPD; 35, 35, 30%) followed by 4 weeks of refeeding period (RFD) on the same diets ad libitum. Body mass was monitored daily and hindlimb muscles as well as major body fat sites were dissected and precisely weighted at the end of CR or RFD. Eleven mice on ad libitum chow diet served as controls throughout the experiment.

Results and discussion. CR resulted in more than 30% weight loss with no differences between diet groups ($p > 0.05$). Majority of it was contributed to body fat loss while muscle mass loss was much less but still significant compared to controls ($p < 0.01$–0.001), however with no differences between diet groups ($p < 0.05$). During RFD period both LFD and HPD groups regained back lost body, muscle and fat mass to levels of controls ($p > 0.05$). However, LCD overshot controls and both other diet groups in body and fat mass by 18–21% and 100–118%, respectively ($p < 0.001$).

Conclusions. High-fat diet leads to similar improvements in body composition during CR but much greater body fat recovery and overshoot during ad libitum post-diet period in aged mice.

References

Aragon, A. A., Schoenfeld, B. J., Wildman, R., Kleiner, S., VanDusseldorp, T. et al. (2017). International society of sports nutrition position stand: diets and body composition. *Journal of the International Society of Sports Nutrition, 14,* 16. doi:10.1186/s12970-017-0174-y

Ge, L., Sadeghirad, B., Ball, G., da Costa, B. R., Hitchcock, C. L., Svendrovski, A. et al. (2020). Comparison of dietary macronutrient patterns of 14 popular named dietary programmes for weight and cardiovascular risk factor reduction in adults: Systematic review and network meta-analysis of randomised trials. *British Medical Journal, 369,* m696. doi:10.1136/bmj.m696

Muhammad, H., Vink, R. G., Roumans, N., Arkenbosch, L., Mariman, E. C., & van Baak, M. A. (2017). Dietary intake after weight loss and the risk of weight regain: Macronutrient composition and inflammatory properties of the diet. *Nutrients, 9*(11), 1205. doi:10.3390/nu9111205

Keywords: obesity, body mass, regain, diet, mouse.

LOCAL COOLING EFFECT ON CENTRAL FATIGUE FOR PERSONS WITH MULTIPLE SCLEROSIS

Gintarė Daukšaitė, Marius Brazaitis, Nerijus Eimantas, Neringa Baranauskienė
Lithuanian Sports University, Lithuania

Background. Fatigue is one of the most common and disabling symptoms in patients with multiple sclerosis (MS) (Manjaly et al., 2019). Studies have reported that some cooling strategies applied before and/or during exposure to heat have successfully facilitated the development of heat-related fatigue in people with MS (Grahn & Heller, 2008; Kaltsatou & Flouris, 2019). Previous studies have shown that the main methods to reduce the effects of exercise-induced hyperthermia are local cooling therapy, which is based on the application of heat-removing material on the skin surface (Kaltsatou & Flouris, 2019; Reynolds, Short, Westwood, & Cheung, 2011). Since the head and neck areas are particularly sensitive to cold and cooling interventions, we investigated the effects of cooling the head and neck on the central fatigue of MS patients.

Research methods. We studied age-matched (18–43 years of age) men with multiple sclerosis (n = 18) they were selected for experimental cooling group (n = 9) and control group (n = 9). The inclusion criteria for MS subjects were a Kurtzke Expanded Disability Status Score <4 and a Fatigue Severity Scale Score >5. Both groups performed an exercise load of 100 intermittent isometric knee extensions with flexion of 60° with 5-s contractions and 20-s rest. Physical load consisted of a constant torque target sequence at 50% of maximal voluntary contraction (MVC). Variables measured before, during, and after exercise. We evaluated central activation ratio (CAR), electrically induced force and maximal voluntary contraction (MVC).

Results and discussion. The MS cooling group showed significantly higher ($p < 0.05$) central activation ratio and maximal voluntary contraction results compared to the control group, while performing physical load. We found that cooling the head and neck activates the CNS system to perform fatiguing exercise with less central fatigue compared with non-cooling in people with MS.

Reynolds et al. (2011) already found that head and neck cooling may be an effective tool in increasing ambulatory capacity in individuals with MS and heat sensitivity. Other studies examining different cooling methods: cooling exercise environment (Grover et al., 2017), cooling hand in the chamber (Grahn & Heller, 2008) or whole-body cooling (Eijnde, Keytsman, Wens, & Hansen, 2014) effects on MS-related fatigue shows that these methods decreased central fatigue and can extend participation in day-to-day physical activities despite thermally stressful conditions.

Conclusions. Local cooling of the head and neck area reduces central fatigue compared to the control group while performing fatiguing physical load. These findings may help optimize rehabilitation strategies to improve the function of people with MS and reduce fatigue.

References

Eijnde, B., Keytsman, C., Wens, I., & Hansen, D. (2014). Whole-body cooling does not compromise muscle oxidative capacity in subjects with multiple sclerosis. *NeuroRehabilitation, 35*(4), 805–811.

Grahn, D. A., & Heller, H. C. (2008). Cooling via one hand improves physical performance in heat-sensitive individuals with multiple sclerosis: A preliminary study. *BMC Neurology, 8*(1), 1–8.

Grover, G., Ploughman, M., Philpott, D. T., Kelly, L. P., Devasahayam, A. J., Wadden, K., ... & Button, D. C. (2017). Environmental temperature and exercise modality independently impact central and muscle fatigue among people with multiple sclerosis. *Multiple Sclerosis Journal – Experimental, Translational and Clinical, 3*(4), 2055217317747625.

Kaltsatou, A., & Flouris, A. D. (2019). Impact of pre-cooling therapy on the physical performance and functional capacity of multiple sclerosis patients: A systematic review. *Multiple Sclerosis and Related Disorders, 27,* 419–423.

Manjaly, Z. M., Harrison, N. A., Critchley, H. D., Do, C. T., Stefanics, G., Wenderoth, N., ... & Stephan, K. E. (2019). Pathophysiological and cognitive mechanisms of fatigue in multiple sclerosis. *Journal of Neurology, Neurosurgery & Psychiatry, 90*(6), 642–651.

Reynolds, L. F., Short, C. A., Westwood, D. A., & Cheung, S. S. (2011). Head pre-cooling improves symptoms of heat-sensitive multiple sclerosis patients. *Canadian Journal of Neurological Sciences, 38*(1), 106–111.

Keywords: multiple sclerosis, cooling, fatigue, temperature, central activation ratio.

THE EFFECT OF SUCCINATE SUPPLEMENTATION ON MUSCLE HYPERTROPHY AND ATROPHY IN ADULT C57BL/6J MICE FED TWO DIFFERENT DIETS

Mantas Dirmontas[1], Mindaugas Kvedaras[1], Indrė Libnickienė[1], Aivaras Ratkevičius[1, 2]

[1]Lithuanian Sports University, Lithuania; [2]Queen Mary University of London, U.K.

Background. Succinate is an intermediate of the mitochondrial metabolism. Succinate supplementation increased the rate of protein synthesis in skeletal muscles of C57BL/6J mice and C2C12 mouse muscle cells (Yuan et al., 2017). We hypothesized that dietary succinate supplements might promote muscle hypertrophy in response to functional overloading and reduce muscle wasting after denervation. We studied effects of succinate supplements in C57BL/6J mice fed regular diet (RD) with low fat content (20% kcal fat) and ketogenic diet (KD) with high fat content (80% kcal fat).

Research methods. 15-week-old male C57BL/6J mice (n = 40) were fed RD or KD and received water (W) or water supplemented with 2% succinate (S) ad libitum for 12 weeks. After six weeks of the feeding overloading of plantaris (PLAN) muscle was induced by denervation of the gastrocnemius and soleus (SOL) muscles of the right leg while left leg served as a control. After the following 6 weeks, mice were sacrificed by exposure to high CO_2. Immediately afterwards leg muscles were collected and frozen at -80 degree of Celsius for later analysis. Data is presented as means ± SD.

Results and discussion. S had the same effect as W on overloading-induced gain of PLAN mass for both diets (135.9 ± 9.1 vs 135.6 ± 12.5% control for RD and 133.1 ± 7.7 vs 130.3 ± 9.6% control for KD). CSA of type I fibres in PLAN was not different between S and W treatments either. After denervation SOL mass did not differ between these conditions or diets too (66.2 ± 13.8 vs 67.8 ± 12.0% control for RD and 67.7 ± 9.8 vs 71.1 ± 18.0% control for KD). There were no differences in type I and type II fiber CSA of SOL between S and W conditions after denervation.

Conclusions. Neither dietary fat nor succinate content has a significant effect on muscle response to functional overloading or denervation in adult C57BL/6J mice.

References

Yuan, Y., Xu, Y., Xu, J., Liang, B., Cai, X., Zhu, C., ... & Wang, X. (2017). Succinate promotes skeletal muscle protein synthesis via Erk1/2 signaling pathway. *Molecular Medicine Reports, 16*(5), 7361–7366.

Keywords: succinate supplement, ketogenic diet, muscle hypertrophy, muscle atrophy.

RELATIONSHIP BETWEEN BODY COMPOSITION, CARDIOVASCULAR INDICATORS AND BALANCE MANAGEMENT IN THE ELDERLY

Guoda Gorovojūtė, Vida Janina Česnaitienė
Lithuanian Sports University, Lithuania

Background. The balance control system is closely related to physical changes in the body, cardiovascular disease. Research goal to evaluate and compare the relationship between body composition, cardiovascular indicators, and balance management in the elderly. Body composition changes with age, especially in the elderly. Changes in body composition with age are one of the most pronounced and inevitable consequences of aging. Some studies show a decrease in muscle mass, loss of lean mass, and an increase in total fat mass in the elderly (Genton et al., 2011). Aging is associated with alterations in the structural and functional properties of large and small arteries (Najjar, Scuteri, & Lakatta, 2005). Hypertension in older adults is related to adverse cardiovascular outcomes, such as heart failure, stroke, myocardial infarction, and death (Oliveros et al., 2020). Cognitive impairment is defined as the manifestation of physical weakness and cognitive decline in the elderly. Cognitive impairment is also associated with loss of coordination. Cardiovascular disease also has a significant impact. It can also be more difficult for individuals after stroke to coordinate their balance and manage individual muscle groups.

Research methods. The study involved 72 older people. About 45.8 percent (n = 33) were male and 54.2 percent (n = 39) women. The study applied static posturography using force plate (KISTLER). During the test, the subject stands on the force plate in three different positions: simple posture with legs compressed, eyes open, arms crossed over chest; simple posture with legs compressed, eyes closed, arms crossed over chest; leg-to-leg posture, eyes open, arms crossed on chest. For the evaluation of equilibrium control, we used the rate of change of the coordinates of the projection of the pressure center in the horizontal plane Vcop mm/s. Also anthropometric measurements blood pressure and heart rate measurements (age, weight, height, fat % FFM, blood pressure).

Results and discussion. The study found that the older the age, the lower the fat ratio ($p = 0.037$). It was found that the higher the age, the lower the diastolic blood pressure ($p = 0.015$). The results of the balance test are directly dependent on height, fat-free mass weight and systolic blood pressure ($p < 0.05$). The balance study showed that when the legs were straight and the eyes closed, the test results were directly dependent on height, fat-free weight, and systolic blood pressure ($p < 0.05$). Also, the older the age of the subjects, the lower their balance stability results when the foot is facing each other and the eyes are open. Several studies have shown an association between low muscle mass and various heart diseases in the elderly (Santana, Mendes, Silva, & Pinho, 2019).

Conclusions. Higher stability in balance is lead by lower fat ratio, systolic blood pressure, lower fat free mass, weight and higher diastolic blood pressure.

References

Genton, L., Karsegard, V. L., Chevalley, T., Kossovsky, M. P., Darmon, P., & Pichard, C. (2011). Body composition changes over 9 years in healthy elderly subjects and impact of physical activity. *Clinical Nutrition, 30*(4), 436–442.

Najjar, S. S., Scuteri, A., & Lakatta, E. G. (2005). Arterial aging: Is it an immutable cardiovascular risk factor? *Hypertension, 46*(3), 454–462.

Oliveros, E., Patel, H., Kyung, S., Fugar, S., Goldberg, A., Madan, N., & Williams, K. A. (2020). Hypertension in older adults: Assessment, management, and challenges. *Clinical Cardiology, 43*(2), 99–107.

Santana, N. D. M., Mendes, R. M. L., Silva, N. F. D., & Pinho, C. P. S. (2019). Sarcopenia and sarcopenic obesity as prognostic predictors in hospitalized elderly patients with acute myocardial infarction. *Einstein (Sao Paulo), 17*.

Keywords: elderly, body composition, balance in elderly.

EFFECTS OF PHYSIOTHERAPY ON JOINT PAIN AND AMPLITUDE IN INDIVIDUALS WITH SHOULDER IMPINGEMENT SYNDROME

Laura Gustauskienė, Vaida Pokvytytė
Lithuanian Sports University, Lithuania

Background. Shoulder pain due to musculoskeletal disorders are the second most common in orthopedic practice (Consigliere, Haddo, Levy, & Sforza, 2018). Shoulder joint impingement syndrome (SIS) occurs when soft tissues become painfully stuck in the shoulder joint area, which causes pain, a decrease in the amplitude of shoulder joint movements and muscle strength (Watts, Williams, Kim, Bramwell, & Krishnan, 2017). Research suggests that mobilization with movement is beneficial in reducing pain and improving movement amplitude in individuals with SIS. Therefore, these days remain relevant in searching for the most effective methodology for treating shoulder impingement syndrome. The study aimed to determine the effect of different physiotherapy techniques on shoulder pain and range of motion.

The novelty of this study is to find that mobilization with movement combined with conventional physiotherapy is more effective in reducing shoulder pain and increasing range of motion.

Research methods. The study included 16 (9 women and 7 men, so the majority of subjects were women (56.25%)) subjects who were required to have an ultrasound (UG) or magnetic resonance imaging (MRI) scan and were diagnosed with SIS.

Subjects were divided into two groups. The study group (n = 8) was given shoulder joint mobilization with movement (MWM) plus conventional physiotherapy, and the control group (n = 8) received only conventional physiotherapy exercises. Subjects were evaluated before the study, after 2, and after four weeks of the study. An amplitude with goniometry and the pain with the VAS scale was assessed in both subject groups.

Results and discussion. A comparison of changes in the intensity of shoulder pain in both groups showed a reduction in shoulder pain after 2 weeks, but the results did not differ significantly ($p = 0.448$). However, comparing the results in both groups after 4 weeks, a statistically significant reduction in shoulder pain was observed in the study group ($p = 0.043$). The results also revealed that after 4 weeks of conventional physiotherapy, combined with MWM, the range of motion of arm movements increased significantly compared with the results of conventional physiotherapy. Analyzing the scientific literature patients with shoulder impingement syndrome who has MWM sessions of exhibited significantly better outcomes for pain during shoulder flexion, pain-free range of shoulder flexion, maximal shoulder flexion, and maximal external rotation than those patients who were in the sham group (Delgado-Gill et al., 2015; Meena & Varghese, 2020).

Conclusions. Conventional physiotherapy and physiotherapy with movement of the shoulder joint with movement in the presence of SIS were effective in reducing pain after 2 and 4 weeks, especially significant relief of pain after 4 weeks with movement of the shoulder joint with movement. With conventional physiotherapy and physiotherapy with shoulder joint mobilization with movement, the range of motion of arm movements increased after both 2 and 4 weeks, but with the use of physiotherapy with movement mobilization, the range of motion of movements increased more.

References

Consigliere, P., Haddo, O., Levy, O., & Sforza, G. (2018). Subacromial impingement syndrome: Management challenges. *Orthopedic Research and Reviews, 10,* 83–91.

Delgado-Gil, J. A., Prado-Robles, E., Rodrigues-de-Souza, D. P., Cleland, J. A., Fernández-de-las-Peñas, C., & Alburquerque-Sendín, F. (2015). Effects of mobilization with movement on pain and range of motion in patients with unilateral shoulder impingement syndrome: A randomized controlled trial. *Journal of Manipulative and Physiological Therapeutics, 38*(4), 245–252.

Meena, V., & Varghese, J. G. (2020). Effectiveness of mulligans mobilisation with movement on shoulder dysfunction: A systematic review. *Journal of Clinical & Diagnostic Research, 14*(10).

Watts, A. R., Williams, B., Kim, S. W., Bramwell, D. C., & Krishnan, J. (2017). Shoulder impingement syndrome: A systematic review of clinical trial participant selection criteria. *Shoulder & Elbow, 9*(1), 31–41.

Keywords: SIS – shoulder impingement syndrome, MWM – mobilization with movement.

THE EFFECT OF PHYSICAL FITNESS LEVEL ON GLYCOLYTIC CAPACITY IN RESPONSE TO PROLONGED FASTING: A PILOT STUDY

Berta Ylaitė, Nerijus Eimantas, Rima Solianik, Sandra Kilikevičienė, Marius Brazaitis
Lithuanian Sports University, Lithuania

Background. Nutritional strategies including fasting became popular as a research topic and in clinical settings to consider the possible health benefits associated, as well as in sport contexts included in fast weight loss protocols and to improve body composition or performance (Johnstone, 2015; Stockman, Thomas, Burke, & Apovian, 2018). However, less is known regarding the impact of prolonged fasting (i.e., 48 h) on the metabolic response during exercise (Hargreaves & Spriet, 2020; Mookerjee, Nicholls, & Brand, 2016) in particular considering subjects of different physical fitness levels or training backgrounds (Vieira, Costa, Macedo, Coconcelli, & Kruel, 2016). Therefore, we aimed in this pilot testing to acquire early data about the possible role of physical fitness level on glycolytic capacity during exercise after 48 h fasting exposure.

Research methods. Two well-trained (TM) and one physically active (PM) males volunteered for the present study. The subjects were tested for resting metabolic rate (RMR), maximal oxygen consumption (VO_2max) and substrate oxidation during incremental cycling till exhaustion, exercising and resting circulating lactic acid (LA) and blood glucose (GL) concentrations. All the tests were performed in normal fed conditions and after 48-h fasting, as well as 24-h after fasting as recovery status marker.

Results and discussion. 48-h fasting impacted RMR decrease only in TM, while interestingly in PM RMR increased. Metabolic response to fasting during exercise differed between TM and PM, in particular, the TM increased utilization of FAT and CHO constantly from the beginning of the exercise compared to normal condition. At 75–80% $\dot{V}O_2max$, the TM showed a fast drop in FAT and an increase in CHO utilization, and at the same time, LA reached a small peak indicating anaerobic metabolism and reaching immediately a plateau and exhaustion of the subject. After 48-h fasting glucose intake did not affect LA kinetics during exercise and the overall exercise capacity in both levels of physical fitness.

Conclusions. The initial outcomes of this pilot study showed different pathways in metabolic response to prolonged fasting of TM compared to PM. Although the current data represent an extract from pilot testing, the results look promising and future steps extending our testing to a larger population will allow deeper analyses and understanding.

References

Hargreaves, M., & Spriet, L. L. (2020). Skeletal muscle energy metabolism during exercise. *Nature Metabolism, 2*(9), 817–828.

Johnstone, A. (2015). Fasting for weight loss: An effective strategy or latest dieting trend? *International Journal of Obesity, 39*(5), 727–733.

Mookerjee, S. A., Nicholls, D. G., & Brand, M. D. (2016). Determining maximum glycolytic capacity using extracellular flux measurements. *PLoS One, 11*(3), e0152016.

Stockman, M. C., Thomas, D., Burke, J., & Apovian, C. M. (2018). Intermittent fasting: Is the wait worth the weight? *Current Obesity Reports, 7*(2), 172–185.

Vieira, A. F., Costa, R. R., Macedo, R. C. O., Coconcelli, L., & Kruel, L. F. M. (2016). Effects of aerobic exercise performed in fasted v. fed state on fat and carbohydrate metabolism in adults: A systematic review and meta-analysis. *The British Journal of Nutrition, 116*(7), 1153–1164.

Keywords: caloric restriction, exercise metabolism, physical performance, lactic acid.

THE EFFECT OF BODY TEMPERATURE DURING CYCLING EXERCISE, HOT AND COLD WATER IMMERSION ON CELL-FREE DNA LEVELS IN YOUNG ADULTS

Ema Juškevičiūtė[1, 2], Nerijus Eimantas[1], Sandra Kilikevičienė[1], Viktorija Treigytė[1], Kostas Mongirdas[1], Elmo Neuberger[2], Perikles Simon[2], Marius Brazaitis[1]

[1]Lithuanian Sports University, Lithuania; [2]Johannes Gutenberg University, Germany

Background. Cell-free DNA (cfDNA) is an important part of a noninvasive class of biomarkers known as liquid biopsy. In healthy individuals, most cfDNA originates from hematopoietic cells, but a significant amount of it also arises from other tissues (Han & Lo, 2021). As a versatile biomarker, cfDNA is involved in inflammation, immunomodulation, and other pathophysiological conditions (Kustanovich, Schwartz, Peretz, & Grinshpun, 2019). Following exercise, cfDNA concentrations increase immediately and normally return to baseline levels within two hours of recovery (Fatouros et al., 2010). Neutrophils homeostasis is sensitive to increased body temperature (Capitano et al., 2012). Since the main source of cfDNA is granulocytes (neutrophils belong to a group of granulocytes), we hypothesize that an increased body temperature (induced by cycling exercise or hot water immersion) would result in higher cfDNA concentration.

