The 28th Symposium of the International Council for Physical Activity and Fitness Research (ICPAFR)

Physical Activity and Fitness: Challenges and New Perspectives

BOOK OF ABSTRACTS

August 24–27, 2016, Kaunas, Lithuania

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Lithuanian Sports University

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The 28th Symposium of the International Council for Physical Activity and Fitness Research

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KEYNOTE SPEAKERS

KEYNOTE 1

Brian Martin, MD MPH

BIOGRAPHY

Brian Martin received his MD in 1990 from the Medical Faculty of the University of Basel and his Master of Public Health in 1996 from the Harvard School of Public Health. He qualified as a specialist in Prevention and Public Health FMH (Swiss Medical Association) in 1997 and holds the Certificate of the Swiss Society for Sports Medicine (SSSM). Since 2012 he has a postdoctoral lecture qualification ("Venia Legendi" as "Privatdozent") in Social and Preventive Medicine (Preventive Medicine and Public Health) at the University of Zurich. Since 2014, he is "Kantonsarzt" (Chief Medical Officer) of the canton of Basel-Country in Switzerland. From 2009 to September 2015 he was the head of the Physical Activity and Health Unit at the Epidemiology, Biostatistics and Prevention Institute EBPI (formerly Institute of Social and Preventive Medicine ISPM) of the University of Zurich where he continues to work.

Brian Martin was in charge of the Network HEPA (Health-Enhancing Physical Activity) Switzerland from its foundation in 1999 until 2004. In the year 2000, he was the chair of the working group on "health promotion through physical activity and sports" for the "Concept for a National Sports Policy in Switzerland". He has served in several national and international expert groups including the Expert Committee for WHO Europe's Ministerial Conference on Counteracting Obesity 2006. From 2005 to 2009 he was the Chairman of HEPA Europe, the European Network for the Promotion of Health-Enhancing Physical Activity, from 2010 to 2014 the Chairman of Agita Mundo, the global network for physical activity promotion.

Brian Martin's main research interests are population-based interventions for physical activity promotion as well as approaches to prevention and health promotion in health care. This includes studies on patterns and determinants of health behaviour, the effectiveness of approaches and interventions as well as the development and implementation of strategies and policies.

PHYSICAL ACTIVITY PROMOTION IN THE CONTEXT OF OVERALL HEALTH POLICY

Brian Martin

University of Zurich; Office of Public Health, Canton of Basel-Country, Switzerland

Great improvements in the fight against infectious diseases and improvements in living conditions have led to a situation where non-communicable diseases (NCDs) have become a great concern for many countries and their health systems. The World Health Organisation defines four big groups of NCDs (cardiovascular diseases, cancer, diabetes type 2 and chronic obstructive pulmonary diseases), three more groups could also be included: mental health disorders, cognitive disorders and degenerative diseases of the musculoskeletal system. In some countries, these diseases are already responsible for more than 50% of health costs. In view of limited resources in the health system, prevention of NCDs becomes a priority and heath behaviour inducing physical activity behaviour has a key role in this respect.

The benefits of a physically active lifestyle on an individual's health have been clear for quite some time, and recent research has focussed on the effectiveness of interventions to reach population groups and to improve their physical activity behaviour. The International Society for Physical Activity and Health ISPAH and its advocacy council GAPA have defined 7 "best investments" for the promotion of physical activity at the population level: schools, transport, urban planning, the health system, public education, integrated community-wide programmes and sport for all. In Vilnius in 2015, WHO has agreed on a Physical activity strategy for the WHO European Region and now urges member states to develop their own strategies and activities. HEPA Europe, WHO's European network for the health-enhancing physical activity, facilitates the exchange between experts in the field and provides support for the development of strategies and activities. Physical activity also has many other benefits in addition to NCD-prevention, and so has the potential to reach further segments of the population and to have a positive impact on health at the population level.

Keywords: *health policy, physical activity, non-communicable diseases (NCD).*

KEYNOTE 2

Andrew P Hills, PhD AEP FASMF

BIOGRAPHY

Professor Andrew Hills was appointed to his new role at the School of Health Science – University of Tasmania in 2016 having been Professor of Allied Health Research, Mater Research Institute – University of Queensland since 2011. Previously he was Professor of Energy Metabolism at Queensland University of Technology. Prof. Hills is a past Co-Director of the Australasian Child and Adolescent Obesity Research Network (ACAORN) and a former President of the Australia and New Zealand Obesity Society (ANZOS). He has completed numerous research consultancies with the International Atomic Energy Agency (IAEA), World Health Organization (WHO), and International Olympic Committee (IOC), and advised governments and health systems in many jurisdictions. Prof. Hills has published over 230 peer-reviewed papers and reviews, 28 book chapters, and authored or edited 10 books. Andrew is a Fellow of Sports Medicine Australia and an Accredited Exercise Physiologist (AEP).

Prof. Hills is a world-leading clinician, researcher and advocate in public health having primary research interests in physical activity and health, particularly the prevention and management of obesity and related conditions. He has made major global contributions in the obesity field, including the assessment of body composition and energy expenditure using stable isotope techniques. His work has played an integral role in the development of safe and effective treatments and innovative research involving the needs of the overweight and obese. The result has been the creation and evaluation of novel nutrition and exercise approaches to weight management, including the prevention of weight gain and regain.

EFFECTIVE EXERCISE INTERVENTIONS FOR OBESITY AND TYPE 2 DIABETES

Andrew P. Hills

University of Tasmania, Australia

Lifestyle interventions, with a focus on increased engagement in physical activity and exercise, have often been described as public health's 'best buy' or 'best bet'. In this context, such interventions are potentially potent for the prevention and management of obesity, type 2 diabetes (T2DM) and related chronic conditions. Despite a growing body of evidence to support the physical, social and mental health benefits associated with participation in regular physical activity and exercise, lifestyle practices of many individuals in developing and developed countries are suboptimal. Poor lifestyle characteristics typically include low levels of habitual physical activity, increased sedentary time and a poor diet in combination with overweight and obesity – in short, a recipe for T2DM. High-risk groups for T2DM include the obese, those with high blood pressure, existing heart disease or strong family history of diabetes, Indigenous populations, women with a history of gestational diabetes, and various ethnic groups, including south Asians. A major challenge is to propose the optimal combination of exercise and diet, including modality of exercise and composition of diet, to provide the greatest therapeutic benefit. This presentation explores lifestyle modification, specifically exercise intervention approaches for obesity and T2DM, in the context of various sociocultural and environmental challenges.

Keywords: *exercise, overweight and obesity, physical activity, type 2 diabetes.*

KEYNOTE 3

Dale Esliger, PhD

BIOGRAPHY

Dr. Esliger has world leading expertise in his field, and has already published over 50 manuscripts (H-Index 17) and been involved in numerous research and enterprise collaborations attracting funding exceeding £2.5M. As the founder of the Physical Activity and Public Health Research Group, he is currently supervising 9 PhD students and 1 postdoc. Dr. Esliger has been the lead consultant for national surveys and international consortia that have used objective sensors (Health Survey for England, Framingham Heart Study, Canadian Health Measures Survey, International Children's Accelerometry Database) and has collaborated in the development of several novel measurement devices which have gone through to market. He has gained experience in academia, industry (e.g., Unilever, Philips, ActivInsights, TTP, Technogym, Canadian Para-Nordic Skiing, KineSoft, Lumo) and government. Dr. Esliger is currently working with colleagues in engineering to develop a wrist worn optical heart rate sensor aimed at the sport and fitness market.

Dr. Esliger's research focuses on enhancing the accelerometry based measurement of physical activity and sedentary behaviour. Recently, he has incorporated non-invasive, continuous physiological sensing into his research in an effort to develop more sophisticated physical activity and sedentary behaviour measurement methodologies/technologies to advance our understanding of the interplay between physical activity, sedentary behaviour, and health.

OPPORTUNITIES IN "LIFESTYLE MEDICINE": INTEGRATING CONTINUOUS, NON-INVASIVE MEASURES TO ACHIEVE MORE POTENT BEHAVIOUR CHANGE

Dale Esliger

Loughborough University, UK

After years of waiting in the wings, physical activity has recently taken centre stage in the world of **sport, exercise, and health science**. In a UN High Level Meeting in September, 2011, the World Health Organisation (WHO) made a Political Declaration on the Prevention and Control of Non-communicable Diseases (NCD). NCDs, principally cardiovascular diseases, diabetes, cancers and chronic respiratory diseases, are the leading causes of preventable morbidity and disability, and currently cause over 60% of global deaths. This landmark meeting elevated NCDs to the highest level of leadership at global, national and local levels to foster whole of government, cross sector collaboration in all aspects of health.

The WHO has put together a comprehensive global monitoring framework, including indicators, and a set of voluntary global targets for the prevention and control of NCDs. For the first time, physical activity has been included in the targeted constellation of health risk factors, alongside smoking, blood pressure and diet. To help achieve targets, the WHO has indicated that improving country-level surveillance and monitoring should be a top priority.

A novel way to accomplish this would be to design a **War Room for Physical Activity Surveillance/Research.** Perhaps the best way to explain this ambitious idea is to seed your imagination with a picture in your mind of the NASA Mission Control room. Control rooms such as these are not uncommon in the communicable disease realm (think of SARS and West Nile outbreaks); however, to our knowledge, nothing like this has been proposed to tackle NCD's (i.e., chronic disease; long term conditions; lifestyle disease).

Therefore, the main aim of this presentation will to showcase novel, adaptable, scalable, unobtrusive technologies and systems that quantify movement behaviours linked to relevant health outcomes with the expressed intent to facilitate a step change in understanding lifestyle behaviour change.

Keywords: *physical activity, sedentary behaviour, sensors, feedback, self-monitoring.*

SYMPOSIUM SESSION 1

Chairs: **Dr. Brian Martin (Switzerland)**
Prof. Dr. Saulius Šukys (Lithuania)

HEALTH PROMOTING UNIVERSITIES ACT FOR THE IMPROVEMENT OF POPULATION'S HEALTH

Irena Misevičienė, Rasa Jankauskienė, Saulius Šukys

Lithuanian Sports University, Kaunas, Lithuania

Background. An International Okanagan Charter (2015) for Health Promoting Universities and Colleges (HPU) states that the vision and the aim of HPU is: *"To transform the health and sustainability, the current and future societies, to strengthen communities and to contribute to the well-being of people, places and the planet"*. Being a member of Lithuanian network of HPU since 2015, Lithuanian Sports University (LSU) is going to solve such two main objectives as to embed health into all aspects of campus culture, across the administration, operations and academic mandates and to lead health promotion action and collaboration locally and globally.

Methods. HPU network follows the recommendations of International movement of HPU and the main principles of the actions mentioned in the Okanagan charter. Lithuanian HPU network includes three Universities – LSU, Aleksandras Stulginskis University (ASU) and Klaipėda University (KU). In 2015 universities adopted HPU Constitution. The Constitution describes the governance and actions of HPU network.

Results. The HPU action programme for three years was elaborated. LSU is going to plan the actions in two directions: (1) health in all university policies; (2) leadership in health promotion. Health enhancing physical activity (HEPA) at personal, group and community levels is the focus of actions. One of the elements of HPU programme is evaluation. The survey of LSU students and academic staff is planned in June. The first results of the pilot survey of students will be presented.

Conclusion. Ideology of HPU development is the example of good practice to implement new European health policy "Health 2020" and it is as an added value of sustainable development goals achievement in Lithuania.

Keywords: *health promotion, policy, health enhancing physical activity (HEPA).*

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HEALTH PROMOTION AMONG STUDENTS: ROLE OF THE UNIVERSITY

Ramunė Žilinskienė, Laima Galkutė

Vilnius University, Vilnius, Lithuania

Background. Quality of life and health of people in particular are in the centre of sustainable development strategies. The world community has just agreed to a post-2015 development agenda (UN, 2015) including the goal to ensure healthy lives and promote wellbeing for all ages recognizing the dependence of health on a range of social interventions and the life supporting ecosystems of the planet. The presentation is dedicated to discuss both current situation and a perspective for student health promotion based on the paradigm of sustainable development at Vilnius University.

Methods. The survey was carried out applying a standardized questionnaire. In total, 464 full-time students of the first cycle were involved, representing four study fields: social, physical, biomedical sciences as well as the humanities. The 'LimeSurvey' platform was used for data collection.

Results. Health as the main criterion of the quality of life was chosen by 86.2% of students. All in all, students' opinions reflect a good balance between materialistic and post-materialistic (post-modern) values. However, physical elements of health, such as regular physical activity, nutrition and prevention of addictions, dominate in defining essential factors in health promotion. Social environment, psychological wellbeing and ecological conditions are not considered as that important. Students noticed their expectation of fitness services adapted to their individual health situation, provision of reliable information as well as proactive role of university in health promotion through teaching and research. When assessing contribution of studies to their personal development, students stressed enhancement of self-confidence, abilities of problem solving, self-expression and communication. On the other hand, a sense of personal responsibility for health and environment (ecology) got the lowest scores.

Conclusion. Health promotion could not be possible without considering health as an integral component of the quality of life. University authorities shall rethink its role and strategy in providing transformative education not only in relation to health issues, but also in favour of transition towards more sustainable society. A concept of health promoting university as presented in the Okanagan Charter (2015) could be considered as an attractive opportunity to integrate health, well-being and sustainability into multiple activities of university.

Keywords: *health promotion, physical activity, sustainable development, rethinking university.*

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THE RELATIONSHIP OF CHILDHOOD FITNESS TO EXECUTIVE FUNCTIONS: A SYSTEMATIC REVIEW

Tineke Mariën

Ghent University, Ghent, Belgium

Background. Children are becoming increasingly inactive and unfit due to the upcoming sedentary technologies and declines in community-based physical exercise (Tomkinson & Olds, 2007; Huybrechts et al., 2010). This lifestyle change does not only impact physical health, but also seems to affect cognitive health. Several cross-sectional studies suggest that cardiorespiratory fitness is related to increased levels of cognitive performance in elderly (Bherer et al., 2013). The aim of this systematic review was to provide an overview of relevant empirical studies and clarify the relationship between physical fitness and executive functions in children (0–18 years of age).

Methods. A systematic literature search was conducted in the electronic databases PubMed, Web of Science and SPORTDiscus for relevant studies reporting on the relationship between childhood fitness and executive functions. Cross-sectional studies were selected and evaluated on their methodological quality with a checklist of the Dutch Cochrane Center. Outcome parameters were selected for each executive function task and reported for three main domains of executive functioning: inhibition, working memory and cognitive flexibility.

Results. Findings suggest a positive relationship between physical fitness and specific domains of executive functioning. The included studies reported increased inhibition, set-shifting and non-verbal working memory in children with higher aerobic fitness levels. Tasks requiring a higher level of inhibitory control appear to be more sensitive to changes related to physical fitness levels. Response accuracy seems to be more influenced by aerobic fitness then response time in inhibitory control and switch tasks.

Conclusion. A growing body of research suggests a beneficial relationship between physical fitness and executive functioning in children. However, good quality randomized-controlled trails are necessary to establish a causal link between these constructs.

Keywords: *systematic review, physical fitness, executive function, children, adolescents.*

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PHYSICAL ACTIVITY, SPORTS, PERSONALITY: BEING PHYSICALLY INACTIVE INCREASES EXPOSURE-ADJUSTED INJURY RISK IN YOUNG MEN

Eva Martin-Diener, Simon Foster, Meichun Mohler-Kuo, Brian Martin

University of Zurich, Zurich, Switzerland

Background. Physical activity (PA) is important for health, but injuries are a concern, particularly in males and young adults. Up to 50% of all injuries in this age group are sports-related. However, it is not clear how levels of PA or sports affect total injury risk: it has been suggested that PA could protect from injuries occurring in other settings. Little is known about associations between personality variables such as sensation seeking or aggression and injuries in the context of PA and sports. This study aimed at investigating the complex relationships between PA, sports, personality variables and injury risk in young men.

Methods. Baseline and 15-month follow-up data were used from a large cohort study surveying young Swiss men (C-SURF study). Risk factors assessed at baseline were level of PA (IPAQ-short), frequency of sports participation and levels of sensation seeking (Brief Sensation Seeking Scale) and aggression (Zuckerman-Kuhlman Personality Scale). The outcome was the number of injuries during the past 12 months, reported at follow-up. Data were available for 4695 men (mean age 21.3 years). Poisson regression was used to assess injury risk as incidence rate ratios (IRR) in subgroups while accounting for exposure to moderate-to-vigorous PA (MVPA).