Research methods. Here, we investigated the effect of body core temperature (T_c) on cfDNA release. To identify the relative contribution of T_c on cfDNA release, 15 young male participants completed an exercise trial (cycling at 60% VO_2max until T_c reaches 39 ℃), hot water (43–44 ℃) immersion (until T_c reaches 39 ℃), and cold water (10 ℃) immersion for 1 hour. Blood samples for cfDNA analysis were taken every time the core temperature rose by 0.5 ℃ or returned to baseline during or after cycling and immersion in hot water. In cold water immersion, blood samples were collected every 15 minutes. cfDNA concentrations were quantified by analyzing unpurified plasma via the quantitative real-time polymerase chain reaction (qPCR) with primers targeting the noncoding long interspersed nuclear element (LINE) L1PA2 family (reactions were performed on a CFX384 Touch Real-Time PCR detection system (Bio-Rad, München, Germany). Statistical analysis was done using R program (v3.6.3).

Results and discussion. During cycling exercise, cfDNA levels increased steadily 5–98-fold from Pre (9.81 ± 4.36 ng/ml) to 39 ℃ (57.31 ± 31.82 ng/ml). Compared to Pre values, the cfDNA levels were significantly increased at each point in time and remained elevated until T_c returned to pre-exercise values ($p \leq 0.05$). In the passive heating trial, there were significant elevations of cfDNA concentrations measured at T_c 39 ℃ and 38.5 ℃ post compared to the baseline value. The values were increased by 1.85-fold and 1.95-fold, respectively (18.34 ± 7.03, 19.34 ± 10.77 ng/ml). We found no significant changes in cfDNA concentration during and after cooling at each of the eleven time points. The levels remained between a minimum of 9.18 ± 3.98 ng/ml and maximum of 12.14 ± 11.49 ng/ml.

Conclusions. Our analysis reveals different responses of cfDNA depending on the changes in core temperature. Since neutrophils play a key role in the release of cfDNA at resting conditions (Moss et al., 2018), and during exercise (Neuberger et al., 2022), neutrophils might contribute to cfDNA increases during heating. However, since the fold changes are much higher during exercise (5.89-fold) compared to heating conditions (1.95-fold) a different activation of the cells is likely. Our observations indicate that the release of cfDNA is dependent on the duration of exercise and body temperature.

References

Capitano, M. L., Nemeth, M. J., Mace, T. A., Salisbury-Ruf, C., Segal, B. H., McCarthy, P. L., & Repasky, E. A. (2012). Elevating body temperature enhances hematopoiesis and neutrophil recovery after total body irradiation in an IL-1-, IL-17-, and G-CSF-dependent manner. *Blood, The Journal of the American Society of Hematology, 120*(13), 2600–2609.

Fatouros, I. G., Chatzinikolaou, A., Douroudos, I. I., Nikolaidis, M. G., Kyparos, A., Margonis, K., ... & Jamurtas, A. Z. (2010). Time-course of changes in oxidative stress and antioxidant status responses following a soccer game. *The Journal of Strength & Conditioning Research, 24*(12), 3278–3286.

Han, D. S., & Lo, Y. D. (2021). The nexus of cfDNA and nuclease biology. *Trends in Genetics, 37*(8), 758–770.

Kustanovich, A., Schwartz, R., Peretz, T., & Grinshpun, A. (2019). Life and death of circulating cell-free DNA. *Cancer Biology & Therapy, 20*(8), 1057–1067.

Moss, J., Magenheim, J., Neiman, D., Zemmour, H., Loyfer, N., Korach, A., ... & Dor, Y. (2018). Comprehensive human cell-type methylation atlas reveals origins of circulating cell-free DNA in health and disease. *Nature Communications, 9*(1), 1–12.

Neuberger, E. W., Sontag, S., Brahmer, A., Philippi, K. F., Radsak, M. P., Wagner, W., & Simon, P. (2022). Physical activity specifically evokes release of cell-free DNA from granulocytes thereby affecting liquid biopsy. *Clinical Epigenetics, 14*(1), 1–7.

Keywords: circulating cell-free DNA, exercise, cold water immersion, hot water immersion.

EFFECT OF EXERCISE AND KINESIOLOGICAL TYPING ON 12–16 YEAR OLD ADOLESCENTS' POSTURE

Eglė Kemerytė-Ivanauskienė, Jūratė Česnavičienė

Vytautas Magnus University, Education Academy, Lithuania

Background. Skeletal maturity, pubertal processes and psychological causes during maturation period, can all contribute to the development of kyphotic posture in adolescents. The most common postural disorder in adolescents is thoracic kyphosis, which has increased dramatically during this pandemic period. The correction of this posture is usually achieved by physiotherapy (Feng, Wang, Zhang, & Zhou, 2018). However, splints or postural correctors are often used alongside, and often have impact on the adolescent's impaired quality of life. Kinesiology taping is widely used to improve voluntary muscle control, coordination, muscle tone or posture in children and adolescents with cerebral palsy (Sousa Jr, de Lima, Neves da Silva, & Vaz, 2017), but there is little research data on the combination of physiotherapy exercises and kinesiology taping to correct healthy adolescents' kyphotic posture, although it has been suggested that kinesiology taping may not only maintain joint stability by correcting muscle function, but also restore and optimise postural symmetry (Costa, Rodrigues, Leal, & Rocha, 2013).

Research methods. The study included 23 people with light kyphosis posture. Inclusion criteria: age 12–16 years; adolescents' upper spine posture was rated as satisfactory on the Hoeger posture scale; adolescents the subjects did not have scoliosis. After posture evaluation, adolescents were divided in 2 groups: one group received physiotherapy exercises. The other group received physiotherapy exercises and kinesiological taping. The following methods were used in the study: literature analysis, evaluation of adolescents' posture applying photometric method: posture was assessed using the mobile application APECS (PRO version) in standing, full height, frontal and sagittal planes) (Singla, Veqar, & Hussain, 2017). Sagittal head, head-neck, and shoulder deflections and thoracic kyphosis angle were assessed. In frontal plane the symmetry of head, shoulders, scapula, hips, knees and feet were evaluated.

Results and discussion. The results of the study showed that adolescents' kyphosic posture was positively influenced by physiotherapy exercises and the combination of physiotherapy and kinesiological taping after 12 weeks intervention. However, the combined application of kinesiological taping had significant positive effect on the adolescents' sagittal head ($t = 2.51$; $p < 0.05$), head-neck ($t = 2.78$; $p < 0.05$) angles and thoracic angle ($t = 3.02$; $p < 0.05$). Exercises and kinesiological taping had a positive impact on symmetry of adolescents' head, shoulders, scapula, hips, knees and feet in both groups, but no statistically significant changes were found.

Conclusions. It was established that physiotherapy exercise complex together with kinesiological taping had a significant positive impact on adolescents' kyphosic posture, than applying only exercise complex alone.

References

Costa, C. S. N., Rodrigues, F. S., Leal, F. M., & Rocha, N. (2013). Pilot study: Investigating the effects of kinesio taping on functional activities in children with cerebral palsy. *Developmental Neurorehabilitation, 16*(2), 121–128.

Feng, Q., Wang, M., Zhang, Y., & Zhou, Y. (2018). The effect of a corrective functional exercise program on postural thoracic kyphosis in teenagers: A randomized controlled trial. *Clinical Rehabilitation, 32*(1), 48–56. doi:10.1177/0269215517714591

Singla, D., Veqar, Z., & Hussain, M. E. (2017). Photogrammetric assessment of upper body posture using postural angles: A literature review. *Journal of Chiropractic Medicine, 16*(2), 131–138. doi:10.1016/j.jcm.2017.01.005

Sousa Jr, R., de Lima, P., Neves da Silva, J., & Vaz, D. V. (2017). Effects of kinesiology taping in children with cerebral palsy: A systematic review. *Fisioterapia em Movimento, 30,* 373–382. doi.org/10.1590/1980-5918.030.s01.ar06

Keywords: posture, kyphosis, kinesiology taping, exercise, adolescent.

CHANGES IN THE INTERFACE BETWEEN NUTRITION AND BODY COMPOSITION INDICATORS DURING THE PRE-COMPETITION CYCLE IN JUDOKAS

Andrej Klokov, Daiva Vizbaraitė
Lithuanian Sports University, Lithuania

Background. Judo is an Olympic sport that requires big physiological and psychological effort. Judo players compete in high intensity 4 min bouts with extra time without limit if fighters are equal and no score is made in first 4 min. Combat sports athletes compete in different weight categories and judo is not an exception. Often athletes try to reduce their body weight to compete not in their natural weight class with purpose to gain an advantage, because of the lean muscle mass. Methods and pre-competitive weight control management are not so clear among high level Lithuanian male judo athletes. Analysing different preparation cycles allows to determine athletes body composition and nutrition changes due to their interface, what can be crucial for high performance in professional sport. The aim of this study was to evaluate the changes in the relationship between nutrition and body composition indicators of judo athletes during the pre-competition cycle.

Research methods. Quantitative research – questionnaire survey, nutrition diary analysis and anthropometric measurements (including measurements of fat wrinkles). Sports nutrition preferences were revealed based on dietary habits questionnaire and questionnaire of nutrition knowledge. Diet and fluid intake diary revealed nutrition specificity during basic preparation cycle and pre-competition cycle. Questionnaires were made based on Franchini, Brito, Fukuda and Artioli (2014), Yerzhanova, Sabyrbek and Milašius (2017), Visiedo, Frideres and Palao (2017), Jurikova and Nguyen (2017) and Martinez-Rodriguez, Vicente-Salar, Montero-Carretero and Roche (2015) research papers questionnaires. Body composition (weight (kg), body fat (%, kg), free fat mass (%, kg), KMI) was analysed by Body Composition Analyser Wunder TBF-300 MA, Germany. Four fat wrinkles (biceps, triceps, shoulder blade, hip) were absorbed by Medical Skinfold Caliper Model SH5020, Korea. Basal metabolic rate and energy expenditure were calculated by Harris-Benedict equation for men. Statistical analysis was made by MS Excel and IBM SPSS 22.

Results and discussion. The study found that the biggest anthropometric changes occurred among athletes who lose weight during the pre-competition cycle. They were able to lose 4 ± 4 kg of body weight, 1 ± 3 kg of body fat, 2 ± 2 kg of fluid and 1 ± 2 kg/m^2 of total BMI. Nutrition didn't had any significant effect on fat wrinkles, but it's significant reduction had effect on anthropometric markers. During pre-competition cycle athletes are lighter, their BMI, fat mass, lean body mass decrease compared to the basic preparation cycle.

Conclusions. It has been rewild that athletes start to lose weight 5–7 days before the competition, increasing training intensity and reducing nutrition and fluid consummation, which is contrary to good physical shape. The workout plan should meet nutritional needs, taking into account the specifics of pre-competition weight control.

References

Franchini, E., Brito, C. J., Fukuda, D. H., & Artioli, G. G. (2014). The physiology of judo-specific training modalities. *The Journal of Strength & Conditioning Research, 28,* 1474–1481.

Jurikova, J., & Nguyen, H. D. (2017). Eating habits in judokas. *Quality in Sport, 4*(3), 7–21.

Martinez-Rodriguez, A., Vicente-Salar, N., Montero-Carretero, C. E., & Roche, E. (2015). Nutritional strategies to reach the weight category in judo and karate athletes. *Science of Martial Arts, 11,* 381–391.

Visiedo, A., Frideres, J. E., & Palao, J. M. (2017). Design, validation, and reliability of survey to measure knowledge of nutrition, weight control and its risks. *Central European Journal of Sport Sciences and Medicine, 20*(4), 39–51.

Yerzhanova, E., Sabyrbek, Z., & Milašius, K. (2017). Comparative evaluation of actual nutrition and micronutrients provision of judo wrestlers of various sport performance levels. *Sport Science, 3*(89), 47–53.

Keywords: judo, athlete nutrition, body composition, pre-competition cycle.

LOW-FAT DIET RESULTS IN LOWER RESPIRATORY QUOTIENT DURING CALORIC RESTRICTION AND REFEEDING THAN OTHER DIETS BUT IT IS NOT A PREDICTOR OF GREATER BODY FAT BURNING IN MICE

Ravi Kumar[1], Andrej Fokin[1], Tomas Kazimieras Povilonis[2], Petras Minderis[1]

[1]Lithuanian Sports University; [2]Lithuanian University of Health Sciences, Lithuania

Background. Weight regain following weight loss is a frequent problem that people with obesity or athletes of weight-making sports face (Fothergill et al., 2016). It is suggested that diets high in carbohydrate or protein decrease or increase energy expenditure, respectively, and thus affect energy balance and success of weight maintenance (Ebbeling et al., 2018; Oliveira et al., 2021). Our goal is to examine the role of diet composition on weight maintenance and energy metabolism in aged mice during caloric restriction (CR) and post-dieting period (P-CR).

Research methods. Males of C57BL/6J mouse strain were grown until 18-month-old and then mice with overweight were selected and divided into 4 groups matched by body mass: low-fat (20, 20, 60% of kcal from fat, protein, carbohydrate), low-carbohydrate (60, 20, 20%, respectively), high-protein (30, 35, 35%, respectively) and control (regular chow diet) (n = 9–11 each). Mice were subjected to 30% CR for 4 weeks followed by ad libitum P-CR feeding for 4 weeks using the same diets. Controls were fed ad libitum all the time. Body mass and 23-h indirect calorimetry in metabolic cage (energy expenditure, respiratory quotient, physical activity levels) were assessed during CR and P-CR.

Results and discussion. Weight loss was similar between the diet groups during CR ($p > 0.05$) but only low-carb group regained more weight in P-CR than had initially prior CR. Energy expenditure did not differ between diet groups neither during CR nor P-CR ($p > 0.05$) but was lower in CR and higher in P-CR compared to controls. Energy expenditure normalized to body mass was similar between diet groups during CR but lower in low-carb group during P-CR compared to high-pro and especially low-fat group ($p < 0.001$). Physical activity did not differ between diet groups neither during CR nor P-CR ($p > 0.05$). Respiratory quotient was significantly lower in low-carb group compared to all groups during both CR and P-CR ($p < 0.01$–0.001).

Conclusions. Low-carb diet is associated with greater weight regain and lower relative energy expenditure after previous weight loss compared to other type of diets in aged mice. Low respiratory quotient in low-carb diet indicates overall fat metabolism and oxidation (from diet + body storage) and is not a good predictor of burned body fat.

References

Fothergill, E., Guo, J., Howard, L., Kerns J. C., Knuth, N. D., et al. (2016). Persistent metabolic adaptation 6 years after The Biggest Loser competition. Obesity, 24(8):1612-1619. doi: 10.1002/oby.21538

Ebbeling, C. B., Feldman, H. A., Klein, G. L., Wong, J., Bielak, L., et al. (2018). Effects of a low carbohydrate diet on energy expenditure during weight loss maintenance: randomized trial. BMJ, 363, k4583. doi: 10.1136/bmj.k4583

Oliveira, C., Boulé, N. G., Sharma, A. M., Elliott, S. A., Siervo, M., et al. (2021). A high-protein total diet replacement increases energy expenditure and leads to negative fat balance in healthy, normal-weight adults. Am J Clin Nutr,113(2):476-487. doi:10.1093/ajcn/nqaa283

Keywords: obesity, diets, refeeding, macronutrients, calories.

THE EFFECT OF ACUTE SUPRAMAXIMAL EXERCISE ON COGNITIVE TEST SCORES OF BASKETBALL PLAYERS PLAYING IN DIFFERENT POSITIONS

Egemen Manci, Çağdaş Güdücü, Erkan Günay, Cem Ş. Bediz
Dokuz Eylül University, Turkey

Background. There are cognitive requirements as well as physiological requirements to be successful in basketball and sports (Abdelkrim, Chaouachi, Chamari, Chtara, & Castagna, 2010). In addition to physiological/physical/tactical factors, cognitive factors also play an important role in winning a sports competition (Jakovlievic, Pajić, & Gardašević, 2015; Stella, Peacock, & Chuan, 2013). In this regard, different cognitive tests were applied to athletes who have been playing basketball for many years, before and after an acute supramaximal exercise and examined in three different groups (guard, forward and center) (Abdelkrim et al., 2010, Chang, Labban, Gapin, & Etnier, 2012).

Research methods. 28 basketball players who have been playing basketball and licensed for about 10 years were included in this research. Three different cognitive tests (Change Detection, Timewall, and Clock Test) were administered to the participants "before and after" the acute Sprint Interval Training exercise (SIT) on a computer (Gurkan et al., 2018). Cognitive tests were administered to all athletes at the same times of the day (10:30–12:00) and in the same environments. All tests were explained to the participants and their written consent was obtained. This study was approved by Dokuz Eylul University Non-Interventional Research Ethics Committee.

Results and discussion. In the Change Detection test, in which a certain stimulus must be found in the shortest time among different variables, the players playing in the guard position were found to be significantly more successful in the number of correct answers than the players playing in other positions ($p < 0.05$). Additionally, on the cognitive test related to timing skills, the athletes playing in the center position achieved significantly better scores ($p < 0.05$). It may be that training in a specific position for many years improves the cognitive skills of the athletes in different aspects. If these abilities are supported by cognitive training, athletes can be more successful and maybe can reach elite levels more easily. In addition, the fact that the differences between positions did not change after SIT, which is an exercise model similar to fatigue in a basketball match, shows that cognitive skills acquired with chronic adaptation are not affected by high-intensity activities/competitions.

Conclusions. As a result, when tests measuring different cognitive skills were applied to the participants, significant differences were observed between the positions. In addition, the differences between the cognitive test scores between the positions before the exercise continued after the exercise.

References

Abdelkrim, N. B., Chaouachi, A., Chamari, K., Chtara, M., & Castagna, C. (2010). Positional role and competitive-level differences in elite-level men's basketball players. *The Journal of Strength & Conditioning Research, 24*(5), 1346–1355.

Chang, Y. K., Labban, J. D., Gapin, J. I., & Etnier, J. L. (2012). The effects of acute exercise on cognitive performance: A meta-analysis. *Brain Research, 1453,* 87–101.

Gurkan, F. T., Bediz, C. S., Colakoglu, B. M., Guducu, C., Eskicioglu, E., Balci, G. A. et al. (2018). Investigation of the effects of intermittent and continuous exercise methods on cognitive functions, risk taking, working memory and attention. *Acta Physıologıca*.

Jakovljević, S., Pajić, Z., & Gardašević, B. (2015). The influence of selected cognitive abilities on the efficiency of basketball players. *Facta Universitatis: Series Physical Education and Sport, 13*(2), 283–290.

Stella, N. Y., Peacock, J. B., & Chuan, T. K. (2013). Investigating the cognitive contribution to basketball behavior and performance. *Procedia – Social and Behavioral Sciences, 97,* 715–722.

Keywords: basketball, cognitive performance, cognitive tests, SIT.

EFFECTS OF MUSCLE ELECTRO STIMULATION ON BLOOD LACTATE AND COGNITIVE FUNCTION IN INDIVIDUALS WITH SPINAL CORD INJURIES

Ugnė Mazuronytė, Wouter A. J. Vints, Oron Levin, Masiulis Nerijus, Vaida Pokvytytė
Lithuanian Sports University, Lithuania

Background. This research is a first step in a better understanding of the possible effect of electrical muscle stimulation on paralyzed muscles and cognitive function in spinal cord injury patients. If we can confirm that muscle contraction can improve cognitive function; this may ultimately lead to designing a treatment strategy that may be used by rehabilitation physicians. The new insights gained from this research may be used to give advice to spinal cord injury patients on how to enhance cognitive function by muscle activity. We want to examine the feasibility of applying neuromuscular electrical stimulation in spinal cord injury patients on gluteal and hamstring muscles to increase lactate and improve cognitive function.

Research methods. In total 18 test subjects participated in the study (4 females and 14 males). The symbol digit modalities test (Smith, 1973): This test measures processing speed, complex visual tracking and working memory. The oral version of this test is proven to be reliable in spinal cord injury patients (Nightingale et al., 2019). It has been validated in the Lithuanian population in multiple sclerosis patients (Giedraitienė, Kizlaitienė, & Kaubrys, 2015). Lactate measurement: capillary lactate will be measured from a drip of blood collected on a test strip after pinprick in a fingertip. Lactate measurements will be performed six times for each subject. Neuromuscular electrical stimulation: electrical stimulation will be applied using a portable stimulator with surface electrodes. Electrical stimulation will be applied to induce a tetanic contraction of the gluteal and hamstring muscles with the low intensity protocol and high intensity protocol. Electrical stimulation will be given for at least 60 minutes with a biphasic 6s–18 s activation-rest cycle, 50 Hz (frequency), a 300–400 μs pulse duration. The high intensity protocol will be similar. However, the activation-rest cycle will be shortened to 6s–6s to increase the volume per time. One cycle now requires only 12 s instead of 24 s. Therefore, total time is decreased to 30 minutes. The maximum current amplitude will not be higher than 110 mA. In addition, we will ask subjects to provide a medical history file from their general practitioner.