Results. Even 48.6% of the participants reported at least one injury for the previous 12 months. After accounting for exposure to MVPA in the multivariate model, the most inactive individuals had the highest injury risk and those with high levels of PA and sports participation once per week the lowest (IRR(active vs. inactive) = 0.14 [0.12-0.16]). Higher levels of sensation seeking increased IRR marginally, but there was no association between aggression and injury risk.

Conclusion. Injury risk is high in young men. Being inactive is a strong injury risk factor when exposure is taken into account. The role of the personality variables is less clear.

Keywords: *young men, physical activity, personality, injuries, incidence rates.*

INFLUENCE OF UNORGANIZED PHYSICAL ACTIVITY ON PERFORMING FOOTBALL MOTOR SKILLS IN ORGANIZED PHYSICAL EDUCATION CLASSES

Durdica Miletic, Petra Mandic Jelaska, Jelena Pausic

University of Split, Split, Croatia

Background. Insufficient physical activity of young children becomes a major problem of societies all over the world. Numerous investigations pointed out relation of children's activities with their future health status (Sallis at al., 2000) and specially obesity of children (Krebs et al., 2003). Inactivity in childhood can result in a failure to develop fundamental movement skills (FMS), and undeveloped FMS in proper age can affect motor learning and motor performance in organized physical education (PE) classes (Culjak et al., 2014).

The main aim of investigation was to establish relations between unorganised daily physical activity/inactivity and football skill performance in organized PE classes.

Methods. As many as 79 children aged 8–10 years, 41 girls and 38 boys, were included in this investigation. Physical activity and inactivity was evaluated by using a proxy-questionnaire "Netherlands Physical Activity Questionnaire˝ (NPAQ). Performance of four basic football skills (foot instep kick, ball head kick without jump, leading the ball with mid-ridge and deception fake shot) were videotaped and later assessed individually by three experienced PE teachers. Football skills were divided into 7 segments. A score of 0 was given if the segment was missing from the performance or was not performed correctly, a score of 1 if the segment was performed with some mistakes, and a score of 2 if the segment was performed correctly. To establish an overall performance score, the sum of the 7 segment scores was taken.

Results. Between-subjects reliability (Cronbach's Alpha coefficient from .97 to .99) and within-subject reliability (coefficient of variance from 33.87 to 47.57) were analysed for four football skills. An independent - sample *t*- test revealed differences between boys and girls in performing all four football skills all in favour of boys. Unorganized daily activity of children positively correlated with their mastering of football skills in three of four tests. Daily inactivity negatively correlated with two of four football tests.

Conclusion. The obtained results imply that an increase of children's unorganized daily activities can improve the mastering of motor skills in PE classes. More information about the content of daily unorganized activity is necessary for conducting more effective organized physical activity.

Keywords: *football skills, topological skill assessment, gender differences.*

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ASPECTS OF THE SELF-REFERENT THOUGHT IN ITALIAN SPELEOLOGISTS

Franco Viviani, Tommaso De Vivo

University of Padova, Padova, Italy

Background. Some aspects of the Self-Referent Thought such as Body Image (BI) and Body Satisfaction (BS) are not well known in subjects widely using their bodies for working or leisure purposes. It is hypothesized that they are less biased that those commonly found in literature.

Methods. In order to gain insights on BI and BS, modified versions of the Fallon and Rozin's Test (1988) test and the Body Part Satisfaction Scale were administered online to a cohort of Italian professional speleologists (189 males and 69 females aged 18–68 years, belonging to most of the Italian regions). Vital statistics and curricular data, height and weight and the degree of physical activity carried out weekly were ascertained with questionnaires. Subjects were subdivided on the basis on the level of performance reached, after a thorough scrutiny of their previous curricula. Data were compared with those available in literature for Italians.

Results. On the average, speleologists tended to conform to their imagined professional body typology, even if their ideal physique for cave explorers was more ectomorphic. Despite the high physical variability found, these professionals detained a correct vision of their bodies and showed a good degree of satisfaction regarding their own body and its different parts.

Conclusion. On the average, speleologists tend to conform to their imagined professional body typology, even if their ideal physique for cave explorers is more ectomorphic. Despite the high physical variability found, these professionals detain a correct vision of their bodies and show a good degree of satisfaction regarding their own body and its different parts.

Keywords: *body image, body satisfaction, speleologists.*

SYMPOSIUM SESSION 2

Chairs: **Prof. Dr. Andrew P. Hills (Australia)**
Prof. Dr. Arvydas Stasiulis (Lithuania)

THE IMPACT OF ENDURANCE EXERCISE (TRAINING) IN FASTED VS. FED STATE IN HEALTHY SUBJECTS AND TYPE 2 DIABETES ON GLYCEMIC CONTROL AND INSULIN SENSITIVITY: A SYSTEMATIC REVIEW

Dorien De Strijcker[1], Patrick Calders[1], Dominique Hansen[2]

Ghent University[1], Ghent, Belgium; Hasselt University[2], Diepenbeek, Belgium

Background. In healthy individuals (HI), certain muscular adaptations emerge during acute endurance exercise (AEE) in fasted state that may lead to greater improvements in insulin sensitivity and/or glycemic control, as opposed to AEE in fed state (Hansen et al., 2010; Umpierre et al., 2013; Van Proeyen et al., 2011). However, it remains uncertain whether endurance exercise (training) (EET) in fasted vs. fed state would lead to greater improvements in glycemic control and insulin sensitivity in HI and type 2 diabetes mellitus (T2DM) patients (Schisler & Ianuzzo, 2007). Therefore, the aim of this systematic review was to examine the impact of AEE and EET in fasted vs. fed state on insulin sensitivity and glycemic control in HI and T2DM patients.

Methods. A systematic literature search was conducted in MEDLINE, Web of Science, and SPORTDiscus, using keyword combinations derived from the research question. Clinical trials that directly compared the effects of AEE or EET in postprandial vs. fasted state in HI or T2DM patients were included and evaluated on their methodological quality. Outcome parameters were concentrations of glucose, insulin, free fatty acids, and glycated hemoglobin (HbA1c) content.

Results. No full consensus was found for the metabolic responses, among the 11 articles on AEE in HI (AEE-HI). However, the most frequent reported pattern, independent from exercise timing, was a decreased glycaemia and insulinemia, and increased FFA-concentration. Six studies evaluated AEE in T2DM. It was impossible to detect a general pattern for fasted AEE since HbA1c and pre-exercise glucose levels might influence the glucose response, while the insulinemia remained preserved and FFA increased or remained constant. Independently of baseline HbA1c, the AEE-HI pattern was found in fed T2DM. EET did not influence the acute metabolic response pattern in postprandial state in HI, since this remained identical pretraining to posttraining. This pattern was in line with that found for AEE-HI. Fasted EET resulted in the AEE-HI pattern pretraining but evolved posttraining into a stable glycaemia and insulinemia. No publications were found for EET in T2DM.

Conclusion. Findings are very inconsistent within both populations and also in exercise volumes (AEE or EET), mainly due to large heterogeneity in exercise protocols, measurement techniques/timings and nutrition. Research is absolutely necessary for EET in T2DM.

Keywords: *endurance exercise, fasted state, fed state, insulin sensitivity, glycaemic control.*

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CARDIORESPIRATORY FITNESS AND PHYSICAL ACTIVITY LEVEL CHANGES AFTER 12 WEEKS EXERCISE INTERVENTION IN BLACK AFRICAN POPULATION

Nauris Tamulevicius[1, 2], Guillermo R. Oviedo[3, 4], Sunday Onagbiye[3], Mashudu Phidza[3], Caroline Madise[3], Stanislaw H. Czyż[3], Sarah J. Moss[3]

University of Tampa[1], Tampa, USA; Barry University[2], Miami, USA;
North-West University[3], Potchefstroom, South Africa; University Ramon Llull[4], Barcelona, Spain

Background. Physical activity (PA) and cardiorespiratory fitness (CRF) are linked with prevention and improvement of health (Gill et al., 2013; Haskell et al., 2007). There is strong evidence that regular PA reduces the rates of non-communicable disease such as coronary heart disease, high blood pressure, stroke, metabolic syndrome, type II diabetes, breast cancer, colon cancer, and depression (Lee et al., 2013). It is unclear whether PA interventions could promote changes in CRF and physical activity levels (PAL) in black African population from South Africa's low socioeconomic communities.

Research aim was to assess the changes in PAL and CRF during a PA intervention in black African population from low socioeconomic communities in South Africa.

Methods. Total of 103 participants were randomly divided into two groups. The Exercise Intervention group (EIG) consisted of 6 men (aged 51 ± 17 years) and 55 women (aged 59 ± 11 years), whereas the Control group (CG) consisted of 2 men (aged 66 ± 1 years) and 40 women (aged 60 ± 8 years). All subjects had at least one of the non-communicable diseases diagnosed. EIG followed an aerobic and strength training program for 12-weeks, once a week, 1 hour each session. Before and after the PA program CRF was assessed using metabolic step test (Cortex MetaMax); total PA (TPA), time spent in sleep/sedentary activities (SST), light PA (LPA) and moderate to vigorous PA (MVPA) were assessed during 7 consecutive days using a combined accelerometry and heart rate monitor (ActiHeart). ANCOVA tests were used to analyse differences after 12-weeks training. Baseline measures, age and gender were used as covariates.

Results. After the PA intervention significant changes in CRF ($p < .001$) were observed. VO_2 peak increased from 17.3 ± 4.6 to 23.2 ± 5.5 ml/kg/min ($p < .001$), while non-significant increases were found for TPA, LPA and MVPA, and SST.

Conclusion. Our results have shown that training once a week increases CRF and slightly reduces sedentary behaviours patterns in black Africans from low socioeconomic communities. These changes may lead to stabilization and/or prevention of non-communicable diseases.

Keywords: *cardiorespiratory fitness, physical activity, non-communicable diseases, black African population.*

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ASSOCIATIONS BETWEEN INFLAMMATORY MARKERS, BODY COMPOSITION AND PHYSICAL ACTIVITY IN OLDER WOMEN

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Background. The aim of this study was to evaluate the associations between body composition parameters and inflammatory markers in urban community older women.

Methods. A group of 36 women aged 68–81 years (mean age of 73.9 years) participated in this study. The body composition was measured by dual-energy x-ray absorptiometry. Absolute and relative values of body fat, lean body mass and appendicular lean mass (ALM), skeletal mass index (SMI), bone mineral content (BMC) and bone mineral density (BMD) were assessed in this study. Venous blood samples were collected and fasting serum concentrations of interleukin-10 (IL-10), tumour necrosis factor α (TNF-α) and interleukin-6 (IL-6) were determined. Physical activity profile was measured by the Voorrips habitual physical activity questionnaire.

Results. Inflammatory markers (serum IL-10 and IL-6) concentrations correlated ($p < .05$) positively with BMC, BMD and body fat mass. Serum IL-10 correlated ($p < .05$) positively with BMC of arms, legs, BMC total ($r = .42$, $r = .47$ and $r = .42$, respectively), and with relevant BMD criteria ($r = .39$, $r = .37$ and $r = .39$, respectively). Positive correlations ($p < .05$) were noted between IL-6 and BMC of trunk, spine and pelvis ($r = .52$, $r = .49$ and $r = .47$, respectively) as well as BMD of trunk and spine ($r = .37$ and $r = .37$, respectively). Fat of trunk, visceral and total had positive correlations ($p < .05$) with IL-6 ($r = .47$, $r = .38$ and $r = .39$, respectively). No significant correlations were noted between serum TNF-α and assessed body composition parameters. TNF-α correlated ($p < .05$) negatively with Voorrips total score ($r = -.42$). Voorrips total and sport scores correlated ($p < .05$) positively with SMI ($r = .37$ and $r = .35$, respectively).

Conclusion. In healthy older women, serum IL-6 and IL-10 concentrations were associated positively with BMC, BMD and body fat mass values, whereas TNF-α concentration associated negatively with physical activity. No significant association between serum TNF-α concentration and body composition parameters were observed in older women in this study.

Keywords: *ageing, body composition, inflammatory markers, women.*

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IMPACT OF LONG-TERM AEROBIC PHYSICAL ACTIVITIES ON COGNITIVE FUNCTIONING: EVALUATION OF THE PILOT STUDY

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Background. Research indicates that from the age of 30–90 adults lose around 15% of cortex and 25% of white matter, which leads to cognitive decline (Colcombe & Kramer, 2003) that accelerates around the age of 50 (Young, 2015). The impact of aging is especially noticeable in executive functioning, e.g. decline in working memory (Boucard et al., 2012). Explicit research has shown improvement in cognitive functioning in seniors who have participated in short-term interventions with aerobic elements (Varma et al., 2015); however, the impact of long-term aerobic physical activities is still unknown. This research aims to evaluate the pilot study on the impact of long-term aerobic physical activities on cognitive functioning.

Methods. Thirteen seniors aged 65–79 (*M* = 71.23) participated in a psychological and physical evaluation. Participants were categorized based on the frequency of daily aerobic activities – sedentary, exercising at least 3 times a week and athletes. Psychological evaluation focused on memory, attention and reaction speed, while in physical examination an analysis of body composition, determination of aerobic capacity and an examination of brain structure with MRI was conducted. In addition, participants were given Montreal Cognitive Assessment test for cognitive screening. Only those participants getting the score of at least 26 were included in data analysis. We hypothesised that participants with long-term aerobic physical activity experience would have higher results in cognitive tests.

Results. We found that only 54% of all participants complied with the exclusion/inclusion criteria; moreover, participants – athletes showed lower results in tests measuring executive functioning (e.g. reaction speed and working memory), which might indicate higher significance of educational level. Another limitation found was difficulty in defining criteria for group division.

Conclusion. While currently our hypothesis cannot be confirmed, the pilot study indicates several significant limitations that might impact the results, which will be taken into account in the future research.

Keywords: *aerobic physical activity, cognitive functioning, aging.*

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DANCE TRAINING WITH THE NEW SPORT AND REHABILITATION WALKER

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Background. The aging process goes along with many changes which each individual experiences differently. For example, the senses deteriorate and seniors have losses in abilities for strength, endurance and coordination. Especially the balance ability decreases in older age frequently leading to falls (Mietzel, 2012).

The walker project aims at counteracting against the decline of cognitive and physical abilities. The sport and rehabilitation walker differs in many points from the regular walker. In the new device the senior places himself/herself in an upright posture and has a greater freedom for leg movements. Furthermore the risk of falling is minimized due to this inside position, which offers a greater sense of security.

Methods. For the first evaluation, a pilot study was conducted in autumn of 2015 with twelve physically and mentally limited seniors at the ages of 60 to 96 years.

The participants were allocated to either an intervention (n = 5) or an inactive control group (n = 7). Over a period of three months, seniors learned various dances and performed versatile movements. Every training session was structured in warm up, followed by learning of dance choreography and at the end cool down. The following test procedures were used before and after intervention:

1) Cognition: Montreal Cognitive Assessment (MoCA), Trail Walking Task (TWT)

2) Psychology: Falls Efficacy Scale (FES)

3) Physiology: Berg-Balance-Scale (BBS)

Results. The first analyses of the pre- and post-tests show a positive trend in favour of the FES. The intervention group exhibited less fear after the training as compared to the control group, which, however, failed to become significant (Z = -1.887, p = .059). The results of the MoCA (Z = -.841, p = .400), and the BBS (Z = -.843, p = .399) showed no significant improvements in both groups. Only the second task of the TWT (counting during walking), showed a significant enhancement for all seniors (Z = -2.824, p = .005).

Conclusion. The Sport and Rehabilitation Walker gives physically limited and disabled seniors the chance to move and to dance. The pilot study showed that dancing had an influence on abilities of balance, memory, attention, as well the sense of fear.

Keywords: *aging, senior, walker, dance.*

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EFFECTS OF THE VARIABILITY PRACTICE ON THE ACCURACY OF THE APPROACH SHOT FOREHAND DOWN THE LINE IN TENNIS

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Background. Variability appears in the practice of the motor skills of tennis, including tactical situations raised by the opponent, during the learning process and technical training and even under environmental conditions that affect the efficiency of the shot. Such variability requires the need for continuous adaptation by the player. The aim of the present study was to test the effect of the practice variable and specifically the accuracy of the forehand approaching the net.