Results and discussion. All subjects participated in the control group where no eletrostimulation was applied and experimental group where we applied electrostimulation. Participants were picked randomly and got either high intensity elektrostimulation or low intensity electrostimulation. The results consist of comparing the participants results where not electrostimulation was applied to results where electrostimulation was applied to a participant. After application of high intensity electrical stimulation which lasted 30 minutes, the concentration of lactate in the blood in the experimental group was 4.4 ± 2.32 mmol/l, and in the control 2.14 ± 1.38, the difference between the groups was not statistically significant, therefore we can state that in this group electrostimulation had no effect on blood lactate levels. With low-intensity electro stimulation which lasted 1 hour there was also no significant effect on blood lactate observed, the lactate concentration before the experiment was 2.23 ± 0.89 mmol/l, after stimulation 2.8 ± 1.26 mmol/l. According to The Symbol Digit Modalities Test (SDMT), the cognitive cognition of the subjects differed statistically significantly after high-intensity electro stimulation in the third test. In this group the test result before the elctrostimulation was 62.14 ± 12.6 and after the elctrostimulation and 15 minutes rest 69.8 ± 15.9 points, however, in the control group, when no electro stimulation was applied, only passive rest, the subjects thus showed better cognitive function results in the experiment with 67.3 ± 12.6 points, and after 15 minutes rest 71.7 ± 15 points. The low-intensity 1-hour electro-stimulation improved the cognitive function of the subjects, with better results in the third test: 61.3 ± 13 points before the experiment and 68.6 ± 10.9 points after the experiment, while in the control group, cognitive function did not change statistically significantly before the experiment 63.3 ± 12 points, and after the experiment 67.1 ± 18 points.

Conclusions. The concentration of Lactate in blood have not changed significantly comparing low and high intensity groups. Cognitive function results got better in both high and low electrostimulation groups.

References

Giedraitienė, N., Kizlaitienė, R., & Kaubrys, G. (2015). The BICAMS battery for assessment of Lithuanian-speaking multiple sclerosis patients: Relationship with age, education, disease disability, and duration. *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research, 21,* 3853.

Nightingale, T. E., Lim, C. A. R., Sachdeva, R., Zheng, M. M. Z., Phillips, A. A., & Krassioukov, A. (2019). Reliability of cognitive measures in individuals with a chronic spinal cord injury. *Physical Medicine & Rehabilitation, 11*(12), 1278–1286.

Smith, A. (1973). *Symbol digit modalities test*. Los Angeles: Western Psychological Services.

Keywords: electrostimulation, cognitive function, spinal cord injury, the concentration of lactate.

THIGH MUSCLE EMG ACTIVITY DURING SIT-TO-STAND AFTER A PREOPERATIVE HOME EXERCISE PROGRAM IN WOMEN WITH KNEE OSTEOARTHRITIS

Monika Mets[1], Piret Tootsi[1], Jelena Sokk[1], Jaan Ereline[1], Tiit Haviko[2], Mati Pääsuke[1], Helena Gapeyeva[1]

[1]Institute of Sport Sciences and Physiotherapy, University of Tartu, Tartu, Estonia;
[2]Department of Traumatology and Orthopaedics, Tartu University Hospital, University of Tartu, Tartu, Estonia

Background. People perform up to 71 sit-to-stands a day (Bohannon, 2015). Patients with knee joint osteoarthritis (OA) perform it less due to knee extensor and flexor muscle dysfunctions (Bohannon, 2015; Alnahdi, Zeni, & Snyder-Mackler, 2012). Not much is known about muscle activation during a sit-to-stand task. Investigating bioelectrical activity of thigh muscles in knee OA patients during a Sit-to-Stand test would provide useful insight (Mets et al., 2022). The aim was to assess the EMG activity of thigh muscles in concentric and eccentric phases of a Five Times Sit-to-Stand test (FTSST) in women with severe knee OA after a preoperative home exercise program (HEP).

Research methods. Seventeen women aged 54–71 years with severe knee OA participated twice: pre-and post-HEP. They performed an 8-week preoperative HEP consisting of 15 exercises including resistance training with elastic bands (Thera-Band, System of Progressive Exercise, USA), balance and stretching exercises. The bioelectrical activity of thigh muscles during concentric and eccentric phases of the Sit-to-Stand test (FTSST) was recorded by a 16-channel electromyograph (Mega Electronics, Finland) with a synchronous knee joint range of motion measurement by an electrogoniometer (SG150, Biometrics Ltd., UK).

Results and discussion. In the current study, before performing the exercise program, the participants demonstrated higher activation and co-activation of thigh muscles in both phases (concentric and eccentric) of the Sit-to-Stand test. The HEP program was aimed to reduce thigh muscle dysfunction and increase muscle strength and thus knee joint stability. Post-HEP, the knee OA patients showed lower ($p < 0.05$) bioelectrical activity and a decrease in co-activation of thigh muscles in the concentric and eccentric phases of the FTSST, and reduced ($p < 0.05$) activation asymmetry between involved and uninvolved limbs. FTSST time after HEP also decreased ($p < 0.05$) and participants were 2.6 seconds faster compared to pre-HEP, indicating that the sit-to-stand movement was more efficient.

Conclusions. After an 8-week preoperative HEP, positive changes in the bioelectrical activity of thigh muscles during the FTSST were noted in knee OA women. Preoperative home exercises reduce co-activation of thigh muscles and decrease activation asymmetry between limbs in concentric and eccentric phases of FTSST. Exercise performance including resistance exercises is recommended for knee OA patients.

References

Alnahdi, A. H., Zeni, J. A., & Snyder-Mackler, L. (2012). Muscle impairments in patients with knee osteoarthritis. *Sports Health, 4*(4), 284–292. https://doi.org/10.1177/1941738112445726

Bohannon, R. W. (2015). Daily sit-to-stands performed by adults: A systematic review. *The Journal of Physical Therapy Science, 27*(3), 939–942. doi:10.1589/jpts.27.939. PMID: 25931764

Mets, M., Tootsi, P., Sokk, J., Ereline, J., Haviko, T., Pääsuke, M., & Gapeyeva, H. (2022). Thigh muscle activation after a home exercise program in knee osteoarthritis patients. *Physical & Occupational Therapy in Geriatrics*. doi:10.1080/02703181.2022.2036295

Keywords: knee osteoarthritis, home exercise program, electromyography, five times Sit-to-Stand test.

REVIEW OF RESEARCH ON BEETROOT JUICE USE PROTOCOLS TO INCREASE ATHLETIC PERFORMANCE

Jekaterina Neteca[1], Inga Liepina[1], Una Veseta[2], Maija Dzintare[1]

[1]Latvian Academy of Sport Education; [2]Riga Stradins University, Latvia

Background. In the past 20 years, nitric oxide has become a milestone in terms of both athlete physiology and medicine, pharmacology studies. Furthermore, the consumption of beetroot juice, which is rich in nitrates that are converted into nitric oxide in human body, also has an impact on oxygen delivery to skeletal muscles, muscle efficiency, increases oxygen and nutrient delivery to various organs and may thus have a positive impact on sports performances (Bailey et al., 2010). Various protocols are reviewed and the purpose of this review is to find the best protocol that athletes can use safely and practically.

Research methods. The literature sources used in this paper were obtained from PubMed, MEDLINE, SportDiscus data, ProQuest, ScienceDirect, Web of science, Scopus and Cochrane central using keywords: beetroot juice, nitrate, nitric oxide, endurance, protocols. The research analysis provides a summarizing overview regarding the evidence of beetroot juice used as a dietary supplementation and its effects on training physiology and athletic performance.

Results and discussion. Although most of the studies showed no significant differences in the performance of the endurance-trained athletes after nitrate supplementation, some studies indicated that with the same maximum and mean power, the VO_2 values decrease after nitrate supplementation (Dominguez et al., 2017). Furthermore, the time to exhaustion was delayed with nitrate supplementation in a race time trial between 5 and 30 min (Campos et al., 2018). The results suggest enhanced performance (Jones, 2014). The dose necessary for a significant effect remains unclear since some results used acute doses of 12 mmol of nitrate and others applied smaller doses (up to 6 mmol/day of nitrate), and the best period for ingestion is 2–3 h before competing.

Conclusions. The variety of results makes it difficult to draw clear conclusions about nitrate supplementation among endurance sports performance athletes. Given the plethora of studies connecting vascular NO bioavailability with markers of vascular health such as blood pressure and endothelial function, further exploration of this topic is clearly warranted, to clarify the mechanisms underpinning intra and inter compartmental nitrogen-oxide chemistry and resultant physiological outcomes, such as cardiovascular health and exercise in larger more heterogeneous groups of subjects.

References

Bailey, S. J., Fulford, J., Vanhatalo, A., Winyard, P. G., Blackwell, J. R., DiMenna, F. J., Wilkerson, D. P., Benjamin, N., & Jones, A. M. (2010). Dietary nitrate supplementation enhances muscle contractile efficiency during knee-extensor exercise in humans. *The American Physiological Society, 109*(1), 135–148. doi:10.1152/japplphysiol.00046.2010

Campos, H. O., Drummond, L. R., Rodrigues, Q. T., Machado, F. S. M., Pires, W., Wanner, S. P., & Coimbra, C. C. (2018). Nitrate supplementation improves physical performance specifically in non-athletes during prolonged open-ended tests: A systematic review and meta-analysis. *The British Journal of Nutrition, 119,* 636–657. doi:10.1017/S0007114518000132

Dominguez, R., Cuenca, E., Mate-Munoz, J. L., García-Fernandez, P., Serra-Paya, N., Estevan, M. C. L., Herreros, P. V., & Garnacho-Castano, M. V. (2017). Effects of beetroot juice supplementation on cardiorespiratory endurance in athletes. A systematic review. *Nutrients, 9*(1), 43. https://doi.org/10.3390/nu9010043

Jones, A. M. (2014). Dietary nitrate supplementation and exercise performance. *Sports Medicine, 44*(1), 35–45. doi:10.1007/s40279-014-0149-y

Keywords: beetroot juice, nitrate, nitric oxide, endurance, protocols.

THE EFFECT OF PHYSIOTHERAPY ON NECK PAIN IN SEDENTARY WORKERS

Erika Pavalkytė, Saulė Sipavičienė
Lithuanian Sports University, Lithuania

Background. Neck pain is a highly prevalent musculoskeletal disorder that can affect physical, social and psychological aspects of the individual, increasing public health costs (Genebra, Maciel, Bento, Simeao, & Vitta, 2017). Neck pain is very common among office workers. Approximately 43% to 69% of office workers experience neck pain per year. Altered functional status impairs the quality of work and life, which becomes a social and economic burden for both patients and society (Sihawong, Janwantanakul, Sitthipornvorakul, & Pensri, 2011).

Research methods. Aim of the study: to determine of effect of different physiotherapy programs on neck pain. Methods: 26 subjects (18 to 60 years old) with chronic non-specific neck pain participated in the study. In group I, were 7 women and 5 men. In group II, were 9 women and 5 men. Measurements were performed before and after 6 weeks of physiotherapy. The pain was assessed using a numerical rating scale and neck movement amplitudes were measured using an inclinometer. Group I received physiotherapy in the studio for 30 minutes 3 times a week. The second group of subjects were learnt in exercise and self massage and continued the study independently, at work and at home. Group II received exercises for 10 minutes 3 times a day, 5 days per week. In the evening, after work, self-massage with a spiky ball for 5 minutes, 5 times per week.

Results and discussion. Results. In group I neck flexion improved 13.4% and the results were statistically significant ($p < 0.001$). In group II, neck flexion improved by 1.9% and the results were not statistically significant ($p = 0.066$). The results in the neck flexion monitoring of different physiotherapy techniques applied were statistically significant between the groups ($p = 0.029$). After the intervention neck extension improved by 4.1% in group I and reached statistically significant results ($p = 0.011$); in group II, neck extension improved by 2.6% with also statistically significant results ($p = 0.008$). Pain at 6 weeks was reduced by 35.6% in group I and was statistically significant ($p < 0.001$); in group II, pain was reduced by 15% and also reached statistical significance ($p < 0.033$). After the experiment, the results were statistically significant between groups ($p = 0.038$).

Conclusions. After 6 weeks of training, the neck pain was reduced and the range of motion improved after both exercising in the physiotherapy studio and exercising independently. However, the effect was more significant with performing exercises in the physiotherapy studio, because the percentage amplitudes of the movements increased more in the first than in the second group.

References

Genebra, C. V., Maciel, N. M., Bento, T. P., Simeao, S. F., & Vitta, A. D. (2017). Prevalence and factors associated with neck pain: A population-based study. *Brazilian Journal of Physical Therapy, 21*(4), 274–280. doi:10.1016/j.bjpt.2017.05.005

Sihawong, R., Janwantanakul, P., Sitthipornvorakul, E., & Pensri, P. (2011). Exercise therapy for office workers with nonspecific neck pain: A systematic review. *Journal of Manipulative and Physiological Therapeutics, 34,* 62–71. doi:10.1016/j.jmpt.2010.11.005

Keywords: physiotherapy, neck pain, sedentary work.

EVALUATION OF STATIC AND DYNAMIC BALANCE PERFORMANCE IN TEAM SPORTS ATHLETES

Inese Pontaga, Svens Vilks

Latvian Academy of Sports Education, Latvia

Background. The results of many investigations (Pau et al., 2015; Sell, 2012) confirm that static and dynamic balance are different athletes' characteristics and there is not any correlation between these balance conditions. Dynamic balance depends more on neuromuscular training, certain patterns of movements, it is affected by training experience in sports with training programs involved regularly repetition of lower body dynamic training exercises (Filipa, Byrnes, Paterno, Myer, & Hewett, 2010; Goncalves et al., 2020; Chaabene at al., 2021). The aim of our study is to compare static and dynamic balance characteristics and determine correlations between them in male and female team sports players and controls.

Research methods. Basketball, handball, volleyball, beach volleyball, and football players (30 males – M, 25 females – F) who play in the first or second league teams, and controls (17 M, 25 F) participate. Their age is 19–24 years. All team athletes train from three to five times per week (six to twelve hours per week) and participate regularly in competitions, the training experience ranges from five to sixteen years; the controls are healthy, physically active people who do not participate in sports training. The stork stand static balance test (SSBT) is used to measure static balance. The dynamic balance of each athlete is measured using the Y-lower body dynamic balance test (Y-LBDBT).

Results and discussion. The SSBT results do not differ in the team sports players (50–53 s in M; 32–36 s in F) and the control groups (50–51 s in M; 34 s in F) of the same gender but have overall higher values in males. The normalized leg's reach distances and sum of the Y-LBDBT are significantly greater (from 98% to 101%), but side-asymmetry of them lower (≤ 2%) in the team sports players groups of both genders than in the controls (the reach distances vary from 84% to 87%, side-asymmetry ≤ 5%). Our results are in good agreement with the data of Filipa et al. (2010), Goncalves et al. (2020), Chaabene et al. (2021) that dynamic balance depends more on regular execution of plyometric exercises, these exercises lead to similar dynamic stability in the right and left leg, and dynamic balance does not depend on the gender of athletes. The correlation between static and dynamic stability was not significant in all groups ($r \leq 0.051$; $p \geq 0.278$) which confirms that they are independent each from other (Pau et al., 2015; Sell, 2012).

Conclusions. Dynamic stability determined by the Y-LBDBT is significantly better with smaller normalized reach distances' side-asymmetry and the same in male and female team sports players than in the control group, but static balance which is not specific for team sports athletes does not differ in both groups of participants.

References

Chaabene, H., Negra, Y., Sammoud, S., Moran, J., Ramirez-Campillo, R., Granacher, U., & Olaf Prieske, O. (2021). The effects of combined balance and complex training versus complex training only on measures of physical fitness in young female handball players. *International Journal of Sports Physiology and Performance, 16*(10), 1439–1446. doi:10.1123/ijspp.2020-0765

Filipa, A., Byrnes, R., Paterno, M. V., Myer, G. D., & Hewett, T. E. (2010). Neuromuscular training improves performance on the star excursion balance test in young female athletes. *Journal of Orthopaedic and Sports Physical Therapy, 40*(9), 551–558. doi:10.2519/jospt.2010.3325

Goncalves, C., Bezerra, P., Clemente, F. M., Vila-Cha, C., Leao, C., Brandao, A., & Cancela, J. M. (2020). Effect of instability and bodyweight neuromuscular training on dynamic balance control in active young adults. *International Journal of Environmental Research and Public Health, 17*(23), article 8879, 10 p. doi:10.3390/ijerph17238879

Pau, M., Arippa, F., Leban, B., Corona, F., Ibba, G., Todde, F., & Scorcu, M. (2015). Relationship between static and dynamic balance abilities in Italian professional and youth league soccer players. *Physical Therapy in Sport, 16*(3), 236–241. doi:10.1016/j.ptsp.2014.12.003

Sell, T. C. (2012). An examination, correlation, and comparison of static and dynamic measures of postural stability in healthy, physically active adults. *Physical Therapy in Sport, 13*(2), 80–86. doi:10.1016/j.ptsp.2011.06.006

Keywords: stork stand balance test, Y-lower body balance test, team sports, task-specific balance training.

ONLINE AEROBIC ADAPTED PHYSICAL ACTIVITIES FOR IMPROVING FUNCTIONING AND QUALITY OF LIFE IN PERSONS WITH CHRONIC STROKE

Elza Sebre, Aija Klavina

Latvian Academy of Sport Education, Latvia

Background. People with chronic stroke follow a sedentary lifestyle (Billinger et al., 2014; Taricco et al., 2014). Inactivity adversely affects cardiovascular health and may increase the risk of recurrent stroke (Belfiore, Miele, Gallè, & Liguori, 2018; Pang, Charlesworth, Lau, & Chung, 2013). Covid-19 pandemic highlights the importance of online physical activity programs (Kwok, 2020). The aim of the study was to evaluate the impact of online aerobic adapted physical activity program (OA-APA) on the physical health and quality of life parameters of persons with chronic stroke. Additional aim was to compare heart rate with and without specialist supervision.

Research methods. This multiple case study enrolled 3 women (51–71 years old) with chronic stroke in OA-APA. The program was conducted 4 months, 3 times per week and was divided in phases (A/B). Phase A: participants did exercise program online with a specialist for 2 weeks. Phase B: next 2 weeks they did the program independently according to the video material and recommendations. Heart rate was monitored with Polar heart belt in every session and later analyzed (Min HR, Avg HR, Max HR). Main outcome measures were: 6MWT, Berg Balance Scale, SF-36, IPAQ.

Results and discussion. The OA-APA program consisted of exercises to improve mobility, balance, upper and lower limb functions (walking, sit ups, weight shift, half squats etc.). Recommended exercise intensity was 55–80% of Max HR (87–138 BPM). All participants maintained the recommended exercise intensity in Phase A and B (average HR range between 55–140 BPM). In the initial assessment before OA-APA program all participants had low mobility (6MWT 100–200 m), slight balance problems (BBS 48–49 points), 2 participants had problems of activities of daily living (Modified Barthel Index 14–20 points), moderate to high physical activity level (IPAQ 1143–3438 MET-min/week) and SF-36 showed lowest quality of life scores in domains like pain, role limitations due to emotional problems, role limitations due to physical health and physical functioning. Re- evaluation results will be held and analyzed in April.

Conclusions. Results presented that OA-APA exercise program is easy to perform and applicable for persons with chronic stroke. Participants, both exercising online under the supervision of a specialist and exercising independently, followed the recommended exercise intensity successfully and safely. In general, during the A and B phases, stable and predictable average heart rate results were observed.

References

Belfiore, P., Miele, A., Gallè, F., & Liguori, G. (2018). Adapted physical activity and stroke: A systematic review. *The Journal of Sports Medicine and Physical Fitness, 58*(12), 1867–1875. https://doi.org/10.23736/S0022-4707.17.07749-0

Billinger, S. A., Arena, R., Bernhardt, J., Eng, J. J., Franklin, B. A., Johnson, C. M., MacKay-Lyons, M., Macko, R. F., Mead, G. E., Roth, E. J., Shaughnessy, M., Tang, A., American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Lifestyle and Cardiometabolic Health, Council on Epidemiology and Prevention, & Council on Clinical Cardiology (2014). Physical activity and exercise recommendations for stroke survivors: A statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke, 45*(8), 2532–2553. https://doi.org/10.1161/STR.0000000000000022

Kwok, Ng. (2020). Adapted physical activity through COVID-19. *European Journal of Adapted Physical Activity,* 13(1), 1. doi:10.5507/euj.2020.003.

Pang, M. Y., Charlesworth, S. A., Lau, R. W., & Chung, R. C. (2013). Using aerobic exercise to improve health outcomes and quality of life in stroke: Evidence-based exercise prescription recommendations. *Cerebrovascular Diseases (Basel, Switzerland), 35*(1), 7–22. https://doi.org/10.1159/000346075

Taricco, M., Dallolio, L., Calugi, S., Rucci, P., Fugazzaro, S., Stuart, M., Pillastrini, P., Fantini, M. P., & Esercizio Fisico di Gruppo/2009 Investigators (2014). Impact of adapted physical activity and therapeutic patient education on functioning and quality of life in patients with postacute strokes. *Neurorehabilitation and Neural Repair, 28*(8), 719–728. https://doi.org/10.1177/1545968314523837

Keywords: stroke, adapted physical activities, telerehabilitation, aerobic exercise, mobility.

THE BENEFICIAL EFFECT OF 12 WEEKS OF RESISTANCE TRAINING ON MUSCULAR STRENGTH AND ASSOCIATED DEVELOPMENTS IN BRAIN NEURONAL INTEGRITY OF OLDER ADULTS

Samrat Sheoran[1], Wouter Arthur Johan Vints[1], Gintarė Katkutė[1], Kristina Valatkevičienė[2], Rymantė Gleiznienė[2], Vida Janina Česnaitienė[1], Oron Levin[1], Nerijus Masiulis[1]

[1]Lithuanian Sports University; [2]Hospital of Lithuanian University of Health Sciences Kaunas Clinics, Lithuania

Background. Aging is associated with numerous detrimental physiological changes which includes sarcopenia and loss of muscle strength (Keller & Engelhardt, 2013), as well as decline in brain structural and functional integrity (Yankner, Lu, & Loerch, 2008). Recent studies indicate use of resistance training (RT) as a form of exercise which has shown to concurrently improve muscle and brain function (Pinho, Aguiar, & Radák, 2019). So far, no studies have examined the direct effect of chronic RT on brain neuronal integrity. This study aimed to examine the effect of RT-induced neuroplasticity and examine if these changes are related to exercise dependent increase in muscle strength.

Research methods. 41 sedentary older adults (60–80 y) were enrolled in 12 weeks of lower limb based RT program (EXP: n = 20, CONT: n = 21). Muscular strength was assessed by measuring peak torque (PT) in knee extension and flexion (60 deg/s) using Biodex isokinetic dynamometer. Brain neuronal integrity was quantified by analyzing N-Acetylaspartate (NAA) concentration derived from Magnetic Resonance Spectroscopy (MRS) spectra. Post MRS spectra processing using LCModel software in two brain regions, namely the hippocampus (HPC) and sensorimotor cortex (SM1) was done to obtain NAA metabolite concentration (tNAA/tCr).

Results and discussion. Responders (pre-to-post change in PT knee extension and flexion > 3%) experienced a significant increase in PT extension (Bonferroni corrected $p < 0.001$) as well as flexion (Bonferroni corrected $p = 0.018$), while there were no changes observed in non-responders and CONT ($p > 0.05$). Moreover, responders exhibited a tendency of increased tNAA/tCr concentration in HPC ($p = 0.044$), whereas in CONT group, a trend of decline in SM1 region tNAA/tCr ($p = 0.048$) was observed. Pre-to-post change $\Delta = [(POST - PRE/PRE)*100]$ revealed a significant positive correlation between ΔPT knee flexion and ΔtNAA/tCr concentration of SM1 region ($r = 0.735$, $p = 0.024$) and a tendency of positive association between ΔPT knee extension and ΔtNAA/tCr concentration in SM1 ($r = 0.602$, $p = 0.086$). No associations were found in ΔPT knee extension or flexion with ΔtNAA/tCr concentration in HPC ($p > 0.05$).

Conclusions. Resistance training significantly improves muscular strength in older adults, and is directly associated with mediating an increase in brain integrity specifically in sensorimotor cortex. The beneficial effects of RT appears to be not only localized to muscular improvements but also related to concurrent fostering of neuroplasticity in brain regions.

References

Keller, K., & Engelhardt, M. (2013). Strength and muscle mass loss with aging process. Age and strength loss. *Muscles, Ligaments and Tendons Journal, 3*(4), 346.

Pinho, R. A., Aguiar, A. S., & Radák, Z. (2019). Effects of resistance exercise on cerebral redox regulation and cognition: An interplay between muscle and brain. *Antioxidants, 8*(11), 529.

Yankner, B. A., Lu, T., & Loerch, P. (2008). The aging brain. *Annual Review of Pathology: Mechanisms of Disease, 3*, 41–66.

Keywords: aging, muscle-brain crosstalk, neuroplasticity.

TWO WEEKS PHYSICAL ACTIVITY RESTRICTION EFFECTS ON HEALTH-RELATED FACTORS

Mangirdas Šermukšnis, Aivaras Ratkevičius, Anelė Gedmantaitė
Lithuanian Sports University, Lithuania

Background. Physical fitness is an integral part of health. Decreased physical activity can adversely affect a person's physical ability to work and be healthy. Reducing the number of steps to 2,000 steps per day can: reduce insulin sensitivity, increase anabolic sensitivity, and reduce strength (Devries et al., 2015). Also, a decrease in the number of steps has an impact on the development of chronic diseases (Neufer et al., 2015), a decrease in skeletal muscle mass, and an increase in adipose tissue (Breen et al., 2013). The aim of this study is to determine the effect of a two-week reduction in the number of steps on muscle strength and endurance.

Research methods. Subjects were divided into two groups: the control group and the study group. The subjects were young non-athletic boys and girls. Initially, the subjects were acquainted with the course of the study and filled in questionnaires. The body composition of the subjects was then checked with the help of "Tanita" scales. The subjects then performed an aerobic capacity test, during which the pulse was monitored with a "Sigma Pc 3.11" heart rate monitor at a load of 1.5 W/kg for 3 minutes and then a 2 W/kg for 3 minutes load on the "Monark894E" ergometer without interruption. The third test was a power test on a contact platform, during which 3 maximum vertical jumps were performed with a hand bridge, in case the last jump is best, additional jumps are performed until the highest score is reached. A fourth test was then performed, in which four maximal series of extensions/flexions in the isometric muscle contraction mode were performed with the help of isokinetic dynamometer "Biodex3" with a rest interval of 1 minute between each movement. The last test was the Wingate test for anaerobic endurance on a "Monark894E" bike with a maximum sprint of 30 seconds with 7.5% of the test body weight. After all tests, smart bracelets were issued to subjects to track the number of steps, the average number of steps in the study was to be 2000 steps or less, and the control group continued to maintain its normal physical activity.

After two weeks, all tests were repeated in both groups.

Results and discussion. After two weeks of step-restriction intervention, all of the test group indicators deteriorated. Knee extensor muscle strength decreased by 5%, knee joint muscle strength decreased by 8%, jump height decreased by 6%, and aerobic capacity test with resistance of 1.5 W/kg. results increased an average by 13 beats per minute, and with a resistance of 2 W/kg load results increased by an average of 20 beats per minute. The control groups results showed no significant changes. So, it could be argued that the steps limitation to 2000 steps per day for a period of 14 days adversely affects knee extensors isometric strength, power indicators, and aerobic capacity indicators.

Conclusions. Two-week step reduction intervention caused: an increase in heart rate at submaximal intensity of (2 W/kg). A tendency for a decline in peak cycling power, a tendency of increased heart rate at submaximal intensity of (1.5 W/kg) and a decrease of strength in knee extensors also was present. However, intervention did not affect: body composition. 8201 steps per day was enough to maintain: body composition muscle strength aerobic fitness.

References

Breen, L., Stokes, K. A., Churchward-Venne, T. A., Moore, D. R., Baker, S. K., Smith, K., ... & Phillips, S. M. (2013). Two weeks of reduced activity decreases leg lean mass and induces "anabolic resistance" of myofibrillar protein synthesis in healthy elderly. *The Journal of Clinical Endocrinology & Metabolism, 98*(6), 2604–2612.

Devries, M. C., Breen, L., Von Allmen, M., MacDonald, M. J., Moore, D. R., Offord, E. A., & Phillips, S. M. (2015). Low-load resistance training during step-reduction attenuates declines in muscle mass and strength and enhances anabolic sensitivity in older men. *Physiological Reports, 3*(8), e12493

Neufer, P. D., Bamman, M. M., Muoio, D. M., Bouchard, C., Cooper, D. M., Goodpaster, B. H., ... & Laughlin, M. R. (2015). Understanding the cellular and molecular mechanisms of physical activity-induced health benefits. *Cell Metabolism, 22*(1), 4–11.

Keywords: physical inactivity, step count, strength, endurance.

THE EFFECT OF COGNITIVE FATIGUE ON MOTOR WORKING CAPACITY IN YOUNG AND ELDERLY SUBJECTS

Asta Terentjevienė[1], Dalia Mickevičienė[1], Diana Karanauskienė[1], Dovilė Valančienė[1], Rima Solianik[1], Albertas Skurvydas[1, 2, 3]

[1]Lithuania Sports University; [2]Vilnius University; [3]Vytautas Magnus University, Lithuania

Background. Older adults activate more executive, cognitive, and association brain regions than young to perform various tasks (Klaassen et al., 2014; Park & Reuter-Lorenz, 2009). While performing cognitive tasks, components such as working memory, response inhibition, error monitoring, etc. are actively involved and measured with the "Go/NoGo" task (Junichi, 2010). Knowing that the components of cognitive function deteriorate with age (Zaninotto, Batty, Allerhand, & Deary, 2018), we hypothesize that elderly men will be more exhausted and make more mistakes in a "Go/NoGo" task lasting 2 hr than younger men.

Research methods. Eight elderly (age: 72.7 ± 5.7, height: 176.3 ± 4.8 cm, BMI: 25.1 ± 3.1 kg/m^2) and 11 young (age: 22.2 ± 2.7, height: 180.1 ± 6.3 cm, BMI: 23.5 ± 2.5 kg/m^2) males took part in this study. Cognitive function (using ANAM-4) and motor (hand-grip strength) performance, motivation and subjective feeling of task, transcranial magnetic stimulation (TMS) response, prefrontal cortex activity with Functional near-infrared spectroscopy (fNIRS) was measured before and after "Go/NoGo" task lasting 2 hr. During 2 hr task, it was required to respond to a go stimulus as quickly as possible, but to withhold a response to a no-go stimulus. During the Go/NoGo task accuracy and mean response time was measured.

Results and discussion. The result showed that during the prolonged cognitive load (PCL), both groups had a significantly similar increase in the number of "Incorrect NoGo" errors. Only in young men reaction time (RT) of "Incorrect NoGo" as well as intraindividual variability of RT "Incorrect NoGo" significantly increased during PCL. After PCL, handgrip strength decreased for the young men, and latency of TMS significantly increased for both group. PCL significantly decreased the switching/rest ratio of oxygenated haemoglobin (was assessed with fNIRS) for the young and the elderly men, however significantly greater for elderly than young men. The more the prefrontal cortex was activated before exercise during the switching task, the fewer the number of "Incorrect NoGo" errors made by the young men and the greater the number of errors made by the elderly men.

Conclusions. Due to greater mental load and (possibly) greater recruitment (mobilization) of prefrontal cortex during 2 hr "Go/NoGo" task there was greater mental and neuromuscular fatigue in young compared to elderly men. We speculate that young men became more exhausted because of their better ability to activate the prefrontal cortex during 2 hr "Go/NoGo" task.

References

Junichi, C. (2010). Localizing performance of go/no-go tasks to prefrontal cortical subregions. *Current Opinion in Psychiatry, 23*(3), 267–272. doi:10.1097/YCO.0b013e3283387a9f

Klaassen, E. B., Evers, E. A., de Groot, R. H., Backes, W. H., Veltman, D. J., & Jolles, J. (2014). Working memory in middle-aged males: age-related brain activation changes and cognitive fatigue effects. *Biological Psychology, 96,* 134–143. doi:10.1016/j.biopsycho.2013.11.008

Park, D. C., & Reuter-Lorenz, P. (2009). The adaptive brain: aging and neurocognitive scaffolding. *Annual Review Psychology, 60,* 173–196. doi:10.1146/annurev.psych.59.103006.093656

Zaninotto, P., Batty, G. D., Allerhand, M., & Deary, I. J. (2018). Cognitive function trajectories and their determinants in older people: 8 years of follow-up in the English Longitudinal Study of Ageing. *Journal of Epidemiology and Community Health, 72*(8), 685–694.

Keywords: aging, mental and motor fatigue, executive function.

THE EFFECT OF DIFFERENT PHYSIOTHERAPY PROGRAMS ON THE BALANCE AND STRENGTH OF THE LOWER EXTREMITIES IN THE ELDERLY

Lukas Uogintas, Saulė Sipavičienė
Lithuanian Sports University, Lithuania

Background. World health organization claims that falls are the second most common cause of accidental death in the world. Typical factors such as weakened lower extremities, experience of collapse, gait/balance disorders and visual field disturbances, and external factors (Park, Ryu, Kwon, & Lee, 2019). Studies have shown that lower limb exercises with a Swiss ball can be effective in improving muscle strength, balance, gait, and reducing post-collapse injury in patients (Lim & Kang, 2021).

Research methods. There where 12 subjects aged 65 to 75 years. Subjects were divided into two groups: the Swedish wall group (n = 6) and the physiotherapy ball group (n = 6). Subjects underwent physiotherapy exercises for 30 min per day, 5 days a week for 3 months. Subjects were subjected to leg strength and balance tests: sit-stand, stand-up-and-go, Romberg and Berg balance scale.

Results and discussion. When evaluating patients speed of the task of completing in stand up and go test, the speed of the test was gradually decreasing between the two groups of patients. Romberg's test scores showed that one after the start of testing (2.1 ± 0.7 points and 2.0 ± 0.9 points, after one month) and two (2.3 ± 0.8 points and 2.6 ± 0.5 points) and three months (3.0 ± 1.1 point and 2.8 ± 0.8 points), higher scores of the above test were obtained by study participants who performed exercises with a physiotherapy ball. The time spent completing the Berg's variable step task decreased consistently and significantly among subjects who performed exercises at both the Swedish wall ($p = 0.03$) and those who exercised with a physiotherapy ball ($p = 0.03$) with increasing time from the start of the study. The results of the data analysis showed that one month after the start of the study, the sit-to-stand speed (2.3 ± 1.0 s) was higher in the subjects who exercised on the Swedish wall compared to the subjects who performed exercises on the physiotherapy ball (2.0 ± 0.8 s), but 2 months (1.5 ± 0.3 s and 2.0 ± 0.9 s, respectively) and 3 months (1.3 ± 0.3 s and 1.6 ± 0.5 s, respectively) from the study individuals who performed exercises on a physiotherapy ball had a better sit-to-stand at baseline; 4 months after the start of the study, the sit-to-stand performance rates of both subjects were relatively similar to 1.2 ± 0.1 s and 1.2 ± 0.3 s).

Conclusions. After application of physiotherapy with Swedish wall and physiotherapy ball both showed improvement in the elderly muscle leg strength and balance.

References

Lim, Y. J., & Kang, S. H. (2021). Effect of various lower extremity exercises using the swiss ball while standing on balance, muscle strength, gait and fall efficacy in stroke patients: A pilot study. *The Journal of Korean Physical Therapy, 33*(4), 202–209.

Park, B. M., Ryu, H. S., Kwon, K. E., & Lee, C. Y. (2019). Development and effect of a fall prevention program based on the King's Goal Attainment Theory for fall high-risk elderly patients in long-term care hospital. *Journal of Korean Academy of Nursing, 49*(2), 203–214.

Keywords: fall, balance, elderly, physiotherapy, leg strength.

THE INFLUENCE OF DIFFERENT PHYSIOTHERAPY METHODS ON CORE MUSCLE STATIC ENDURANCE, ELECTRICAL ACTIVITY AND SPINAL MOBILITY

Simonas Usevičius, Vilma Juodžbalienė
Lithuanian Sports University, Lithuania

Background. Core stability is a very widely analyzed topic. For the past twenty years, professional sports have focused a lot on core muscle stabilization exercises. Most of the researches have focused mainly on injury prevention and on improving athletic training (Wirth et al., 2017). The benefits of various torso stability-enhancing exercise programs in injury prevention, rehabilitation, and sports are already proven (Abdelraouf & Abdel-aziem, 2016; Cabanas-Valdés et al., 2016). In our research we chose healthy individuals to avoid the development of lower back pain during exercises that would interfere with the dosing of the intended intervention and it would be more difficult to determine the true effect on core muscle static endurance, electrical activity, and spinal mobility. Some authors suggest using unstable surfaces to improve torso stability due to maximal torso-stabilizing muscle activity according to the EMG study (Calatayud et al., 2015), however, perhaps the McGill methodology and it's "big three exercises" which is considered to be one of the least stressing approach on the lower back (McGill, 2015) and allows all exercises to be performed without any additional equipment is more effective in improving the static endurance of the core stabilizing muscles?

Research aim. To determine different physiotherapy methods on core stabilizing muscle static endurance, electrical activity of core muscles and spinal mobility.

Research methods. Our research included 20 healthy adults without back pain which were divided into two groups. First (McGill) group (n = 10) consisted of 6 males and 4 females that are 33.5 ± 6.94 years old. Second (unstable surface) group (n = 10) consisted of 6 males and 4 males that are 29 ± 6.99 years old. Before the research subjects were asked to fill a form which consisted of questions about gender, age, recent or current existence of lower back pain. Two assessments overall were made (before intervention and after 8 weeks). Trunk flexor endurance test, trunk extensor endurance test, trunk lateral endurance test were used to determine trunk static muscle endurance. Surface EMG of rectus abdominis, external oblique, transversus abdominis and quadratus lumborum was used to determine electromyographic activity of these muscles during an 8 seconds isometric contraction of static curl-up (hands behind the head), side plank and plank. Modified Schober test was used to determine the range of motion of the lumbar spine. McGill group had to do an 8 week program consisting of the "McGill stabilization exercises". The program consisted of one warm up exercise called "bracing of the abdominals" and four main exercises consisting of the "cat-camel" "curl up", "bird-dog" and "side plank". The unstable surface group had to do an 8 week program consisting of core stabilizing muscle exercises with unstable surfaces. The program consisted of one warm up exercise called "dead-bug" and four main exercises with or without unstable component. Both groups had to perform exercises 3 times a week, 30–60 mins per session. In each group the intensity and duration of the exercises were assessed individually each session and after 3 weeks and 6 weeks the harder version of exercises were introduced in program.

Results and discussion. The change in left side lateral trunk endurance test score did not differ significantly between the two groups ($p = 0.853$). In the McGill group, the result improved on average by 10 ± 11.3 s, and in the unstable surface group by 6.2 ± 9.55 s. The result of the trunk extensor endurance test showed that unstable surface group improved statistically significantly more (19.1 ± 12.11 s) than the result of the McGill group (5.7 ± 9.88 s) ($p = 0.029$). The change in static endurance of other muscle groups (right side lateral trunk endurance test and trunk flexor endurance test) did not differ between the groups. The mean change in Schober extension test results was 0.09 ± 0.17 cm in McGill group and -0.08 ± 0.1 cm in group of unstable surfaces ($p = 0.029$). The change in flexion did not differ between groups ($p = 0.739$). Comparing the maximum voluntary electrical muscle contraction between the groups, the differences between the left external oblique muscle ($p = 0.007$) and the right side transversus abdominis muscle ($p = 0.023$) and left side transversus abdominis muscle activity ($p = 0.019$) were found. Significantly higher activity was observed in unstable surface group. The maximum voluntary electrical contraction of the other muscles did not differ between the groups.

After the study, the difference in electrical muscle activity during static curl-up between the groups was found only in the right quadratus lumborum muscle ($p = 0.023$) The activity of the quadratus lumborum in McGill group was (mean ± SD, 9.2 ± 5.51% MVC), and (mean ± SD, 15.8 ± 8.39% MVC) in unstable surface group. No statistically significant difference between the groups was observed in terms of electrical muscle activity during right plank exercise. According to the results of electrical muscle activity during left side plank exercise the two groups did not differ statistically significantly. According to the results of electrical muscle activity during plank exercise the two groups did not differ statistically significantly. There were statistically significant correlations between static muscle endurance and flexibility after the study. The following statistically significant relationships were obtained: moderate positive correlation between abdominal and right trunk muscle endurance ($p = 0.007$, $r = 0.587$), between abdominal and back muscle endurance ($p = 0.044$, $r = 0.455$), between abdominal muscle endurance and Schober extension test ($p = 0.016$, $r = 0.532$), between back muscle endurance and Schober extension test ($p = 0.048$, $r = 0.448$), between Schober extension and flexion test ($p = 0.023$, $r = 0.505$), and a strong positive correlation between trunk flexor endurance and left lateral trunk endurance ($p = 0.004$, $r = 0.62$). The unstable surface program significantly improved healthy individuals static endurance of the abdominal, right side trunk, and back muscles, increased left external oblique abdominal muscle activity during static curl-up exercise, right external oblique activity during right-side plank exercise, and decreased mobility of Schober

extension test. McGill method significantly improved healthy individuals static endurance of abdominal, right and left side trunk muscles, increased left transversus abdominis muscle activity during static curl-up exercise, decreased muscle activity of left transversus abdominis during left side plank and left external oblique during plank, but didn't have an effect on spine mobility. In terms of clinical value it is worth mentioning that there was a clinically relevant decrease in left external oblique activity during plank exercise in McGill group ($r = 0.57$), thus, suggesting that McGill exercises might not be recommended in sports or rehabilitation programs if the main goal is to train/activate external oblique muscle. To prove this hypothesis, more trials with greater sample is needed in the future.