Methods. Thirty national players who had more than 5 years of experience participated (*N* = 30) in the practice of tennis; their age was 12.9 ± 1.1 years; height 158.5 ± 8.3 cm; weight 55.12 ± 6.9 kg. Players were distributed randomly in two experimental groups (10 players: variable training; 10 players: specific training) and a control group (10 players: regular training). The experimental groups were subjected to a 1 month of specific training and variability, respectively (12 sessions, 20 min., 3 sessions a week), while the control group performed their routine training, not deferring their number of hours of training per week and duration of the sessions of the experimental groups.

Results. The results showed a significant increase in the precision of the experimental groups, whist the control group seemed to show an improvement in the accuracy with respect to the retention of learning.

Conclusion. The variability in the conditions of training (surface type) and equipment (ball type) appears to have an impact on the precision of the shots. The variability loads must be controlled enough to stimulate to achieve increased performance without exceeding the levels of variability to limits that could well generate negative transfers and consequently adversely affect the performance.

Keywords: *variability practice, accuracy, approach, tennis.*

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SYMPOSIUM SESSION 3

Chairs: **Dr. Dale Esliger (United Kingdom)**
Assoc. Prof. Dr. Rita Gruodytė-Račienė (Lithuania)

THE RELATIONSHIP BETWEEN SPECIAL POPULATIONS AND CREDENTIALS FOR THE EUROPEAN FITNESS PROFESSIONALS

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Background. According to the annual worldwide survey of top fitness trends by the American College of Sports Medicine in the last 10 years, the education and certification of the exercise professionals have been on the top of this list (Thompson, 2015). Thus, the purpose of this study was to investigate any relationship among the most popular fitness credentials, most common lifestyle diseases and future occupational roles of the fitness professionals based on a current epidemiological overview and prevalence of non-communicable diseases globally (WHO, 2014).

Methods. This study was conducted through an online survey, which was based on a questionnaire including 10 closed-ended questions using a 5-point Likert scale. The questionnaire was sent to the whole database both of the European Health and Fitness Association and European Register of Exercise Professionals. The sample consisted of 950 respondents with the status of the certified fitness professional, accredited vocational training provider, academic institution, National Association or operator within the European health and fitness sector.

Results. The clinical/medical fitness facilities are considered the business area with the second higher attractiveness right after the category of commercial targeted studios. The list of the top ten credentials for the future includes a large variety of exercise specialists in many different categories such as Exercise for Health, Weight Management, Pre-Diabetes, Cardiovascular Disorders and Musculoskeletal Disorders. In addition, Fitness Instructor or Personal Trainer with an additional specialty in Active Ageing or Youth Fitness is considered as one of the most attractive occupations for the near future within health, fitness and wellness industry at European level.

Conclusion. As healthcare continues to evolve, exercise professionals and the whole fitness industry need to evolve as well playing an integral role as a key part of the changing healthcare landscape (Muth, Vargo, & Bryant, 2015). There is a serious interaction among the latest demographic status, epidemiological statistics and future trends in fitness credentials at the global level while the rationale for exercise prescription as the magic pill from physicians is growing systematically through the global initiative of Exercise is Medicine® (Sallis, 2015). Having as the first priority the optimal primary healthcare and the risk stratification of patients concerning the chronic health conditions, medical sector and fitness industry should work intensively to bridge the gap between science and practical application.

Keywords: *medical fitness, exercise professionals, credentials.*

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PSYCHOLOGICAL OUTCOMES OF PHYSICAL ACTIVITY INTERVENTION FOR NON-ACTIVE ADULTS FROM ECONOMICALLY CHALLENGED FAMILIES: "WILL FOR MOVEMENT AND MOVEMENT FOR WILL"

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Background. Due to the recent socio-economic crisis, the poverty rate in Slovenia is increasing. Not only a high unemployment rate but also working in low-paid jobs can often lead to poverty and social exclusion. In economically challenged families where adults are trying to provide resources for family members, their everyday life often revolves around negative and unpleasant experiences. Low socio-economic status and limited resources often lead to unhealthy and inactive lifestyles (Cleland et al, 2012). One of the aims of the project was to create a physical activity intervention to promote an active lifestyle and through that an improvement of the quality of life. »Will for Movement and Movement for Will«, a 15-week long physical activity intervention, was developed for the project. Besides increasing physical functioning, strong emphasis in the intervention was placed on the psychological aspects related to motivation and determinants of behaviour change.

Methods. 17 non-active adults (aged from 19 to 66; M = 44.7 years) attended the program. All were non-active with relatively high BMI (M = 29.9). Semi-structured interviews covering their life story, physical activity and health related behaviours, together with a series of motor tests, were conducted at the beginning and after the end of the program.

Results. Participants reported on increased subjective well-being, optimism and improved mood. According to their subjective interpretations, they have had more energy for coping with everyday requirements. Majority of them have developed exercise as a habit. Setting individual goals, tailoring the exercise sessions and reinforcing their self-regulation resulted in the increase of motivation for physical activity, manifested also in relatively high attendance rate.

Conclusion. The findings suggest that a 15-week multidisciplinary exercise intervention enabled the adult participants with low socio-economic status to improve their health-related physical performance (Cecić Erpič et al., 2016) and several aspects of psychological functioning (Cecić Erpič et al., in press).

Keywords: *physical activity, multidisciplinary intervention, adults, low socio-economic status, psychological outcomes.*

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EFFECTS OF A 36-HOUR SURVIVAL TRAINING ON OXIDATIVE STRESS AND MUSCLE DAMAGE BIOMARKERS

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Background. Intense physical exercise was shown to enhance oxidative stress, which may be associated with muscle damage and a decrease in physical performance. However, little is known about the influence of physical and psychological stress (difficult conditions and sleep deprivation) on oxidative stress. The aim of the study was to analyze changes in oxidative stress and muscle damage markers during 36-h survival training with sleep deprivation.

Methods. The study included 12 male students from the Faculty of Physical Education and Sport in Biała Podlaska, specialty – Physical Education for Uniformed Services. Blood samples from the ulnar vein were collected four times: prior to the survival training (pre-), after 24 and 36 hours of the training (24-h and 36-h, respectively) and following a 12-hour recovery period (12-h recovery). The students were at least 5–6 hours after their last meal at the time of each blood sampling. Throughout the experiment period, all participants received the same meals and had unlimited access to mineral water. The concentration of hydroperoxides (LHs) and the activity of creatine kinase (CK) were determined in blood plasma, superoxide dismutase (SOD) activity in erythrocytes, and the activity of glutathione peroxidase (GPx) in whole blood.

Results. Both LHs and CK increased at 24-h ($p < .05$) and remained elevated at 36-h ($p < .05$). A 12-h recovery was sufficient for normalization of LHs at pre-training level ($p < .05$), and the post-recovery CK was even lower than at the baseline ($p < .05$). The activity of GPx decreased at 36-h ($p < .05$ as compared to 24-h). Although a decreasing tendency for SOD activity was observed at 24-h and 36-h, it did not prove to be statistically significant ($p > .05$). A positive correlation was found between the pre-training activities of GPx and SOD ($r = .60$, $p < .05$), as well as between LHs and CK at 36-h and following 12-h recovery ($r = .51$, $p < .05$ and $r = .59$, $p < .05$; respectively).

Conclusion. Physical and psychological stress associated with 36-hour survival training impairs enzymatic antioxidant defence and enhances lipid peroxidation, which in turn stimulates muscle damage. However, a 12-hour recovery period is sufficient for full regeneration of muscle tissue and restoration of blood prooxidant-antioxidant homeostasis.

Keywords: *oxidative stress, muscle damage, survival training, sleep deprivation.*

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PHYSICAL ACTIVITY DETERMINANTS AMONG PEOPLE WITH SPINAL CORD INJURY

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Background. Individuals with a spinal cord injury (SCI) have the lowest level of physical activity compared with other populations with a disability (Galea, 2012). During inpatient rehabilitation, physical activity is more related with changes of functional, physical state and secondary conditions (Ginis, Jetha, Mack, & Hetz, 2010). In a one–three year period after SCI onset, physical activity is more related with environmental adaptation, social relationships and recovery of physical capacity (Skučas, 2010). People after SCI who have higher physical fitness levels are more active in daily activities and leisure (Ginis et al., 2011). The aim of this study was to assess the changes of self-reported physical activity in persons with SCI during inpatient rehabilitation and in a one–three year period after SCI onset.