Conclusions. The unstable surface program improved static endurance and electrical activity of healthy people core muscles and decreased spinal extension range of motion more comparing to McGill group.

References

Abdelraouf, O. A., & Abdel-aziem, A. A. (2016). The relationship between core endurance and back dysfunction in collegiate male athletes with and without nonspecific low back pain. *International Journal of Sports Physical Therapy, 11*(3), 337–344.

Cabanas-Valdés, R., Bagur-Calafat, C., Girabent-Farrés, M., Caballero-Gómez, F. M., Hernández-Valiño, M., & Urrútia Cuchí, G. (2016). The effect of additional core stability exercises on improving dynamic sitting balance and trunk control for subacute stroke patients: A randomized controlled trial. *Clinical Rehabilitation, 30*(10), 1024–1033. doi:10.1177/0269215515609414

Calatayud, J., Borreani, S., Martin, J., Martin, F., Flandez, J., & Colado, J. (2015). Core muscle activity in a series of balance exercises with different stability conditions. *Gait & Posture, 42*(2), 186–192. doi:10.1016/j.gaitpost.2015.05.008

McGill, S. (2015). *Low back disorders: Evidence-based prevention and rehabilitation*. Canada: Human Kinetics.

Wirth, K., Hartmann, H., Mickel, C., Szilvas, E., Keiner, M., & Sander, A. (2017). Core stability in athletes: A critical analysis of current guidelines. *Sports Medicine, 47*(3), 401–414. doi:10.1007/s40279-016-0597-7

EFFECTIVENESS OF AEROBIC EXERCISE FOR PHYSICAL AND MENTAL HEALTH IN INDIVIDUALS WITH SCHIZOPHRENIA

Ramunė Vansevičiūtė, Arvydas Stasiulis
Lithuanian Sports University, Lithuania

Background. Schizophrenia is a mental disorder characterized by many psychiatric symptoms such as hallucinations, delusions, disorganized speech, anxiety, depression (Girdler, Confino, & Woesner, 2019). People with schizophrenia have a higher degree of obesity and greater difficulty in psychopathology (Luckhoff et al., 2019). In addition to the pharmacological treatment of schizophrenia, exercise therapy has been proposed as an additional therapy (Girdler et al., 2019). Physical activity especially aerobic exercises help to lose weight, improve cardiovascular function, reduce mental health problems such as depression and anxiety (Firth et al., 2020). The aim is to evaluate the effectiveness of aerobic exercise for the physical and mental health of individuals with schizophrenia.

Research methods. The study included 18 participants aged 25 to 50 years with schizophrenia. Subjects were divided into two groups: an experimental group (n = 10) treated with aerobic exercise, and a control group (n = 8) which did not receive interventions. The experimental group received aerobic exercise for 8 weeks, 3 times a week, 40 minutes a day. All participants were measured for aerobic capacity before and after the study using the Astrand-Ryhming test, and mental health was assessed by measuring the extent of depression using the Patient Health Questionnaire PHQ-9.

Results and discussion. The results showed that the mean BMI index decreased statistically significantly ($p = 0.001$) in the study group during aerobic exercise. Although there were no statistically significant differences between groups ($p > 0.05$), positive variability was seen in the experimental group. Assessing aerobic capacity there were no statistically significant changes in both groups and between groups, but VO_2max value increased in experimental group after aerobic exercises. When evaluating the scores of the PHQ-9 questionnaire in the experimental group the incidence of depression statistically significantly decreased from "moderate" to "mild" depression ($p = 0.001$). In the control group was no statistically significant changes ($p > 0.05$). Comparing the experimental and control groups the incidence of depression differed statistically significantly between the groups ($p = 0.01$).

Conclusions. 1. In individuals with schizophrenia, aerobic capacity increased, although the differences were not statistically significant, but positive variability is seen. 2. The application of aerobic exercise to persons with schizophrenia significantly reduced the incidence of depression, improved mood, sleep quality, increased energy, and improved appetite.

References

Firth, J., Solmi, M., Wootton, E. R., Vancampfort, D., Schuch, B. F., Hoare, E., Gilbody, S., Torous, J., Teasdale, B. S., Jackson, E. S., Smith, L., Eaton, M., Jacka, N. F., Veronese, N., Marx, W., Ashdown-Franks, G., Siskind, D., Sarris, J., Rosenbaum, S., Carvalho, F. A., & Stubbs, B. (2020). A meta-review of "lifestyle psychiatry": The role of exercise, smoking, diet and sleep in the prevention and treatment of mental disorders. *World Psychiatry, 19*(3), 360–380.

Girdler, J. S., Confino, E. J., & Woesner, E. M. (2019). Exercise as a treatment for schizophrenia: A review. *Psychopharmacology Bulletin, 49*(1), 56–69.

Luckhoff, H. K., Kilian, S., Olivier, M. R., Phahladira, F., Scheffler, F., Plessis, S., Chiliza, B., Asmal, L., & Emsley, R. (2019). Relationship between changes in metabolic syndrome constituent components over 12 months of treatment and cognitive performance in first-episode schizophrenia. *Metabolic Brain Disease, 34*(2), 469–476.

Keywords: schizophrenia, physical health, mental health, aerobic capacity, depression.

AN IMPACT OF PHYSIOTHERAPY WITH INTERACTIVE GAMES ON PHYSICAL CONDITION OF TEENAGERS WITH MODERATE INTELLECTUAL DISABILITIES

Santa Vareikienė, Diana Rėklaitienė
Lithuanian Sports University, Lithuania

Background. People with moderate intellectual disabilities has lack of motivation. Their inactivity could also be related to low will, inability to make decisions and tasks accurately or control their behavior (Giedrienė, 2013). Furthermore, physical activity of teenagers with intellectual disabilities is significantly lower compared with their peers and this leads to other diseases (Ilinca, Rosulescu, Cosma, & Danoiu, 2019). It has been observed that motivation for activity and cognitive function significantly increases in physiotherapy when using video games (Suárez-Iglesias, Martínez-de-Quel, & Moldes, 2021). The use of other alternative innovative tools like interactive projection games is the way to improve the motivation for physiotherapy and physical condition of people with disabilities (Melville et al., 2015). The goal is to analyze the impact of physiotherapy with interactive games on physical condition of teenagers with moderate intellectual disabilities.

Research methods. In the research we had twenty 12–15 years old teenagers with moderate intellectual disabilities participating. Subjects were divided into two groups: usual physiotherapy, PT ($n = 10$, average age 14.80 ± 0.42 years old) and PT with interactive projection games IPG ($n = 10$, average age 15.00 ± 0.00 years old). Activities were organized for 6 weeks twice per week for all the subjects. All of the individuals before and after the rehabilitation has been evaluated with a Mini Mental-State Examination test, Pictorial motivation scale, physical activity pleasure scale (Health Assessment Survey), Berg balance scale and "Time up and go" test.

Results and discussion. In the group of interactive games, before the application of the program, the mean value of the Berg balance test was 54.10 ± 2.51 (50.00–56.00; 55.50) points, and after the program, the positive change was 54.70 ± 1.64 (52.00–56.00; 55.50) points. A statistically significant difference after the program ($U = 14{,}500$, $p = 0.005$) was found between the groups in adolescents with moderate intellectual disability for cognitive function. The test scores for the group of interactive games were 22.90 ± 2.88 (19.00–29.00; 23.50), while the test scores for usual physiotherapy were 19.00 ± 3.02 (15.00–26.00; 19.00). The mean value of the external motivation scale identified before the application of usual physiotherapy was 2.76 ± 0.25 (2.50–3.00; 2.86) points, after the application of the program it decreased to 1.93 ± 0.90 (1.00–3.00; 2.00) and this change was statistically significant ($Z = -2.132$; $p = 0.047$). In the usual physiotherapy group, the mean value of the motivation scale before the program was 1.28 ± 0.40 (1.00–2.25; 1.13) points, and after the program it increased to 2.06 ± 0.81 (1.00–3.00; 2.36) points. Meanwhile, in the group of interactive games, an improvement in motivation was observed. Before the application of the program, the average value of the motivation scale was 1.33 ± 0.62 (1.00–3.00; 1.00) points, and after the exposure program it was 1.05 ± 0.16 (1.00–1.5; 1.00) points.

Conclusions. Interactive projection games program for teenagers with moderate intellectual disabilities significant impact on cognitive functions and motivation in comparison to usual physiotherapy program.

References

Giedrienė, R. (2013). *Specifiniai mokymosi sutrikimai ir vaiko socializacija*. Vilnius: Edukologija.

Ilinca, I., Rosulescu, E., Cosma, G., & Danoiu, M. (2019). The influence of physiotherapy on functional fitness of adults with Down syndrome. *Discobolul – Physical Education, Sport and Kinetotherapy Journal*. doi:10.35189/iphm.icpesk.2019.16

Melville, A., Mitchell, F., Stalker, K., Matthews, L., Mcconnachie, A., Murray, M. et al. (2015). Effectiveness of a walking programme to support adults with intellectual disabilities to increase physical activity: walk well cluster-randomised controlled trial. *International Journal of Behavioral Nutrition and Physical Activity,* 1–11. http://dx.doi.org/10.1186/s12966-015- 0290-5

Suárez-Iglesias, D., Martínez-de-Quel, O., & Moldes, J. (2021). Effects of videogaming on the physical, mental health, and cognitive function of people with intellectual disability: A systematic review of randomized controlled trials. *Games Health,* 10.

Keywords: moderate intellectual disabilities, balance, cognitive functions, motivation, interactive games.

ALTERATIONS IN COGNITIVE ABILITIES ARE AGE-DEPENDENT RATHER THAN HEAT STRESS DURING SEVERE WHOLE-BODY HYPERTHERMIA IN HEALTHY YOUNG AND OLDER MEN

Junli Wang, Marius Brazaitis, Nerijus Eimantas
Lithuanian Sports University, Lithuania

Background. Physically, with ageing, loss of muscle mass decreases the firing rate and results in lower core body temperature, which attenuates temperature-based conduction velocity of nerves and neural excitability. In addition, age-related atrophy of frontal, parietal, and temporal regions reduced overall cognitive functioning. Therefore, the elderly is particularly vulnerable to the extreme hot ambient environment. Thus, we aim to test the hypothesis that cognitive abilities will decrease more in healthy older men than the young men with rectal temperature increment by 2.5 ℃.

Research methods. Eleven young (19–21 years) and nine older (61–80 years) healthy subjects participated in this study. They were immersed in waist-line hot water (HW, approximately 43 °C) until young men's rectal temperature (T_{re}) up to 39.5 °C and older men's T_{re} reached 39 °C, respectively. T_{re} was measured at rest and throughout immersion with the procedure using a thermocouple inserted to a depth of 12 cm past the anal sphincter. Skin temperature (T_{sk}) was measured with thermistors at three sites: shoulder, forearm, and thigh. Muscle temperature (T_{mu}) was measured with a needle microprobe inserted at a depth of ∼3.5 cm under the skin covering the lateral portion of the gastrocnemius in the right leg. All cognitive performances (short-term memory, visual recognition memory and executive function) were computer- controlled.

Results and discussion. In the forced-choice recognition memory test, no significant changes were found between older and young men in test duration betwixt resting and hyperthermia conditions ($p = 0.2$, $p = 0.21$ for older and young adults, respectively). The number of identified images increased a little bit ($p = 0.411 > 0.05$) in both age groups after whole-body hyperthermia ($p = 0.411 > 0.05$). However, fewer figures were recognized in the elderly than the young counterparts in the resting condition ($p = 0.00$, $p = 0.001$ for the older and young groups, respectively). On the forward digit-span task test, although no significant differences were detected in the mean number of digits identified successfully ($p = 0.451 > 0.05$) between older and young adults in resting and whole-body conditions, adversely, a longer complete time was needed for the test duration in older men at resting condition compared to the young men ($p < 0.05$). The average reaction time was shorter (692 ± 105 vs 601 ± 83 ms, for older and young men, respectively) during heat stress; nonetheless, no significant difference was obtained between the elderly and young age groups regarding accuracy before and after whole-body hyperthermia ($p = 0.24$, $p => 0.99$ for the resting and after whole-body hyperthermia condition, respectively). Physical exercise (Nagamatsu, Handy, Hsu, Voss, & Liu-Ambrose, 2012; Nguyen & Kruse, 2012) promotes positive neuroplasticity, increases cognitive reserve and higher neuronal connection density, and improves cognitive function. I discern the effects of factors such as fitness level, body composition, and chronic disease, thermal tolerance appears to be minimally compromised by age (Kenney & Munce, 2003).

Conclusions. In conclusion, there were age-related declines in cognitive performances in healthy ageing adults compared to the young counterparts in resting and during whole-body hyperthermia conditions; however, cognitive abilities were preserved in healthy ageing men under whole-body hyperthermia. Our findings may suggest cognitive abilities alterations are age-dependent rather than heat stress during severe whole-body hyperthermia.

References

Kenney, W. L., & Munce, T. A. (2003). Invited review: Ageing and human temperature regulation. *Journal of Applied Physiology (Bethesda, Md.: 1985), 95*(6), 2598–2603. https://doi.org/10.1152/japplphysiol.00202.2003

Nagamatsu, L. S., Handy, T. C., Hsu, C. L., Voss, M., & Liu-Ambrose, T. (2012). Resistance training promotes cognitive and functional brain plasticity in seniors with probable mild cognitive impairment. *Archives of Internal Medicine, 172*(8), 666–668. https://doi.org/10.1001/archinternmed.2012.379

Nguyen, M. H., & Kruse, A. (2012). A randomized controlled trial of Tai chi for balance, sleep quality and cognitive performance in elderly Vietnamese. *Clinical Interventions in Aging, 7,* 185.

Keywords: acute heating, cognition, thermoregulation, ageing.

POWER PREDICTION IN CYCLISTS BASED ON CARDIORESPIRATORY PARAMETERS AND BODY COMPOSITION

Szczepan Wiecha, Igor Cieśliński

Jozef Pilsudski University of Physical Education, Poland

Background. In cycling, the level of power generated by the athlete is a key parameter to assess training status and functional ability (Lach et al., 2021). There are many indirect methods of assessing sport performance based on power calculations. The most accurate form is considered to be the direct measurement of cardiorespiratory fitness and metabolic dependencies during a graded test. In Cardiopulmonary exercise testing (CPET), key parameters such as heart rate, lung ventilation, oxygen uptake, RER and additionally capillary blood lactate concentration are determined (Maciejczyk et al., 2014; Price et al., 2022). The determination of the relationship between generated power and cardiopulmonary parameters is particularly important for sports but also clinical assessment. This work aims to develop models for the prediction of maximal and threshold power on the basis of body composition and recorded CPET parameters in a graded test.

Research methods. 1129 male cyclists (age = 37.25 ± 9.10 years; BMI = 24.38 ± 2.73 $kg \cdot m^{-2}$; VO_2max = 51.92 ± 8.05 $mL \cdot min^{-1} \cdot kg^{-1}$) and 130 female cyclists (age = 33.17 ± 7.43 years; BMI = 21.76 ± 2.31 $kg \cdot m^{-2}$; VO_2max = 49.04 ± 6.66 $mL \cdot min^{-1} \cdot kg^{-1}$) underwent CPET and body composition analysis. XGBoost machine learning techniques were used to predict the variables, using Multivariable Linear Regression with 10 fold cross-validation, models were derived to predict the maximum power output (PP) and the corresponding power for the anaerobic threshold (PAT) and the respiratory compensation point (PRCP).

Results and discussion. Of the cardiorespiratory parameter variables, oxygen uptake was predominantly important in both men and women. The coefficient of determination (R2) for men cyclists was observed in PP (R2 = 0.67; MAE = 19.56; RMSE = 26.41), PRCP (R2 = 0.73; MAE = 15.43; RMSE = 20.87) and PAT (R2 = 0.72; MAE = 12.30; RMSE = 16.59). In female cyclist R2 was observed in PP (R2 = 0.70; MAE = 15.31; RMSE = 20.25), PRCP (R2 = 0.72; MAE = 13.01; RMSE = 17.47) and PAT (R2 = 0.68; MAE = 10.71; RMSE = 13.83).

Conclusions. Based on CPET and anthropometric parameters, the obtained regression models show very good prediction of power in cyclists as manifested by high R2 and low MEA and RMSE. The models can be used in sports and clinical assessment, both for internal evaluation of the subject and for population comparison of power in the CPET test.

References

Lach, J., Wiecha, S., Śliż, D., Price, S., Zaborski, M., Cieśliński, I., Postuła, M., Knechtle, B., & Mamcarz, A. (2021). HR max prediction based on age, body composition, fitness level, testing modality and sex in physically active population. *Frontiers in Physiology, 12,* 695950. doi:10.3389/fphys.2021.695950

Maciejczyk, M., Wiecek, M., Szymura, J., Cempla, J., Wiecha, S., Szygula, Z., & Brown, L. E. (2014). Effect of body composition on respiratory compensation point during an incremental test. *The Journal of Strength & Conditioning Research, 28*(7), 2071–2077. doi:10.1519/JSC.0000000000000347

Price, S., Wiecha, S., Cieśliński, I., Śliż, D., Kasiak, P. S., Lach, J., Gruba, G., Kowalski, T., & Mamcarz, A. (2022). Differences between treadmill and cycle ergometer cardiopulmonary exercise testing results in triathletes and their association with body composition and body mass index. *International Journal of Environmental Research and Public Health, 19*(6), 3557. doi:10.3390/ijerph19063557

Keywords: VO_2max, respiratory compensation point, anaerobic threshold, power prediction.

PHYSICAL ACTIVITY, RECREATION AND HEALTH

PRESCRIBING OR CO-DESIGNING EXERCISE IN HEALTHY ADULTS?

Maricarmen Almarcha, Ignacio Gonzalez, Natàlia Balagué
University of Barcelona, Spain

Background. Exercise and physical activity (PA) are critical factors for promoting health. The World Health Organization (WHO) recommends specific types of activity and minimum doses of aerobic and strength training in their guidelines for exercise prescription in health and disease (World Health Organization, 2019). These universal recommendations ignore a vast amount of unique socio-psycho-biological constraints (Balagué, Almarcha, & Hristovski, 2020). From a complex dynamical systems approach, due to the multidimensionality, context-dependency and subjectivity of health and fitness, there are no universal recipes to promote health through exercise (Balagué, Hristovski, Almarcha, Garcia-Retortillo, & Ivanov, 2020; Sturmberg et al., 2019). This study aimed to compare the effectiveness of a co-designed exercise intervention based on complex dynamic systems criteria with a standardized exercise program based on WHO recommendations in healthy adults.

Research methods. Twenty healthy adults (10 men and 10 women, 40 to 55 y.o.), supervised telepathically by personal trainers, participated in 9 weeks of exercise intervention. They were randomly divided into two groups that followed a co-designed exercise program (A group) and a prescribed exercise program based on WHO recommendations. Cognitive and affective responses to each program were tested pre-and post-intervention through DASS21 (Lovibond & Lovibond, 1995) and MAIA (Mehling et al., 2012) questionnaires. 11 participants completed the intervention (A) n = 8; (B) n = 3. Means and standard deviations were calculated for all the variables analyzed. Pre-post differences of the different questionnaire variables were assessed using Paired Sample t-tests.

Results and discussion. Eleven participants completed the intervention (A = 8, B = 3). Inter-groups differences were observed in attention regulation (W = 7.000, Z = -2.256, p < .024, d = 0.68) and post-self-regulation (W = 8.500, Z = -1.971, p < .048, d = 0.59) and anxiety (W = 36.000, Z = -2.602, p < .012, d = 0.78) with a large size effect. Data suggests the development of somatic awareness and self-regulation in daily life in the CoD group, with declines in the WHO group. Post-intervention, CoD group increased significantly perception (t = -12.835, p < .0001), not-distracting capacity (t = -4.492, p <.003), attention regulation (t = -26.839, p < .0001), self-awareness (t = -13.642, p < .0001), self-regulation (t = -13.316, p < .0001), listen to body signals (t = -7.848, p < .0001) and trust (t = -10.991, p < .0001) and decreased depression (t = 7.907, p < .0001), anxiety (t = 27.032, p < .0001) and stress traits (t = 8.973, p < .0001). The WHO group only presents significative differences decreasing not-distracting capacity (t = 5.000, p < .038) and not-worrying (t = 17.000, p < .003) but no significant differences were found for the other variables.

Conclusions. The co-designed exercise program provides meaningful, contextualized and personalized space and time exercise. Proposals seem more effective for developing interoceptive awareness, autonomy, and exercise self-regulation than the prescribed exercise program. Exercise professionals should be focused on selecting and providing adapted, varied, and sufficiently challenging proposals to promote health through exercise in healthy adults.

References

Balagué, N., Almarcha, M., & Hristovski, R. (2020). Updating exercise prescription in health and disease. *Research in Physical Education, Sport and Health, 9,* 3–6.

Balagué, N., Hristovski, R., Almarcha, M., Garcia-Retortillo, S., & Ivanov, C. (2020). Network physiology of exercise: Vision and perspectives. *Frontiers in Physiology, 11,* 611550.

Lovibond, S. H., & Lovibond, P. F. (1995). *Manual for the depression anxiety & stress scales*. 2nd ed. Sydney: Psychology Foundation.

Mehling, W. E., Price, C., Daubenmier, J. J., Acree, M., Bartmess, E., & Stewart, A. (2012). The multidimensional assessment of interoceptive awareness (MAIA). *PLoS One, 7,* e48230. doi:10.1371/journal.pone.0048230

Sturmberg, J., Picard, M., Aron, D., Bennett, J., Bircher, J., & DeHaven, M. (2019). Health and disease – emergent states resulting from adaptive social and biological network interactions. *Frontiers of Medicine, 28,* 6.

World Health Organization (2019). *Global action plan on physical activity 2018–2030: More active people for a healthier world.* Geneva, Switzerland: World Health Organization.

Keywords: exercise prescription, network physiology of exercise, physical activity, health, adherence.

LEVEL OF CORPORATE SOCIAL RESPONSIBILITY FROM THE POINT OF VIEW OF EMPLOYEES: A CASE OF LEISURE ORGANIZATIONS

Regina Andriukaitienė

Lithuanian Sports University, Lithuania

Background. Modern organizations adapt to intense environmental factors with the help of various management tools and solutions. According to Bhalla and Holly (2019), modern definitions of CSR have focused on the "triple bottom line", stressing the concern for people, profit and the environment (Fombrun, Gardberg, & Barnett, 2000) and a focus on several categories such as ethics, environmental sustainability and philanthropy (Chandler & Werther, 2014). Idahosa (2019) noted that corporate social responsibility activity has gained momentum when company executives realized that their immediate operating environment facilitates a smooth business. The benefits of applying the principles of corporate social responsibility are based on studies and the practice of organizations, which shows that corporate social responsibility (if properly implemented) improves operational efficiency, and customer loyalty improves the reputation and financial opportunities of organizations and provides other benefits. When companies strengthen CSRs for their stakeholders, consumers not only express their satisfaction, respect or charm but also identify it. The number of social problems and their complexity influence to take responsibility and find solutions that become not only a public problem but also with the help of the private sector. Understanding the importance of social responsibility of managers of organizations is a necessary provision for the introduction of business-based liability practices against stakeholders, as well as in shaping the social responsibility of employees in business and establishing the basis for socially responsible ethical communication with stakeholders. According to Park, Lee and Kim (2018), more companies devote their efforts to retaining their employees and taking care of their development, which can contribute to the company's performance and competitiveness. Whitfield and Dioko (2012) argues that CSR's activities can improve the organization's performance by saving costs, strengthening, the reputation of the organization and discouraging regulatory action that could lead to high costs for the organization. Galbreath (2010) mentions that CSA is expected to show justice or decency to the client, leading to higher satisfaction.

Research methods. The study aims to assess the awareness of the level of corporate social responsibility of relationships with customers, employees, the community, and the environment in leisure organizations from the point of view of employees. The research method is an online survey. The questionnaire consisted of a scale for determining the level of socially responsible behaviours of organizations with stakeholders. The criteria are evaluated in a system of one to five points and calculate the average of the scale groups and the overall level of social responsibility (1 – extremely low, 2 points – low, 3 – medium, 4 – high, 5 – extremely high level). The study involved ten leisure services companies.

Results and discussion. Evaluations of social responsibility behaviour of organizations show that employees rate the responsibility of the organization in the market by 4.25 points, the organization's responsibility towards employees is 3.27 points, the responsibility against the community is rated at 3.26 points, the social responsibility of the organization in the environment is evaluated with a minimum score of 2.78 points. Taking into account the aspects of the theory of the application of the principles of social responsibility to stakeholders, it should be noted, the main stakeholder is employees and it is, therefore, relevant to take into account their interests, i.e. the level of installation of the workplace, the physical and hygienic conditions of work, the possibilities of vocational education, safety and health guarantees, legal fairness, ensuring an ethical and favourable climate of work and other factors are of medium level focus on external stakeholders to ensure the interests of the organization's customers and community members, which indicates a higher marketing orientation, and employees remain less important. The area to be improved is the development of social responsibility in the environment, it focuses on saving resources, however, other initiatives involving workers and customers in environmental activities are less common.

Conclusions. The main conclusion is that from the point of view of employees of companies providing leisure services, the social responsibility of organizations meets the average level of social responsibility of organizations, the organization's desire to strengthen relations with the parties concerned therefore requires new solutions, especially in the field of the environment. When assessing relations with employees, strengthening social responsibility in this area of activity is also only at a moderate level, and given that employees are the most important internal stakeholder, management decisions are necessary for the relationship with employees.

References

Bhalla, N., & Holly, K. (2019). Examining cultural impacts on consumers' environmental CSR outcomes. *Corporate, Communications: An International Journal, 24*(3), 569–592. doi:10.1108/CCIJ-09-2018-0094

Chandler, D., & Werther, W. B. (2014). *Strategic corporate social responsibility. Stakeholders, globalization, and sustainable value creation.* 3rd edition. United States of America.

Fombrun, C. J., Gardberg, N. A., & Barnett, M. L. (2000). Opportunity platforms and safety nets: Corporate citizenship and reputational risk. *Business and Society Review, 105*(1), 85–106.

Galbreath, J. (2010). Drivers of corporate social responsibility: The role of formal strategic planning and firm culture. *Rich Journal of Management, 21*(2).

Idahosa, L. O. (2019). Understanding environmental sustainability, corporate social responsibility and responsible tourism in literature vs practice. *GeoJournal of Tourism and Geosites, 26*(3), 956–973.

Park, S. Y., Lee, C. K., & Kim, H. (2018). The influence of corporate social responsibility on travel company employees. *International Journal of Contemporary Hospitality Management, 30*(1), 178–196.

Whitfield, J., & Dioko, L. A. (2012). Measuring and examining the relevance of discretionary corporate social responsibility in tourism: Some preliminary evidence from the UK conference sector. *Journal of Travel Research, 51,* 289–302.

Keywords: corporate social responsibility, level, stakeholders, leisure.

OBJECTIVELY-MEASURED PHYSICAL ACTIVITY AND HEALTH-RELATED QUALITY OF LIFE AMONG CHILDREN WITH HIGH AND LOW SOCIOECONOMIC STATUS

Tayebeh Baniasadi[1], Sheida Ranjbari[2], Amir Dana[2], Sedighe Khajeaflatoon Mofrad[3]

[1]Indiana University, United States of America; [2]Islamic Azad University, Iran; [3]Farhangian University, Iran

Background. Purpose: research on the relationship between physical activity (PA) and health-related quality of life (HRQoL), to date, have rarely investigated how this relationship differ across individuals with high and low socioeconomic status (Basterfield, Burn, Galna, Karoblyte, & Weston, 2021; Calzada-Rodríguez et al., 2021; Wafa et al., 2016; Zhang et al., 2021). The aim of this study is to explore the relationship between objectively-measured PA and HRQoL, and examine how this relationship differs across children with high and low socioeconomic status.

Method. The present study used a correlational-comparative method. Statistical sample included 260 children (age range of 9 to 12 years) from Tehran, Iran, 110 of whom had in high socioeconomic status and 150 children had a low socioeconomic status. PA was measured using the ActiGraph wGT3X-BT accelerometer for seven consecutive days. PedsQL was used to measure health-related quality of life. Independent t test and regression analysis test were utilized for data analysis.

Results. On average, children with higher socioeconomic status had higher moderate-to-vigorous PA (MVPA) than those with lower socioeconomic status (45.28 vs. 37.82 minutes per day, respectively). Moreover, children with higher socioeconomic status perceived higher HRQoL than those with lower socioeconomic status. Regression analysis showed that, after controlling for age and BMI, MVPA was significantly and directly associated with HRQoL in both children with high and low socioeconomic status, however, this relationship was stronger in children with low socioeconomic status.

Conclusions. These finding may indicate that PA and HRQoL are critical concerns for children with low socioeconomic status. Accordingly, it is necessary to adopt appropriate strategies to promote active lifestyle among this population.

References

Basterfield, L., Burn, N. L., Galna, B., Karoblyte, G., & Weston, K. L. (2021). The association between physical fitness, sports club participation and body mass index on health-related quality of life in primary school children from a socioeconomically deprived area of England. *Preventive Medicine Reports, 24,* 101557.

Calzada-Rodríguez, J. I., Denche-Zamorano, Á. M., Pérez-Gómez, J., Mendoza-Muñoz, M., Carlos-Vivas, J., Barrios-Fernandez, S., & Adsuar, J. C. (2021). Health-related quality of life and frequency of physical activity in Spanish students aged 8–14. *International Journal of Environmental Research & Public Health, 18*, 9418.

Wafa, S. W., Shahril, M. R., Ahmad, A. B., Zainuddin, L. R., Ismail, K. F., Aung, M. M., & Mohd Yusoff, N. A. (2016). Association between physical activity and health-related quality of life in children: A cross-sectional study. *Health & Quality of Life Outcomes, 4,* 71.

Zhang, X., Tan, S. S., Franse, C. B., Alhambra-Borrás, T., Verma, A., Williams, G., van Grieken, A., & Raat, H. (2021). Longitudinal association between physical activity and health-related quality of life among community-dwelling older adults: A longitudinal study of Urban Health Centres Europe (UHCE). *BMC Geriatrics, 21*(1), 521.

Keywords: physical activity, quality of life, socioeconomic status, children, accelerometer.

MEDITERRANEAN DIET HABITS BETWEEN LITHUANIAN AND CROATIAN REGIONS

Grėta Burkaitė, Brigita Miežienė
Lithuanian Sports University, Lithuania

Background. Nutrition is thought to be the main factor in improving health conditions in a worldwide aging society (Ruthsatz & Candeias, 2020). The MD has been widely reported as a model of a healthy eating pattern for a better quality of life between adults (Dinu, Pagliai, Casini, & Sofi, 2018; Hernández-Galiot & Goñi, 2017) and for reducing the risk of the most common diseases associated with aging, such as cardiovascular disease (Ahmad et al., 2018), cancer, metabolic syndrome and obesity (Martinez-Lacoba, Pardo-Garcia, Amo-Saus, & Escribano-Sotos, 2018). However, the traditional MD of a plant-based diet is characterized by high consumption of fruits, non-refined cereals, vegetables, olive oil, nuts, legumes, a moderate amount of chicken and fish, and lower consumption of dairy, red meat, and sugars, and wine in moderation (Davis, Bryan, Hodgson, & Murphy, 2015). According to Pribisalić and co-authors (2021), in Croatia the low part of the population adhered to daily dairy products consumption, similarly, to wine use. Also, women presented higher odds of adherence compared to men, while the oldest age group had higher odds of adherence compared to the youngest subjects. Women were more likely to be adherent to the recommended intake of fruit, vegetables, olive oil, nuts, dairy, and red meat, but also they were less likely to be adherent to the eggs and wine intake to MD recommendations. However, it is important to mention that even the people in the Mediterranean are not so interested in following this diet. Therefore MD principles can be applied not only just in Mediterranean countries, but also other regions.

Research methods. In research participated 1 869 subjects (aged 18–35), of them 71.5% were Lithuanians. The distribution between genders was the following: Lithuanian men 40.5%, Croatians – 36.4%, Lithuanian women – 59.5%, Croatian women – 63.5%. MEDAS screen tool was used to measure adherence to MD.

Results and discussion. Female gender for both countries, living in a region instead of the city for Croatians and having higher financial status for Lithuanians was related to higher adherence to MD. Any difference is observed between nationalities in distribution of poor, average and good diet. More than half of young adults in both countries have poor diet, the smaller half indicated average compliance to healthy diet and only about 2 and 3%, among Lithuanians and Croatians comply with the requirements of healthy nutrition. A little bit more than a half of young adults living in Croatia – part of the Mediterranean region, are meeting the recommendation to include olive oil as a main fat into their diet in contrast with 35% of Lithuanians. However, only around a quarter of young Croatians meet the recommended daily amount of olive oil, but still more than Lithuanians (13%). In both countries less than one third of young adults consume the recommended 3 fruits a day, however Croatians have the slight advantage. Also, more Croatians than Lithuanians consume wine, however only around 2% of Croatians and 0.6% of Lithuanians meet the suggested amount of 7 glasses a week (one glass per day). One third of Croatians and a quarter of Lithuanians consume the sufficient amounts of nuts per week, which is significantly less than eat their peers in Croatia. White meat over red is preferred among majority of young adults in both countries, however there is still significant difference of 7% in favor for Croatia. Slight advantage in consumption of legumes is among Croatian young adults, however in both countries, legumes are underestimated and only 12% of young adults in Lithuania vs 16% in Croatia include them in their menu. The consumption of four out of 14 items in Mediterranean diet items' list do not differ between country in Mediterranean region and Lithuania.

Conclusions. The Mediterranean diet of adults aged 18–36 is affected by financial status, especially among Lithuanians. The higher financial status, the better is adherence to MD. According to research results, Lithuanians eat more red meat, vegetables, and fruits. Croatians use more animal fat and choose sweet drinks. An equivalent result of red wine consumption was in both countries.

References

Ahmad, S., Moorthy, M. V., Demler, O. V., Hu, F. B., Ridker, P. M., Chasman, D. I., & Mora, S. (2018). Assessment of risk factors and biomarkers associated with risk of cardiovascular disease among women consuming a Mediterranean diet. *JAMA Network Open, 1*(8), e185708–e185708.

Davis, C., Bryan, J., Hodgson, J., & Murphy, K. (2015). Definition of the Mediterranean diet: A literature review. *Nutrients, 7,* 9139–9153.

Dinu, M., Pagliai, G., Casini, A., & Sofi, F. (2018). Mediterranean diet and multiple health outcomes: An umbrella review of meta-analyses of observational studies and randomised trials. *European Journal of Clinical Nutrition, 72,* 30–43.

Hernández-Galiot, A., & Goñi, I. (2017). Adherence to the Mediterranean diet pattern, cognitive status and depressive symptoms in an elderly non-institutionalized population. *Nutricion Hospitalaria, 34,* 338–344.

Martinez-Lacoba, R., Pardo-Garcia, I., Amo-Saus, E., & Escribano-Sotos, F. (2018). Mediterranean diet and health outcomes: A systematic meta-review. *European Journal of Public Health, 28*(5), 955–961.

Pribisalić, A., Popović, R., Salvatore, F. P., Vatavuk, M., Mašanović, M., Hayward, C., & Kolčić, I. (2021). The role of socioeconomic status in adherence to the Mediterranean diet and body mass index change: A follow-up study in the general population of Southern Croatia. *Nutrients, 13*(11), 3802.

Ruthsatz, M., & Candeias, V. (2020). Non-communicable disease prevention, nutrition and aging. *Acta Biomedica, 91,* 379–388.

Keywords: Mediterranean diet, eating habits, Lithuanians, Croatians.

PHYSICAL ACTIVITY FOR AGING: A LIFELONG LEARNING APPROACH

Alessandro Cudicio, Valeria Agosti, Antonio Borgogni
University of Bergamo, Italy

Background. Elderly's quality of life is negatively affected by senescence. Cognitive abilities are mild and gradually impaired, and motor units becomes bigger and slower. Initially, degeneration process does not significantly affect quality of life, but inactivity can accelerate it. Physical activity (PA) is a needful tool to counteract the effect of aging furthermore, the intervention success is related to the modality of exercise proposition (Bangsbo et al., 2019; Bull et al., 2020). Our aim is to suggest 1) a lifelong learning-based approach for strength and balance exercise, and 2) fatigue and intensity self-evaluation on walking activity.

Research methods. 20 Elderly (65–80 YO) will be asked to participate in PA interventions that will be integrated by the aid of a smartphone application (APP) (Helbostad et al., 2017). They receive suggestion and test: 1) outdoor, during walking to assess the intensity (Talk Test) or the fatigue (OMNI); 2) at home, to self-adapt body posture during strength or balance exercises that are proposed in three incremental difficulty levels, moving from segmental to global execution. PACES-8-it will be used to evaluate enjoyment of the PA before, during and at the end of the study.

Results and discussion. The propose of an APP for PA is a strong implementation to optimize the efficiency and the intensity of exercise. 1) To improve the PA efficiency, data provides instant suggestion to modify the intensity or can elaborate an answer for next walks: the older people that are involved in long-distance walking can receive different test, the first of them is to talk with the APP, more is breathless more is intense. Moreover, through the OMNI scale the subject evaluates the fatigue during and after the walk. 2) Exercises focus on segmental district of the body, lead the elderly to re-build global movement useful for daily life activities. Through self-correction they may improve cognitive abilities related to more efficient and safer execution. Enjoyment assessment is useful to evaluate the activity proposed, more the people enjoy more the people practice PA, in a virtuous cycle for lifelong learning (Boulton-Lewis, 2010; Narushima, Liu, & Diestelkamp, 2018).

Conclusions. This innovative and robust methodology will be proposed in a case series study, it will permit to evaluate the quantity and the quality of physical activity offered with a lifelong learning approach.

References

Bangsbo, J., Blackwell, J., Boraxbekk, C. J., Caserotti, P., Dela, F., Evans, A. B., … Viña, J. (2019). Copenhagen Consensus statement 2019: Physical activity and ageing. *British Journal of Sports Medicine, 53*(14), 856–858. https://doi.org/10.1136/bjsports-2018-100451

Boulton-Lewis, G. M. (2010). Education and learning for the elderly: Why, how, what. *Educational Gerontology, 36*(3), 213–228. https://doi.org/10.1080/03601270903182877

Bull, F., Saad Al-Ansari, S., Biddle, S., Borodulin, K., Buman, M., Cardon, G., … Willumsen, J. (2020). World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *British Journal of Sports Medicine,* 1451–1462. https://doi.org/10.1136/bjsports-2020-102955

Helbostad, J. L., Vereijken, B., Becker, C., Todd, C., Taraldsen, K., Pijnappels, M., … Mellone, S. (2017). Mobile health applications to promote active and healthy ageing. *Sensors (Basel, Switzerland), 17*(3), 1–13. https://doi.org/10.3390/s17030622

Narushima, M., Liu, J., & Diestelkamp, N. (2018). Lifelong learning in active ageing discourse: Its conserving effect on wellbeing, health and vulnerability. *Ageing and Society, 38*(4), 651–675. https://doi.org/10.1017/S0144686X16001136

Keywords: physical activity, elderly, lifelong learning, smartphone, application.

PHYSICAL ACTIVITY IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

Laima Gasiūnienė, Brigita Miežienė
Lithuanian Sports University, Lithuania

Background. The evidence for the benefits of physical activity is extensive and indisputable. The prevalence of chronic non-communicable diseases has long been linked to physical inactivity and is a major public health problem in many parts of the world. It has also been found that in addition to health benefits, a physically active society can receive additional benefits, such as less use of fossil fuels, cleaner air, less congested and safer roads. An increasing number of international organizations around the world are promoting the involvement of national policy frameworks in increasing physical activity, a sustainable development organization being no exception to that. The health and environmental benefits of physical activity are intertwined and are reflected in the "Schedule 2030" goals for sustainable development, such as: good health and well-being, gender equality, industry, innovation and infrastructure, improper diet, etc. (United Nations General Assembly, 2015). According to Dai and Menhas (2020) physical activity is recognized as an important tool in achieving the goals of sustainable development. Salvo et al. (2021), points out that effective strategies to promote physical activity can not only improve human health, reduce the burden of disease, and health care costs, but also offer untapped opportunities to achieve sustainable development goals. The multi-sectoral and multi-component nature of strategies to promote physical activity and sustainable development indicates that a systemic approach is needed to develop effective strategies to increase physical activity and achieve sustainable development goals. It is also emphasized that these synergies have not been sufficiently explored in a global context. The problem of the study. Although physical activity is recognized as an important area in the context of sustainable development, it is not entirely clear how and what sustainable development problems physical activity should solve. These unanswered questions about physical activity and sustainable development encourage researchers around the world to explore the synergies between the goals of physical activity and sustainable development, although research has been conducted (Baena-Morales, Jerez-Mayorga, Delgado-Floody, & Martínez-Martínez, 2021; Dai & Menhas 2020; Salvo et al., 2021) there is still a lack of information on the link between physical activity and sustainable development to achieve goals. The aim of the study: highlight the importance of physical activity in the context of sustainable development.

Research methods. A review analysis of the scientific literature was performed. Literature sources were searched for using the keywords "sustainable development", "sustainable development meanings", "sustainable development goals and physical activity", "sustainable development goals and physical activity". The analysis of literature sources was performed using the "Google Scholar" platform. Literature search was carried out in March 2022, criteria for inclusion of the source: sources were published in Lithuanian and English; the content of the source summary matches the content of the report or the keywords; full access sources. Sources meeting the criteria were analyzed in more detail. For further analysis, 1 document and 3 articles were selected to be the most relevant to the topic of the report.