Methods. The preliminary data was collected during the inpatient SCI rehabilitation programme in the Rehabilitation, Physical and Sports Medicine Centre, Vilnius University Hospital, Santariskiu Clinics, whereas the follow-up data in a one – three year period after SCI onset was collected during summer camps in the Landscape Therapy and Recreation Centre in Monciskes. Life Situation Questionnaire – revised (self-report) and Comprehensive ICF core set for SCI were used in the study.

Results. Physical activity increased significantly during the inpatient rehabilitation programme, but decreasing trends were observed in the first year after SCI onset. During rehabilitation, 44.5% of participants exercised every day, 18.8% – five times per week and 35.7% – four times per week. In the second year, the dominating exercising rates were four times per week (49.2%). In the third year, the exercising rates were 3 times per week (29.9%), but active leisure, games, professional sports and increased participation in housework, social and community activities were more dominant. Participants reported that the main problems limiting their physical activity were related to changes of their functional and health state (muscle functions, spasticity, chronic pain, mobility restrictions), interpersonal (motivation, self-confidence, depression) and environmental factors.

Conclusion. Self-reported physical activity and participation in daily and social life are most related with changes of functioning over the time since SCI onset, environmental adaptation and accessibility as well as social interactions.

Keywords: *physical activity, spinal cord injury, health promotion, social integration, well-being.*

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THE NON-FORMAL PHYSICAL EDUCATION OF CHILDREN: THE INCREASE FACTOR OF PHYSICAL ACTIVITY AND PHYSICAL FITNESS

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Background. Regular participation in physical activity is essential for healthy growth and development. The studies on physical activity reveal that children's physical activity is not sufficient (BHFNC, 2010; Currie et al., 2012; Chen et al., 2014). Physical activity is positively associated with physical fitness: daily physical activity improves or maintains physical fitness. Non-formal physical education (NFPE) is one of the means to increase children's physical activity and physical fitness. The aim of this study was to determine the influence of NFPE on the physical fitness of children aged 13.

Methods. The study was conducted in May, 2013; 356 six-graders (aged 13, 48.0% girls) from four Klaipėda city comprehensive schools participated in the study; 56.5 % of children (48.3% girls) participated in NFPE in school and outside the school. The participants completed five physical fitness tests: 1 mile run/walk, Flexed-arm hang, Sit-ups, Standing long jump, Sit and reach and the Body mass index (BMI) was calculated. Independent *t* test was used to compare the results of NFPE attended and non-attended groups.

Results. Independent *t* test revealed that the results in the NFPE attended group of cardiorespiratory endurance, $t(342) = -2.769$, $p = .006$; upper body muscular strength and endurance, $t(349) = 2.460$, $p = .014$; abdominal muscular strength and endurance, $t(360) = 4.887$, $p = .000$; explosive leg power, $t(354) = 3.163$, $p = .002$ were significantly higher than the NFPE non attended group. Only indices of flexibility, $t(352) = -0.624$, $p = .533$ did not differ significantly.

Conclusion. The organized NFPE activities after school are a meaningful educational form for increasing children's physical fitness.

Keywords: *non-formal physical education, physical fitness, testing.*

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PARTICIPATING IN PHYSICAL ACTIVITY AND SOCIAL APPEARANCE ANXIETY

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Background. It is known that there are multiple associations between physical activity and psychology for human health. One of these associations is social appearance anxiety. Social appearance anxiety is a feeling of distress associated with the perceived evaluation of one's physical self. Some individuals feel relatively little anxiety over this perceived evaluation, while others are highly stressed. There are many studies on physical activity and anxiety, but fewer studies on the social appearance anxiety. Therefore, the aim of this research was to determine social appearance anxiety of individuals interested in physical activity and examine it according to some variables.

Methods. The study group of the research consisted of 38 female and 190 male subjects (53 were aged 12–19 years, 138 were aged 20–34 and 37 were aged 35–50) from four different fitness centres, with a total number of 228 individuals. The data were collected using "social appearance anxiety scale" as a data collection tool. Descriptive statistics, *t* test for independent groups and one-way analysis of variance (ANOVA), Tukey's multiple comparison; Kruskal-Wallis *H* test in the group not normally distributed was used as statistical methods for the evaluation of data.

Results. Adolescents and those who wanted to lose weight demonstrated more social appearance anxiety compared to young adults and those who wanted to be fit.

Conclusion. It was determined that individuals going to the fitness centre demonstrated average levels of social appearance anxiety. Social appearance anxiety of individuals did not vary according to the body mass index (BMI) and gender, but it related to age group and aims of going to the fitness centre. Thus we suggest that the variables of age and aim for going to the fitness centre are determinant attributes of social appearance anxiety.

Keywords: *physical activity, fitness, social appearance anxiety.*

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STEPWISE RELATIONSHIP OF EXERCISE FREQUENCY WITH SERUM BDNF LEVEL AMONG ADOLESCENTS

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Background. Brain-derived neurotrophic factor (BDNF) is essential for several body functions including neural, cognitive, cardiovascular, and metabolic. However, the dose-effect of exercise participation is not fully understood among adolescents. The current study examined the relationship of serum BDNF level with moderate/vigorous exercise frequency in 703 adolescents aged 13–17 years.

Methods. The Enzyme-linked immunosorbent assay (ELISA) was used to evaluate serum BDNF. Additionally, weekly frequency of running was obtained with a self-reporting questionnaire to determine moderate/vigorous exercise.

Results. One-way analysis of variance (ANOVA) revealed differences (p = .001) in BDNF level according to running frequency. Subsequent analysis showed that BDNF was greater (p < .05) in adolescents participating two, three, four and five, but was similar (p > .05) to participating one, six, and seven times per week versus no participation. Additionally, BDNF peaked (p < .05) with three and four times per week running participation. The current data revealed a stepwise relationship of running frequency with BDNF.

Conclusion. These results indicate that participating three-four times per week is most effective in increasing serum BDNF, while participating more than five (i.e. six and seven) times resulted in an inverse relationship of BDNF with exercise frequency. These results are consistent with the current recommendations for moderate/vigorous exercise frequency.

Keywords: *exercise, Brain derived neurotrophic factor (BDNF), adolescents.*

e-POSTER SESSION 1

Chairs: **Prof. Dr. Franco Viviani (Italy)**
Assoc. Prof. Dr. Renata Rutkauskaitė (Lithuania)

STIMULATORY SUPPORT OF DOING SPORTS AT SPORTS CLUBS: GROUNDED THEORY

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Background. In these days, under conditions of increasing range of services being rendered by private sports clubs and centres, doing physical activity is an integral part of healthy life style. But on the other hand, it has become just an everyday tool for creating a certain image of a person's body (Jankauskiene, 2008; Spinter Research, 2013). The problem of this study is reflected by posing a question: what is the main concern of young overweight women when they are doing sports in sports clubs? How to find solution to this problem?

Methods. The classical strategy of the Grounded Theory – Glaser's version (Glaser, 2003) was chosen for the survey. The following methods of data collection were applied: individual interviews, direct observation and virtual comments.

Results. During the first phase of the survey, we sought to find out what was the main concern of young women doing sports in sports clubs. To find the main concern, the data were coded following the principles of the open coding. After the data analysis was completed, the results demonstrated that low self-esteem was the main concern encountered by both personal trainers and young overweight women. During the second phase of the survey, data were collected and analysed further in order to find an answer to the question how the subjects should solve their problem. Open coding was conducted until the core category emerged based on the data used, which was namely the core to the problem the young women were trying to solve. Stimulatory support of doing sports appeared as a theoretical construct during the empirical investigation. It included two important processes: the support (core subcategory I) and stimulation (core subcategory II). The revelation of those two processes allowed the application of the theory of stimulatory support of doing sports.

Conclusion. The support and stimulation processes revealed in the theory of stimulatory support of doing sports should encourage personal trainers at sports clubs to pay attention to the solution of the problem of low self-esteem of young overweight women when they do sports at sports clubs.