Results and discussion. Given the contribution of physical activity to the "Schedule 2030" for sustainable development, investment in physical activity is encouraged, not only because of the direct health benefits, but also because increased walking, cycling, active leisure, sports and games can contribute to a more cohesive, fairer world which is the sustainable development goal. Political actions to promote physical activity have multiple benefits for health, social and economic activities and can directly contribute to the goals of sustainable development (World Health Organization, 2019). In the conclusions of the study Salvo et al. (2021) indicates the general goals of promoting physical activity and sustainable development: reducing the burden of non-communicable diseases; increasing the availability and access to sustainable transport; increasing the availability and access to green spaces; reducing air pollution and its effects on health; reducing injuries and deaths in traffic accidents; reducing carbon emissions; reducing socio-economic inequalities and gender inequalities; improving mental health; reducing violence and crime. Strategies to promote physical activity can contribute to 13 out of 17 sustainable development goals. According to Salvo et al. (2021), not all links between physical activity promotion strategies and sustainable development goals are currently supported by scientific evidence. Research is needed to fully quantify the potential benefits of large-scale physical activity promotion strategies for sustainable development.

Conclusions. According to the WHO "Global action plan on physical activity 2018–2030: more active people for a healthier world", in addition to the many health benefits of physical activity, more active societies can benefit from reduced fossil fuel use, cleaner air, less congested and safer roads, etc. these benefits are interlinked with the achievement of sustainable development ambitions and political priorities. It is argued that investing in policies that promote walking, cycling, sports, active leisure and games can make a direct contribution to many of the "Schedule 2030" sustainable development goals.

References

Baena-Morales, S., Jerez-Mayorga, D., Delgado-Floody, P., & Martínez-Martínez, J. (2021). Sustainable development goals and physical education. A proposal for practice-based models. *International Journal of Environmental Research and Public Health, 18*(4), 2129.

Dai, J., & Menhas, R. (2020). Sustainable development goals, sports and physical activity: The localization of health-related sustainable development goals through sports in China: A narrative review. *Risk Management and Healthcare Policy, 13,* 1419.

Salvo, D., Garcia, L., Reis, R. S., Stankov, I., Goel, R., Schipperijn, J., ... & Pratt, M. (2021). Physical activity promotion and the United Nations Sustainable Development Goals: Building synergies to maximize impact. *Journal of Physical Activity and Health, 18*(10), 1163–1180.

United Nations General Assembly (2015). *Resolution adopted by the General Assembly on 11 September 2015*. A/RES/69/315 15 September 2015. New York: United Nations.

World Health Organization (2019). *Global action plan on physical activity 2018–2030: More active people for a healthier world*. Switzerland.

Keywords: sustainable development, physical activity.

LONGITUDINAL DEVELOPMENT OF CARDIORESPIRATORY FITNESS IN CHILDREN IN TRANSITION FROM KINDERGARTEN TO BASIC SCHOOL ACCORDING TO PARTICIPATION IN ORGANIZED SPORTS

Merike Järvamägi, Eva-Maria Riso, Kirkke Reisberg, Jaak Jürimäe

Tartu University, Estonia

Background. This study examined the longitudinal development of cardiorespiratory fitness (CRF) in children in the transition from kindergarten to basic school according to participation in organized sports and estimated the associations of CRF and body composition indices during the transition from childhood to preadolescence. Cardiorespiratory fitness (CRF) and physical activity (PA) are positively associated in children during growth and maturation (Kristensen et al., 2010). As critical physiological changes take place during childhood and preadolescence, engagement in various types of PA has numerous health benefits including the increase in CRF (Vicente-Rodriguez, 2006). Cardiorespiratory fitness (CRF) and physical activity (PA) are positively associated in children during growth and maturation (Kristensen et al., 2010). As critical physiological changes take place during childhood and preadolescence, engagement in various types of PA has numerous health benefits including the increase in CRF (Vicente-Rodríguez, 2006). Recent study shows that higher level of pubertal CRF, and not PA was associated with lower body fatness indices in late adolescence (Remmel et al., 2021).

Research methods. Children participated in the three-staged longitudinal study (Kindergarten, 6.6 years, n = 212; 1st grade, 7.6 years, n = 136; 5th grade, 11.5 years, n = 142) for 5 years and were categorized into three groups according to participation in organized sports in study period (consistently, episodically, never). Cardiorespiratory fitness was assessed using 20 m shuttle run test, while body composition was measured by skinfold thicknesses and physical activity was registered with accelerometer. International gender- and age-specific CRF reference normatives were also used to characterize participants.

Results. Children who participated consistently in organized sports had significantly higher CRF level and lower body fatness (31.3 ± 13.5 laps in 20 m shuttle run; 21.1 ± 6.3% body fat) in 11.5 years as compared to children who had never participated in sports clubs (20.7 ± 12.0 laps in 20 m shuttle run; 26.1 ± 6.8% body fat). The 20 m shuttle run test in children who participated consistently in organized sports had better 20 m shuttle results also in 6.6 and 7.6 years as compared to children who had no sports experience: 21.8 ± 10 vs 17 ± 9 laps in 6.6 years and 24.3 ± 14 vs 22 ± 12.5 laps in 7.6 years. The percentage of body fat did not differ according to sports club participation in 6.6- and 7.6- years old children. Body composition and CRF did not associate in consistently trained children. The proportion of 5th grade children demonstrating age appropriate healthy CRF was almost threefold higher in group of consistent sports trainings among both in boys and girls than among non-members of sports clubs.

Conclusions. Consistent attendance in organized sports in childhood and early preadolescence ensures higher CRF in 6.6, 7.6- and 11.5- years old children. More healthier body composition was revealed in consistently trained children in 11.5 years as compared to children who had no or episodic experience of organized sports.

References

Kristensen, P. L., Moeller, N. C., Korsholm, L., Kolle, E., Wedderkopp, N., Froberg, K. et al. (2010). The association between aerobic fitness and physical activity in children and adolescents: The European youth heart study. *European Journal of Applied Physiology, 110,* 267–275. doi:10.1007/s00421-010-1491-x

Remmel, L., Tamme, R., Tillmann, V., Mäestu, E., Purge, P., Mengel, E. et al. (2021). Pubertal physical activity and cardiorespiratory fitness in relation to late adolescent body fatness in boys: A 6-year follow-up study. *International Journal of Environmental Research and Public Health, 18,* 4881. doi:10.3390/ijerph18094881

Vicente-Rodríguez, G. (2006). How does exercise affect bone development during growth? *Sports Medicine, 36,* 561–569. doi:10.2165/00007256-200636070-00002

Keywords: cardiorespiratory fitness, organized sports, body composition, physical activity, children.

THE IMPACT OF PHYSICAL ACTIVITY ON ADOLESCENTS' LEARNING BEHAVIOUR

Eglė Kemerytė-Ivanauskienė, Jūratė Česnavičienė, Agnė Brandišauskienė
Vytautas Magnus University, Education Academy, Lithuania

Background. Physical activity confers strong positive health benefits in youth (Maugeri et al., 2020). If physical exercise becomes adolescents' routine, their mental health improves and depressive symptoms decrease in the long-term. Physical activity, especially physical education, improves classroom behaviours and benefits in several aspects of academic achievement, especially mathematics-related skills, reading, and composite scores in youth (Álvarez-Bueno et al., 2017). However, most of today's research shows that students' physical activity is decreasing and learning outcomes are declining; therefore, it is important to search for factors that may influence student health and academic achievements (Lojdová, Kvintová, Štěrbová, & Krol, 2021).

Research methods. The data collection was performed in May 2021. The research sample was composed of 7th–10th grade students, involving 202 students (112 girls and 90 boys). The anonymous self-report questionnaire was divided into three parts. Part I of the questionnaire provided basic information on students (gender, grade). Part II contained Physical Activity Questionnaire for Adolescents (Kowalski, Crocker, & Donen, 2004). Part III contained two subscales of the Student Engagement Scale (Lam et al., 2014), namely Affective Engagement and Behavioural Engagement. In this study, the internal consistency of the PAQ-A, the Affective Engagement subscale, and the Behavioural Engagement subscale was checked with Cronbach's alpha test.

Results and discussion. The ANOVA test revealed that there was no statistically significant difference in the physical activity of students in different grades ($F = 2.457$, $p = 0.064$), although general levels of physical activity of the 7th–8th grade students were slightly higher than the 9th–10th grade students. The highest level of physical activity was determined in physical education classes. The boys' and girls' physical activity total score was not high, either, and did not reveal a statistically significant difference. The multiple linear regression analysis was implemented to determine the influence of physical activity, gender and grade on the affective and behavioural engagement. It was determined that the grade was not a predictor of any engagement dimension. It appeared that gender ($\beta = 0.332$, $p < 0.0001$) and physical activity ($\beta = 0.323$, $p < 0.0001$) as predictors had a significant moderate effect on behavioural engagement.

Conclusions. The findings of our study demonstrated that adolescents' physical activity was a predictor, which had a significant moderate effect on students' behavioural engagement. It was also determined that the physical activity of students was low, whereas its highest level depended mostly on obligatory school physical education classes.

References

Álvarez-Bueno, C., Pesce, C., Cavero-Redondo, I., Sánchez-López, M., Garrido-Miguel, M., & Martínez-Vizcaíno, V. (2017). Academic achievement and physical activity: A meta-analysis. *Pediatrics, 140*(6), e20171498. doi:10.1542/peds.2017-1498

Kowalski, K. C., Crocker, R. E., & Donen, R. M. (2004). *The physical activity questionnaire for older children (PAC-C) and adolescents (PAQ-A) manual*. Canada: University of Saskatchewan.

Lam, S. F., Jimerson, S., Wong, B. P. H., Kikas, E., Shin, H., Veiga, F. H., Hatzichristou, C., Cefai, C., Negovan, V., Stanculescu, E., Yang, H. F., Liu, Y., Basnett, J., Duck, R., Farrell, P., Nelson, B., & Zollneritsch, J. (2014). Understanding and measuring student engagement in school: The results of an international study from 12 countries. *School Psychology, 29*(2), 213–232. doi:10.1037/spq0000057

Lojdová, M., Kvintová, J., Štěrbová, D., & Krol, P. (2021). Assessment of life satisfaction and its selected components in relation to the level of physical activity. *Journal of Physical Education and Sport, 21*(3), 1346–1353. doi:10.7752/jpes.2021.03171

Maugeri, G., Castrogiovanni, P., Battaglia, G., Pippi, R., D'Agata, V., Palma, A., Di Rosa, M., & Musumeci, G. (2020). The impact of physical activity on psychological health during COVID-19 pandemic in Italy. *Heliyon, 6*(6), e04315. doi:10.1016/j.heliyon.2020.e04315

Keywords: physical activity, learning behavior, adolescents.

PARAMETERS THAT INFLUENCE THE ACCUMULATION OF MODERATE-TO-VIGOROUS PHYSICAL ACTIVITY DURING THE PHYSICAL EDUCATION CLASS: JOYMVPA PROJECT

Jarek Mäestu[1], Gregor Jurak[2], Jaka Kramaršič[2], Harto Hakonen[3], Jouni Kallio[3], Janne Kulmala[3], Hermanni Oksanen[3], Henri Tilga[1], Andre Koka[1], Evelin Mäestu[1], Maret Pihu[1], Ausra Lisinskiene[4], Marc Lochbaum[4]

[1]University of Tartu, Estonia; [2]University of Ljubljana, Slovenia; [3]JAMK University of Applied Sciences, Finland; [4]Vytautas Magnus University, Education Academy, Lithuania

Background. Better health and general fitness are related to moderate-to-vigorous physical activity (MVPA) of children and adolescents (Ruiz et al., 2006). However, during the PE class, much of the dedicated time is spent at lower intensities than MVPA. Therefore, schools and sport clubs are great environments for physical activity interventions.

Research methods. The aim of this study was to investigate the role of enjoyment, motivation, game familiarity and size of the group in terms of MVPA during the PE class. 100 different skill-based games were played in 10 min blocks during regular PE lessons, with two 10 min blocks in a row. Each game was tested three times. Heart rate was measured with Polar heart rate sensors with the criteria for MVPA was set as 140 beats or higher. Children's motivation, game familiarity and enjoyment were subjectively measured after the games.

Results and discussion. Multivariate linear regression model was used to associate MVPA with different variables. The average amount of the MVPA during the 10 min game was 76%. Smaller group size, higher motivation and better game familiarity were related to higher MVPA level of the game ($b = -0.147$, $b = 0.338$ and $b = 0.308$, respectively; $p \leq 0.01$).

Conclusions. In conclusion, group size, game familiarity and motivation of the child are related to the amount of MVPA acquired during a 10 min skill-based game in the PE class. The study was founded by Erasmus+ project no: 2019-1-EE01-KA201-051595.

References

Ruiz, J. R., Rizzo, N. S., Hurtig-Wennlof, A., Ortega, F. B., Warnberg, J., & Sjöström, M. (2006). Relations of total physical activity and intensity to fitness and fatness in children: The European Youth Heart Study. *American Journal of Clinical Nutrition, 84,* 299–303.

Keywords: physical education class, moderate to vigorous activity, enjoyment, group size.

THE MODELS OF ORGANIZED PHYSICAL ACTIVITIES AS A FORM OF INVOLVING FAMILY IN SPORT – RECOMMENDATIONS FOR PRACTICE

Krzysztof Piech, Anna Bodasińska

Jozef Pilsudski University of Physical Education, Poland

Background. Numerous authors highlight the leading role of a family in the process of promoting physical activity. Attention is directed to the meaning of parents' physical activity and its influence on children's physical activity. The more active the parents, the more active the children. Research in this field was conducted by Bois and Sarrazin (2006), Birontiene (2012), Piech, Nowak, Birontiene and Biteniece (2013), Piech and Grad (2014), Bodasińska and Piech (2021).

Research methods. The purpose of this study was to define models of physical activity in family and assessment of their impact on the growth of systematic family physical activities within studied families. The material of the research included parents who took part in offered physical activities together with their children (Family Preschool Olympics – 810 families, Classes for parents and children – 100 families, Classes for children with giving homework physical exercises – 38 families). The method utilised was an opinion poll, using a questionnaire. The survey was conducted in years 2004–2020 among parents of children attended kindergartens in Biała Podlaska.

Results and discussion. The child was the most common information source on offered recreational activities and the one who motivates whole family to participate. The most crucial positive effects of involvement in models of physical activities for parents were: happiness of their child, common family fun and active participation of the child. Children mostly shared the information about given homework physical exercises and more than half of the families fulfilled them. Mothers were the participants who took part in activities more often. The most frequent cause of not partaking of the family in doing given homework exercises was the lack of free time. The proposed forms of physical activities, periodic classes as well as recreational events, had an impact on the growth of family engagement in physical activity in their free time.

Conclusions. While promoting physical activity, it is worth paying more attention to the institution of kindergarten. Pre-school age is a period of a significant bond between a parent and a child and of a willingness to fulfil a child's interests. This fact might be used by implementing activities directed at physical education of families into the didactic and educational curriculum of kindergartens.

Recreational and sport activities promote the participation of families in recreation and constitute a significant element in the process of educating children to participate in the future. It is shown in a considerable engagement of parents in performing homework tasks given by the teacher.

Pre-school children may be successful animators of physical activity in a family. The major proof confirming this statement might be the fact that they shared information concerning homework tasks with their parents and they successfully encouraged them to perform these tasks.

The research indicated that after the fair children encouraged their parents to play together, whereas parents used games from the fair in their family free time. Because of the fact that the offered model of recreational event for families engaged and interested the participants, it is worth promoting in pedagogical sphere.

References

Birontiene, Z. (2012). A child as a physical activity stimulator in a family. *Sporto mokslas, 2,* 38–45.

Bodasińska, A., & Piech, K. (2021). Multigenerational physical activity during COVID-19 pandemic – good practices of Biała Podlaska. *LASE Journal of Sport Science, 12*(1), 101–113.

Bois, J., & Sarrazin, P. (2006). Les chiens font-il des chats? Une revue de literature sur le role de parents dans la socialization de leur enfant pour le sport. (The review of literature concerning the role of parents in preparing their children for participation in sport). *Science et Motricite, 57,* 10–54.

Piech, K., & Grad, R. (2014). Role of preschoolers in motivation for physical activity in their families. *Polish Journal of Sport and Tourism, 21*(3), 151–162.

Piech, K., Nowak, K., Birontiene, Z., & Biteniece, I. B. (2013). Physical exercises for pre-school children with homework and parents' mobilization around these tasks. *Polish Journal of Sport and Tourism, 20*(3), 217–226.

Keywords: child, family, physical activity.

FITNESS TRENDS IN PORTUGAL FOR 2022: FITNESS CLIENTS' OPINION

Liliana Ramos, Rita Santos-Rocha, Fátima Ramalho, Isabel Vieira, Vera Simões, Susana Franco
Sport Sciences School of Rio Maior – Polytechnic Institute of Santarem, Portugal

Background. Annually, the American College of Sports Medicine publishes a study of global fitness trends (Thompson, 2021a, b). Studies reveal some differences in trends between different countries. In 2021, the first study on fitness trends in Portugal was carried out, with the opinion of professionals/students in the sector and fitness clients (Franco et al., 2021). In 2022, this study continued. In this way, the objective of the present study is to characterize the fitness trends for 2022, in Portugal, according to fitness clients, as well to compare these results with the opinion of professionals/students for 2022 and with clients in 2021.

Research methods. A sample of 114 fitness clients (70.2% female; 27.2% male), with mean age of 38.8 ± 10.9 years and experience as fitness practitioner of 11.4 ± 11.2 years, answer an online questionnaire, using SurveyMonkey platform, with questions about sociodemographic characterization and about fitness trends. This part was based in the fitness trends of the ACSM questionnaire in Europe in 2021. This instrument was translated, with experts, and the Crosstraining trend was included. For each of the 42 trends, a 10-level Likert scale was used: 1 – lowest tendency; 10 – highest tendency. Descriptive statistics were used to characterize the trends and the *t* test was used for comparisons between the two groups.

Results and discussion. In fitness clients' opinion, the top 5 fitness trends for 2022, in Portugal, are exercise for weight loss, healthy lifestyle and behavior change, employing certified fitness professionals, licenses for fitness professionals, and functional training. There were differences in 15 of the 42 trends between professionals/students and clients, but in the 10 most relevant there are 8 coincident. When comparing the opinion of fitness clients between 2021 and 2022 there were differences in 6 of the 42 trends, and on the 10 main trends identified in 2022 there are 7 coincident with 2021 (Franco et al., 2022). Valorization of educated professionals remains highlighted, and studies indicate that it is important for service quality (Ramos, Oliveira, Carvalhinho, & Franco, 2015). Considering that there is a large overweight and obese population in Portugal, it seems natural that clients consider exercise relevant trends for weight loss, behavior change and a healthy lifestyle.

Conclusions. Top fitness trends for 2022 in Portugal were identified by fitness clients. Although there were some differences in fitness trends between professionals/students and fitness clients, and between 2021 and 2022, there are some consistency in the results. Results should consider that the sample of this study is not representative of Portuguese fitness client's population.

References

Franco, S., Santos-Rocha, R., Ramalho, F., Simões, V., Vieira, I., & Ramos, L. (2021). Tendências do fitness em Portugal para 2021. *Cuadernos de Psicología del Deporte, 21*(2), 242–258. https://doi.org/10.6018/cpd.467381

Franco, S., Santos-Rocha, R., Ramalho, F., Simões, V., Vieira, I., & Ramos, L. (in press). *Tendências do fitness em Portugal para 2022*. Motricidade.

Ramos, L., Oliveira, R., Carvalhinho, L., & Franco, S. (2015). Competências e formação dos técnicos de exercício físico: Opinião dos diretores técnicos de ginásio. *Revista da UIIPS, 3*(3), 182–194. https://revistas.rcaap.pt/uiips/article/view/14390/10776

Thompson, W. R. (2021). Worldwide survey of fitness trends for 2021. *ACSMs Health Fitness Journal, 25*(1), 10–19. http://doi.org/10.1249/FIT.0000000000000631

Thompson, W. R. (2021). Worldwide survey of fitness trends for 2022. *ACSMs Health Fitness Journal, 26*(1), 11–20. https://doi.org/10.1249/FIT.0000000000000732

Keywords: Portugal, trends, fitness, ACSM, clients.

ASSOCIATIONS BETWEEN POSITIVE BODY IMAGE, PHYSICAL ACTIVITY AND DIETARY HABITS IN YOUNG ADULTS

Samrah Saeed

Lithuanian Sports University, Lithuania

Background. Young adults (18–35 years) are on a weight gain trajectory, which is placing them at increased risk of heart disease, cancer, and diabetes. Poor dietary behaviors among young adults, including low intake of fruit and vegetables, and high intake of foods prepared outside the home, and sugar-sweetened beverages, are key factors contributing to this weight gain trajectory. Changes in eating behavior and physical activity can solve these problems. In a recent review of body image studies among community samples of overweight children, all evaluated studies documented greater body dissatisfaction among heavier children and adolescents (Huang, Norman, Zabinski, Calfas, & Patrick, 2007). Managing weight is a big part of health. Changes in behavioral nutrition, physical activity are the ways to make long-lasting changes.