Keywords: *sports club, young overweight women, grounded theory.*

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THE PERCEPTION OF INTENSITY OF EFFORT IN PHYSICAL ACTIVITY PROGRAMS FOR SENIORS

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Background. Physical activity programs (PAP) for older people conducted in institutional settings, have different characteristics and effort requests. For Meurer et al. (2015) the fitness activities had an intensity from slight to moderate, consistent with Rato (2014) who refers to the intensity of the effort applied to gym sessions as mild to moderate, so that they are favourable to the improvement of the physical condition of the elderly. For the British Heart Foundation (2008) the benefits to the health of older people require a total of 30 minutes of moderate physical activity five days a week.

Methods. This qualitative study was conducted from data collected through semi-structured interviews with 11 technicians (9 women and 2 men) responsible for the design, coordination and/or promotion of physical activity programs in different institutional contexts of the region of Aveiro (Portugal). The data were analysed in terms of content analysis (Bardin, 2011).

Results. The results indicate that for the perception of exercise intensity during the PAF in general, all rated between low and moderate, where justified as “exercise (...) as inclusive as possible for everyone to participate” (Beatriz, 39, social worker) and where users feel “able (...) and not that will match they cannot” (Mariana, 32, gerontology psychomotor specialist). There are two cases in which they name as being very low and other two where the efforts can go up to a higher intensity. By way of justification for the lower intensity, Renata (39, social worker) states that “the people themselves are increasingly dependent and is more complicated.” For higher intensity, Matilde (22, gerontology psychomotor specialist) reveals that users “have shown greater ability” or the admission of the possibility of “Some days you may be at a higher intensity” (Gonçalo, 32, Animator).

Conclusion. The inclusion concerns the largest number of older people in PAP, influence the decision to ensure low effort intensity levels to moderate in the PAP, with very few exceptions. On the other hand, those responsible for some of the PAP seem to take into account the need to differentiate the intensity of efforts over the activities of PAP.

Keywords: *physical activity, elderly, intensity of effort.*

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ELDERLY PERSONS' MOTIVATION FOR PHYSICAL ACTIVITY

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Background. Multidimensional model of successful aging is one of the newer models (Iwamasa & Iwasaki, 2011). Thus, the authors distinguish the following elements of the model: physical (e.g., physical activity), psychological, social, cognitive, spiritual and financial security. This model includes various aspects described in the literature, and two rarely explored aspects were distinguished in our research: those of spiritual and financial security. So, the model consists of six dimensions interacting with each other (Mockus & Žukaitė, 2012).

Methods. Our research methodology is based on of the provisions of social cognitive theory implying that the causes of social behaviour and cognitive thinking are important in all aspects of human functioning – motivation, emotions and purposeful activity. Experimental research was carried out in 2014–2015 (duration – 5 months). The study included 30 respondents: 12 men and 18 women (aged 68 $\pm$ 3 years). Functional training was specifically adapted to the elderly to improve their psychomotor skills. The testing method was used to assess respondents' physical parameters: balance, coordination, cognitive skills, and vigorous physical activity. The structured interview was applied to assess their expectations and motivation for healthy and active lifestyle. The data were accumulated and processed using SPSS (Statistical Package for Social Science).

Results. We established that the majority (80%) of the research participants were slightly active and regularly performed low intensity physical activity. After functional training the improvement was observed in: coordination – 0.89 s ($p < .05$), concentration – 1.19 s ($p < .05$), balance – 1.85 s ($p < .05$). The analysis of respondents' motivation for recreational physical activity revealed two main reasons: (1) good emotions during physical activity "energy increases, mood and well-being improve", "it is not boring"; (2) the need for physical activity is associated with physical health and the need to communicate "I would like to be more active", "it is necessary to move physically".

Conclusion. Regardless of the subjects' gender and age, adapted functional training for elderly persons was effective for the development of psychomotor skills ($p < .05$). Motivation for physical activity is related to respondents' positive socialization and expectations of the quality movement and healthy lifestyle.

Keywords: *elderly persons, psychomotor skills, motivation, physical activity.*

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AFTER-SCHOOL PHYSICAL ACTIVITY SELF-EFFICACY LEVELS IN PRIVATE AND PUBLIC MIDDLE SCHOOL STUDENTS

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Background. Physical activity self-efficacy (PASE) is based on the Social Cognitive Theory developed by Bandura (1986). Self-efficacy in children was defined as confidence in their skills and abilities to be physically active to reach a desired outcome (Dishman et al., 2004). The purpose of this study was to examine after school PASE levels of public (n = 207) and private middle school (n = 126) students in central Canakkale, Turkey.

Methods. Cross-sectional survey method was applied to the students and as a data collection instrument "Children's Self-Efficacy and Proxy Efficacy for After-School Physical Activity" (Dzewaltowski et al., 2009) validated by Cengiz and Ince (2013) was used. The instrument had three separate constructs: self-efficacy to be physically active (SEPA), proxy efficacy to influence parents to provide physical activity opportunities (PEPA-P), and proxy efficacy to influence after-school staff to provide physical activity opportunities (PEPA-S).

Results. Multivariate Analysis of Variance (MANOVA) results showed a significant difference between PASE and gender of students, Pillai's Trace = .05, $F(3.\ 315) = 5.75$, $p < .05$. However, no significant difference was observed between PASE and age, school type, grade. Further analyses indicated significant differences in SEPA ($F(1, 15) = 6.06$, $p < .05$) and parent efficacy of participants ($F(1, 15) = 6.72$, $p < .05$).

Conclusion. In conclusion, student's sex was a statistically significant variable in terms of SEPA and PEPA-P. Staff efficacy of students needs to be improved in after-school context among public middle schools.

Keywords: *physical activity self-efficacy, parent efficacy, middle school.*

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SITUATION OF SOCIAL EXCLUSION AND HEALTH OF OLDER UNEMPLOYED IN LITHUANIA

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Background. The relevance and exclusivity of the topic are associated with the selected target group of respondents, unemployed, aged 55–65. This average adult age is identified as critical age for the change of lifestyle and prevention of age-related diseases by the U.S. Department of Health and Human Services (2010). Although unemployment surveys are conducted in Lithuania (Norvilė, 2014), the majority of them emphasize problems caused by unemployment to the persons with disabilities (Neverauskienė, 2012) or youth (Ladauskaitė et al., 2015). For this reason, the aim of this study was to analyse the situation in Lithuania in relation to social exclusion and health of older unemployed using physical activity for healthy ageing. The objectives were (1) to establish lifecycle background of 55–65 year-olds; (2) to establish statistic data about social exclusion of the unemployed; and (3) to establish the impact of physical activity on social exclusion and health.

Methods. Literature analysis and statistic data analysis were used in the study.

Results. The situation of 55–65-year-olds is particularly problematic in Lithuania. This generation suffered long-term psychological stress because they failed to fully overcome economic hardship caused by the transformation which occurred after the collapse of the communist regime. The literature analysis suggests that it caused affective disorders, changes in behaviour and lifestyle as well as dependence on alcohol and medical products. According to the data of Lithuanian Labour Exchange, 36.447 persons older than 55 were registered in 2016, and it accounts for nearly 22 per cent of the unemployed. Many of them did not have a job for more than a year. It can be estimated that the elderly unemployed will become a more isolated social group with sufficiently low self-esteem, deteriorating health and an increasing risk of chronic diseases. Physical activity is recommended by scientists as the most important factor to reduce social exclusion and improve health. It is identified as an instrument for the elimination of social isolation.

Conclusion. The situation of 55–65-year-olds is particularly problematic in Lithuania because they have suffered long-term psychological stress during change of Lithuania historic situation. Many unemployed older than 55 did not have a job for more than a year and have become an isolated social group. Physical activity is a way to reduce social exclusion and improve health.

Keywords: *elderly, unemployed, social exclusion, health, physical activity.*

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THE RELATIONSHIP BETWEEN INTERNAL MARKETING, JOB SATISFACTION, ORGANIZATIONAL COMMITMENT AND JOB PERFORMANCE OF COMMERCIAL SPORTS FACILITY

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Background. The purpose of the study was to examine the relationship between internal marketing, job satisfaction, organizational commitment, and job performance of commercial sports facility based on the precedent study of Yoon Jung Keun and Lee Young Ku (2012) for the relationship between internal marketing and job satisfaction, Byun Hae Sim (2007) for the relationship between job satisfaction and organizational commitment, Shin Hye Sook (2008) for the relationship between job satisfaction and job performance, and Lee Dong Jun (2009) for the relationship between organizational commitment and job performance.