Research methods. The study was a cross-sectional observational quantitative study. STROBE (strengthening the reporting of observational studies in Epidemiology) guidelines for cross-sectional studies were used to carry out the entire study. The sample area was Pakistan. Study participants were young adult students, aged 18–35, both male and female. The questionnaire was created in Google Forms online survey platform. The link to the anonymous survey was distributed on social media such as WhatsApp and email.

Research Method Demographic factors: A range of self-reported demographic indicators was assessed: gender (male, female); age; level of education (School, College, University, Diploma); marital status (Single, Married, Others); having children (Yes, No); employment status (Student, Unemployed, Employed); weight (kg) and height (cm) for body mass index calculation. Positive body image: Positive body image was assessed by Body Appreciation Scale 2 (Tylkaa, Nichole, & Barcalow, 2015). It was used to assess a person's acceptance of the body, the degree of positivity, and respect for the body. It was rated on a 5-point Likert scale from 1 (Never) to 5 (Always). BMI: Sociocultural Attitude: Sociocultural Attitude 4 (SATAQ-4) was used in the appearance questionnaire (Joel Kevin Thompson Body Image Research Group) SATAQ-4 with subscales: internalization of thin and muscular body ideal and perceived pressures towards appearance from peers, media, and family. It was rated on a 5-point Likert scale from 1 (Definitely Disagree) to 5 (Definitely Agree). Dietary habits: To evaluate Dietary habits questions were based on the choice of food consumption frequency with values between 1 (do not consume) and 5 (consume) and will be obtained (Crovetto et al., 2018). Physical activity: The Godin leisure-time exercise questionnaire was used to test leisure-time exercise habits. 8 questions will be asked to identify meeting the new WHO physical activity recommendations (at least 150 minutes of moderate or 75 minutes of vigorous PA per week).

Results and discussion. Body image impacts the wellbeing of young adults. Physical activity and behavioral nutrition play an important role for positive body image in young adults. A more positive body image is associated with better self-esteem, quality of life, physical and emotional well-being, social competence, and self-care and with decreased rates of depression and anxiety (McLean, Paxton, & Wertheim, 2010). On the frequency of reported findings in the journal articles, participation in physical activity and sport was related to less negative and more positive body image. Negative body image was linked to lower physical activity and sport participation and was discussed qualitatively as a barrier to participation. Obtaining knowledge on how and why to employ a healthy lifestyle is a basic developmental need and an important tool for managing challenges arising from the current "obesity epidemic (Jessor, Turbin, & Costa, 2010). A healthy lifestyle, proper nutrition and physical activity have been found to be protective factors against many diseases, including cardiometabolic diseases, hypertension, various cancers, obesity and related diseases (Mokdad, Marks, Stroup, & Gerberding, 2004).

Conclusions. Physical dissatisfaction, diet, eating disorders and exercise disorders are found in young adults all over the world. Thorough nutrition helps people understand who they are by reassuring them that they are okay without judging or accepting themselves. Social media can positively influence body image in many ways. A healthy body image is important because it affect self- esteem, self-acceptance, and your attitude towards food and exercise.

References

Crovetto et al. (2018). *Effect of healthy and unhealthy habits on obesity: A multicentric study Global Physical Activity Questionnaire (GPAQ)*. Retrieved from https://www.who.int/ncds/surveillance/steps/resources/GPAQ_Analysis_Guide.pdf

Huang, J., Norman, G., Zabinski, M., Calfas, K., & Patrick, K. (2007). *Body image and self-esteem among adolescents undergoing an intervention targeting dietary and physical activity behaviors.* PubMed.

Jessor, R., Turbin, M. S., Costa, F. M. (2010). Predicting developmental change in healthy eating and regular exercise among adolescents in China and the United States: The role of psychosocial and behavioral protection and risk. *Journal of Research on Adolescence.*

McLean, S., Paxton, S., & Wertheim, E.(2010). *Factors associated with body dissatisfaction and disordered eating in women in midlife*. PubMed.

Mokdad, A. H., Marks, J. S., Stroup, D. F., & Gerberding, J. L. (2004). Actual causes of death in the United States, 2000. *JAMA: Journal of the American Medical Association*.

Tylkaa, T., Nichole, L., & Barcalow, W (2015). *What is and what is not positive body image? Conceptual foundations and construct definition*. ELSEVIR.

Keywords: body image, body appreciation, beauty ideals internalization, dietary habits, physical activity.

RELATIONSHIP BETWEEN PHYSICAL ACTIVITY, HEALTHY EATING, AND OBESITY

Umaid Hussain Siddiqui
Lithuanian Sports University, Lithuania

Background. Excess body weight is intimately linked to a lack of physical activity. Obesity rates in adults were significantly higher among sedentary men (27%) compared to moderately active (17%) and active individuals (20%), according to the 2004 Canadian Community Health Survey (Tjepkema, 2006). Obesity was also more common in sedentary (27 percent) and moderately active (21 percent) women than in active women (14 percent) (Tjepkema, 2006). Individuals with a high body mass index [(BMI, in kg of body mass (height in m)^2] are more sedentary than those with a lower BMI (Petersen, Schnohr, & Sørensen, 2004) according to the Copenhagen City Heart Study. However, the longitudinal portion of the study, which followed 5142 people for 15 years and evaluated them every 5 years, revealed some surprising results: 1) physical inactivity at one point in time was not linked to the development of obesity (OB), but 2) the development of OB was linked to a reduction in physical activity levels (Petersen et al., 2004).

Research methods. The study was a quantitative cross-sectional observational cross-sectional study. The entire study followed the STROBE (strengthening the reporting of observational studies in Epidemiology) standards for cross-sectional studies.

Results and discussion. Physical exercise appears to be a significant component of weight loss and maintenance lifestyle strategies. Despite the fact that the effects of physical exercise on weight reduction appear to be minor, a dose-response association between physical activity and weight loss appears to exist. Physical activity appears to be a vital behaviour for maintaining long-term weight loss and preventing weight gain. Patients with extreme obesity (BMI 35 kg/m^2) and patients who have undergone bariatric surgery both benefit from physical activity for weight loss. Furthermore, regardless of the effect of physical exercise on body weight, participation in physical activity that improves cardiorespiratory fitness can help overweight and obese people reduce their health risks. As a result, clinical weight-control therapies must include the progression of overweight and obese patients to a sufficient level of physical activity.

Conclusions. The overall goal of this research is to have a better understanding of the effects of OW and OB on motor activities in children. Section 2 attempts to provide broad information on anatomical and muscle peculiarities that must be taken into account for OW and OB individuals. The effect of excess body weight on three key daily living activities, standing, walking, and cycling, is then presented in Sections 3, 4, and 5, respectively. For each action, biomechanical and physiological concepts will be taught. This structure will make it easier to gain a better knowledge of the situation of OW and OB people doing these activities, which could aid in the creation of tailored solutions. The final section focuses on concepts that should be considered for program development and research areas that should be considered in the near future.

References

Petersen, L., Schnohr, P., & Sørensen, T. I. A. (2004). Longitudinal study of the long-term relation between physical activity and obesity in adults. *International Journal of Obesity*.

Tjepkema, M. (2006). Adult obesity. *Health Reports, 17*(3), 9–25.

Keywords: physical activity, healthy eating, obesity.

CONSEQUENCES OF COVID-19 PANDEMIC ON THE LEVELS OF PRIMARY SCHOOL CHILDREN PHYSICAL LITERACY

Monika Širkaitė, Rita Gruodytė-Račienė
Lithuanian Sports University, Lithuania

Background. The main goal of physical literacy (PL) is to increase the lifelong engagement in physical activity (PA). PL is a complex of variables such as motivation and confidence, physical competence, daily behavior, knowledge and understanding, in other words, being physically literate means to value and take responsibility in physically active lifestyle choices. Physical activity behaviors are being established in early years (Edwards et al., 2018), therefore, supporting PL at this age is crucially important considering the rising levels of physical inactivity (Emeljanovas et al., 2018) and the prevalence of obesity among schoolchildren (Ogden et al., 2016). Furthermore, due to COVID-19 pandemic restrictions and online learning children PA level has decreased while sedentary time has increased severely (Zenic et al., 2020). The aim of this investigation is to evaluate the level of PL of primary school children and to compare results with their counterparts evaluated in 2019 (before COVID-19 restrictions) described elsewhere (Širkaitė & Gruodytė-Račienė, 2021) to test the hypothesis that primary schoolchildren PL is of average level and the results are lower in all PL domains.

Research methods. In this cross-sectional pilot study all the 3rd grade students (n = 100, of them 50 were girls) of one school in Kaunas city were recruited to assess their PL. Body height and weight were measured to calculate body mass index (BMI). The Netherland Physical Activity Questionnaire (NPAQ) was used to assess what activities kids prefer to do in their free time. Norwegian Physical Fitness Test Battery for Children was used to evaluate explosive power (standing broad jump), leg muscle power and coordination (jumping 7 m distance on one and two legs), cardiorespiratory fitness (6 min endurance run), and arm muscle power (throwing 1 kg medicine ball). According to the reference scales of Lithuanian schoolchildren, physical competence results met either minimal, average, or maximal level. The Canadian Assessment of Physical Literacy (CAPL) questionnaire was used to examine Motivation & Confidence as well as Knowledge & Understanding domains of PL. The scores in these domains are attributed to one of the four categories: Beginning, Progressing, Achieving, and Excelling. All the results of this study 2022 were compared with the analogical study conducted in 2019 (before COVID-19 restrictions) with 93 participants of the same age (3rd grade students) of the same school (Širkaitė & Gruodytė-Račienė, 2021).

Results and discussion. The Motivation & Confidence score indicates that participants were only at Beginning and Progressing stage (41.2% and 57.6%, respectively). Similarly, the majority of the respondents have not yet reached an acceptable level of PL in Knowledge & Understanding domain: 11.8% and 55.3% of participants were only at Beginning and Progressing stage, respectively; although 21.2% have reached an adequate level, and 11.8% even a highest level of PL. Physical competence of the majority of primary school children in the study of 2022 were of average level in explosive power, leg muscle power & coordination, arm muscle strength, and endurance. With regard to gender, the significant differences were found in health-related physical fitness: boys had greater arms muscle strength. The mean score of leisure time PA of primary schoolchildren was 23.8 ± 3.8 (of max. 35) points, and no significant differences by gender were found. Compared with 2019 study results, children PL had significantly decreased in some domains: physical competences were significantly lower in explosive power, leg muscle, and arm muscle strength; although no significant difference were found in endurance. PA of 3rd graders in 2022 was also lower ($p < 0.05$) compared to their counterparts in 2019 (23.8 ± 3.8 and 25.6 ± 4.7, respectively). Motivation & Confidence as well as Knowledge & Understanding scores were also lower compared to 2019 study, although differences noticed were not significant.

Conclusions. As the consequence of COVID-19 pandemic restrictions and online learning, PA and physical competence of the majority of primary schoolchildren were of average level. Most of the 3rd graders have not yet reached an acceptable level of PL in Motivation & Confidence as well as Knowledge & Understanding domains, i.e. the majority of primary schoolchildren being at Beginning and Progressing stage, only. Compared with 2019 study ("pre-covid generation") results, primary schoolchildren PL in 2022 has significantly decreased in daily behavior and physical competence domains.

References

Edwards, L. C., Bryant, A. S., Keegan, R. J., Morgan, K., Cooper, S. M., & Jones, A. M. (2018). 'Measuring' physical literacy and related constructs: A systematic review of empirical findings. *Sports Medicine, 48,* 659–682.

Emeljanovas, A., Mieziene, B., Gruodyte-Raciene, R., Sukys, S., Rutkauskaite, R., Trinkuniene, L., Fatkulina, N., & Gerulskiene, I. (2018). Results from Lithuania's 2018 Report Card on Physical Activity for Children and Youth. *Journal of Physical Activity and Health, 15*(Suppl 2), S382–S383.

Ogden, C. L., Carroll, M. D., Lawman, H. G., Fryar, C. D., Kruszon-Moran, D., Kit, B. K., & Flegal, K. M. (2016). Trends in obesity prevalence among children and adolescents in the United States, 1988–1994 through 2013–2014. *The Journal of the American Medical Association, 315*(21), 2292–2299.

Širkaitė, M., & Gruodytė-Račienė, R. (2021). Physical education role in Lithuanian primary schoolchildren physical literacy formation. *Human, Technologies and Quality of Education,* 1063.

Zenic, N., Taiar, R., Gilic, B., Blazevic, M., Maric, D., Pojskic, H., & Sekulic, D. (2020). Levels and changes of physical activity in adolescents during the COVID-19 pandemic: Contextualizing urban vs. rural living environment. *Applied Sciences, 10,* 3997.

Keywords: physical literacy, health-related physical fitness, physical activity behavior, COVID-19 restrictions of schooling, primary education.

THE EFFECT OF PHYSIOTHERAPY PROGRAM USING THERAPEUTIC BALLS ON THE BALANCE AND POSTURE OF PRESCHOOL CHILDREN

Jolanta Tirevičiūtė, Jūratė Požėrienė
Lithuanian Sports University, Lithuania

Background. Many studies show that children spend more than 7 hours a day in a sitting position or in front of computers at home. At that time, their posture is affected by furniture. Ordinary furniture is made for adults and it is difficult to adjust height for children, what might cause posture problems (Perić, Stojanović, Pavlovic-Veselinovic, Ilić, & Stojanovic, 2015). Posture is strongly related to balance. The development of these systems also improves the child's motor and sensory functions (Barozzi et al., 2014). Exercises with a therapeutic ball activates the core muscles, which help maintain core stability (Muniyar & Darade, 2018). The aim of this study is to evaluate the effect of physiotherapy program using therapeutic balls on the balance and posture of preschool children.

Research methods. The study included 120 preschool children from 3 to 5 years old. The main inclusion criteria were age (3–5 years old), health (only healthy children), attending the same pre-school. Groups were divided in experimental (n = 60) and control (n = 60) group. Experimental group received physiotherapy program using therapeutic balls for 17 months. Exercises included strength, balance, flexibility training. Control group had activities as usual with their teachers. Two evaluations were performed in the study: posture (using W. K. Hoeger posture assessment methodology) and balance (balance coordination test). The evaluations were performed at the beginning of study, after 8 months and at the end of study.

Results and discussion. The results of independent *t* test showed a significant difference in posture between experimental and control groups after 8 months and in the end of study ($p < 0.05$). In addition to this, there are significant changes in balance between groups in the end of study ($p < 0.05$), however there are no significant changes in balance between both groups after 8 months ($p > 0.05$). Preschool children usually have physical activity twice a week. Most of the time children spend inside the building with limitation to run around. Physiotherapy programs were made to improve strength, balance and flexibility. After 8 months more balance training activities were included to the program, that might improve balance results.

Conclusions. Many studies show that any physical activity improves posture and balance for children but also it is important to choose targeted physiotherapy program to prevent postural disorders (Dobbins, Corby, Robeson, Husson, & Tirilis, 2009). The results of the study show that after 8 months of the physiotherapy program, using therapeutic balls, the children's posture improved in the experimental group, and at the end of the study, the balance and posture improved compared with the control group. Physiotherapy program using therapeutic balls might be beneficial to improve posture and balance in preschool children.

References

Barozzi, S., Socci, M., Soi, D., Di Berardino, F., Fabio, G., Forti, S., Gasbarre, A. M., Brambilla, D., & Cesarani, A. (2014). Reliability of postural control measures in children and young adolescents. *European Archives of Oto-Rhino-Laryngology: Official Journal of the European Federation of Oto-Rhino-Laryngological Societies (EUFOS): Affiliated with the German Society for Oto-Rhino-Laryngology – Head and Neck Surgery, 271*(7), 2069–2077. doi:https://doi.org/10.1007/s00405-014-2930-9

Dobbins, M., Corby, K. C., Robeson, P., Husson, H., & Tirilis, D. (2009). School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6–18. *Cochrane Database System Review, 1*(1). https://doi.org/10.1002/14651858.CD007651.pub2

Muniyar, K. D., & Darade, S. B. (2018). Effect of swiss ball training and conventional physiotherapy to improve balance and mobility in post-stroke patients. *International Journal of Physiotherapy and Research, 6*(3), 2813–2822. doi:10.16965/ijpr.2018.156

Perić, D., Stojanović, D., Pavlovic-Veselinovic, S., Ilić, D., & Stojanovic, T. (2015). The effects of an ergonomic exercise program with a pilates ball on reducing the risk of the incidence of musculoskeletal disorders. *Series: Physical Education and Sport, 13,* 383–391. Retrieved from: https://www.researchgate.net/publication/296061616_THE_EFFECTS_OF_AN_ERGONOMIC_EXERCISE_PROGRAM_WITH_A_PILATES_BALL_ON_REDUCING_THE_RISK_OF_THE_INCIDENCE_OF_MUSCULOSKELETAL_DISORDERS

Keywords: posture, preschoolers, balance, therapeutic ball, physiotherapy.

THE EXPRESSION OF QUALITY OF LIFE OF ATHLETIC STUDENTS AND NON-ATHLETIC STUDENTS

Eimis Vengrauskas, Audronė Dumčienė
Lithuanian Sports University, Lithuania

Background. Quality of life influences people's level of satisfaction as well as the efficiency of their activities (Caponnetto, Magro, Inguscio, & Cannella, 2018). Fostering health and well-being can be perceived as a health-related quality of life (Ridner, Newton, Staten, Crawford, & Hall, 2016). Health-related research has played an important role in shaping positive health behaviors (Snedden et al., 2019). A person's quality of life is largely determined by their physical activity and health (Leifa & Zheleznyak, 2017). Good physical health and well-being is connected to a sense of motivation, because, as Deci and Ryan (2000) point out, intrinsic motivation occurs when an activity provides pleasure, while extrinsic motivation involves external goals such as health or social acceptance.

Research methods. To assess the quality of life of students Health-Related Quality of Life Assessment Questionnaire SF-36 was used and eight summary indicators were assessed. Respondents' demographic information was also recorded. All subjects participated in the study voluntarily. All of them gave their consent to participate in the study. Each participant was provided with information about the purpose of the study and the use of the results as well as given the right to withdraw from the study at any time. Twenty athletic and twenty non-athletic students were surveyed. The level of statistical confidence was $p < 0.05$.

Results and discussions. The results of research are shown in Table.

Table. Estimates of quality of life athletic and non-athletic students

Sub-scale	Athletic (n = 20)	Non-athletic (n = 20)	p
	M (SD)	M (SD)	
Physical activity	95.5 (6.67)	88.5 (9.88)	2.63*
Activity restriction due to physical ailments	182.5 (25.78)	174.25 (33.99)	.865
Activity restriction due to emotional disorders	166.67 (43.26)	160.0 (42.72)	.490
Pain	75.56 (18.94)	76.50 (19.59)	.337
Social function	48.89 (9.12)	46.11 (15.41)	.694
Energy / vitality	50.5 (7.76)	44.75 (6.17)	2.593*
Emotional state	42.8 (8.81)	37.4 (5.70)	2.301*
Overall health assessment	65.5 (8.09)	60.75 (14.71)	1.265

Note. * – $p < 0.05$.

Athletic students had statistically significant ($p < 0.05$) higher physical activity, energy / vitality, and better emotional state scores. Athletic students have a higher and overall health assessment score, but not significant. The results of our study confirm the opinions of other researchers (Ronkainen, Aggerholm, Ryba, & Allen-Collinson, 2021) who state that sport has a positive effect on student quality of life assessment.

Conclusions. Athletic students rate their quality of life significantly higher than students who do not play sports.

References

Caponnetto, P., Magro, R., Inguscio, L., & Cannella, M. C. (2018). Quality of life, work motivation, burn-out and stress perceptions benefits of a stress management program by autogenic training for emergency room staff: A pilot study. *Mental Illness, 10*(2), 67–70.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*(4), 227–268.

Leifa, A., & Zheleznyak, Y. (2017). Influence of physical activity on students' life quality. *Physical Education of Students, 21*(5), 244–248.

Ridner, S. L., Newton, K. S., Staten, R. R., Crawford, T. N., & Hall, L. A. (2016). Predictors of well-being among college students. *Journal of American College Health, 64*(2), 116–124.

Ronkainen, N. J., Aggerholm, K., Ryba, T. V., & Allen-Collinson, J. (2021). Learning in sport: From life skills to existential learning. *Sport, Education and Society, 26*(2), 214–227.

Snedden, T. R., Scerpella, J., Kliethermes, S. A., Norman, R. S., Blyholder, L., Sanfilippo, J., & Heiderscheit, B. (2019). Sport and physical activity level impacts health-related quality of life among collegiate students. *American Journal of Health Promotion, 33*(5), 675–682.

Keywords: quality of life, athletic student, non-athletic student.

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Lithuanian Sports University, Sporto str. 6, LT-44221 Kaunas, Lithuania
www.lsu.lt; e-mail: lsu@lsu.lt