Methods. To accomplish the purpose of the study, employees of commercial sports facility located in Seoul aged from 20 to over 40 were subjected to questionnaire survey based on convenience sampling. 300 employees of commercial sports facility filled out the questionnaires by using self-administration method and total of 269 were used for final data analysis through screen test excluding 31 questionnaires of poor, insufficient, dishonest, biased, and duplicated answers.

Results. By utilizing SPSSWIN 21.0, frequency analysis, exploratory factor analysis, reliability analysis, and multiple regression analysis were applied, and the results were as follows: (1) internal marketing influenced job satisfaction; (2) job satisfaction influenced organizational commitment; (3) job satisfaction influenced job performance; (4) organizational commitment influenced job performance.

Conclusion. Internal marketing of commercial sports facility influences organizational commitment and job performance through job satisfaction.

Keywords: *internal marketing, job satisfaction, organizational commitment, job performance.*

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PHYSICAL ACTIVITY AND BODY MASS INDEX OF NORDIC AND BALTIC UPPER SECONDARY SCHOOLCHILDREN AND THEIR BEST CLASSMATES: A PILOT STUDY

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Background. Studies show that boys and girls of primary school, whose best friends are physically active, have higher level of physical activity[1]. Our research aims to investigate the relationships between older school-age students' level of PA and body mass index (BMI) with their best classmate's level of PA and BMI.

Methods. In total, 243 schoolchildren of 16–18 years of age from secondary schools of four cities of Nordic-Baltic countries (i.e. one school per city per country) took part in this pilot study. Participants were from Kaunas, Lithuania (n = 82), Oslo, Norway (n = 60), Malmö, Sweden (n = 59) and Riga, Latvia (n = 42). To measure their total amount of PA (i.e. the energy expenditure in MET-minutes/week) during the past seven days, the short form of an International Physical Activity Questionnaire (IPAQ)[2] was used.

Student's BMI was calculated using the formula: Weight (kg) / Height (m)^2. The level of vigorous (VPA), moderate (MPA) and low (walking) intensity physical activities as well as the total amount of PA (ToPA) of the respondents was determined using IPAQ scoring protocol guidelines[3].

Results. Latvian boys were more physically active than Swedish and Norwegian boys (p < .05). Girls from Norway were less physically active (p < .05) than students from other countries (Lithuania, Sweden, Latvia). Positive relationships were found between Latvian boys and their best classmate's level of PA (r = .79; p < .01). On the contrary, negative correlation (r = -.46; p < .05) was found between physical activity levels of Norwegian girls and their best classmates. Positive relationships were determined between Lithuanian girls and their best classmates' BMI (r = .39; p < .05), i.e. girls are friends with classmates of similar body composition.

Conclusion. Schoolchildren from Latvia consume more energy during physical activities compared with other countries that participated in the study. Positive and statistically significant relationships were established between Latvian boys and their best classmate's level of physical activity. Norwegian girls' and their best classmates' case of physical activity levels showed a negative correlation. Girls from Lithuania are friends with classmates of similar body composition.

Keywords: *physical activity, children, oxygen uptake.*

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RURAL AND URBAN MIDDLE SCHOOL STUDENTS' PHYSICAL ACTIVITY LEVEL AND PHYSICAL ACTIVITY SELF-EFFICACY

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Background. Current research indicates that students' physical activity (PA) levels are decreasing sharply with age (Azevedo et al., 2014; CDC, 2004). For various health accomplishments students should participate in at least 60 minutes of moderate to vigorous PA daily (WHO, 2010). Therefore, the purpose of the study was to examine middle school students' weekly PA levels and PA self-efficacy levels in rural and urban context in Canakkale, Turkey.

Methods. Cross-sectional survey method was applied to the students living in rural (n = 217) and urban (n = 242). For data collection "One-Week Physical Activity Recall Questionnaire" (Kocak et al., 2002; Sallis et al., 1993) and "Children's Self-Efficacy and Proxy Efficacy for After-School Physical Activity" (Cengiz & Ince, 2013; Dzewaltowski et al., 2010) were administered to all students (N = 459).

Results. Descriptive findings showed that rural students of both genders were in higher levels of PA compared to urban students. According to the Multivariate Analysis of Variance (MANOVA), results showed significant difference between Physical Activity Self-Efficacy, Physical Activity (PA) and school type (Pillai's Trace = .02, $F(2, 441) = 5.12$), grade (Pillai's Trace = .04, $F(6, 884) = 2.73$) and sex of students (Pillai's Trace = .05, $F(2, 441) = 10.82$). Further analyses of ANOVA indicated significant differences in school and PA (F (1, 15) = 8.89), grade and PA (F (3, 15) = 4.57) and sex of students with PA self-efficacy (F (1, 15) = 4.27) and PA (F (1, 15) = 21.05).

Conclusion. In conclusion, school type, grade and sex of middle school students were statistically significant variables in terms of PA level and PA self-efficacy. School environment, grade and gender of students need to be supported in the urban context.

Keywords: *physical activity, self-efficacy, middle school.*

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SPORTS AS LEISURE AND WELLNESS ACTIVITY IN VARIOUS UNIVERSITIES IN THE WORLD

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Background. There is a variety of sports and wellness activities in the world's best universities. The aim of this study was to determine if sport is a leisure and wellness activity in the best universities of the world. The objectives: (1) to determine the variety of sports and wellness activities in the best universities; (2) compare these activities within different universities.

Methods. The methods applied in the study were analysis of scientific literature sources and media analysis.

Results. There is an organization in each of the best universities on three continents which is responsible for the university games. The United States university games are governed by NCAA (National Collegiate Athletic Association). The British organization responsible for university games is BUCS. Australian universities compete every year at the Australian University Games. All our researched universities actively pursue sports activities which promote sports clubs, variety of leisure activities and health centres. Leisure time is the time that is separated from the regular human activity and is directed toward enjoyment. Physical activity is one of the forms of leisure time activities. There is a large variety of sports and fitness activities that are offered by the best universities.

Conclusion. The major differences of activities observed are between the schools on different continents rather than between the schools on the same continent.

Keywords: *sport, leisure time, wellness, university, students.*

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THE RELATIONSHIP BETWEEN EDUCATIONAL SERVICE QUALITY, CUSTOMER SATISFACTION, AND BEHAVIOURAL INTENTION OF DANCE ACADEMY

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Background. The purpose of the study is to examine the relationship between educational service quality, customer satisfaction, and behavioural intention of dance academy based on the precedent study of Im Kyung Hee (2009) for the relationship between educational service quality and customer satisfaction, Choi Jung Wook (2011) for the relationship between educational service quality and behavioural intention, and Cho Song Hyun (2002) for the relationship between customer satisfaction and behavioural intention.

Methods. To accomplish the purpose of the study, middle school and high school participants of dance academies located in Seoul aged 13 to 18-years were subjected to a questionnaire based on convenience sampling. 250 participants of dance academies filled out the questionnaires by using self-administration method and total of 234 were used for final data analysis excluding the 16 questionnaires of insufficient, dishonest, duplicated, and biased answers.

Results. By utilizing SPSS 21.0, frequency analysis, exploratory factor analysis, reliability analysis, and multiple regression analysis were used, and the results were as follows: (1) educational service quality of dance academy influenced customer satisfaction; (2) educational service quality of dance academy influenced behavioural intention; (3) customer satisfaction of dance academy influenced behavioural intention.

Conclusion. Educational service quality of dance academy influences behavioural intention through customer satisfaction.

Keywords: *educational service quality, customer satisfaction, behavioural intention.*

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UNIVERSITY EFFORTS TO PROMOTE PHYSICAL ACTIVITY AND HEALTHY LIFESTYLE

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Background: Rapid decline in physical activity rates is observed between 18 and 24 years of age (Grim et al., 2011) when the majority of young people are enrolled in higher education (Huang et al., 2003; Haase et al., 2004). Over the last years there is a tendency to narrow the scope of physical education in the academic curricula in Lithuania, although, in many countries physical fitness and health of children and youth have been deteriorating (Poteliūnienė, 2010). This study is aimed to examine the efforts of universities to promote physical activity and healthy lifestyle.

Methods: Theoretical analysis of scientific literature and empirical study was applied in the study. Five criteria were selected (lectures/practices; guidelines for students with tasks to achieve certain indicators; sports centers; free or low fee access to sports centers; sports teams, clubs, competitions), whereby the website review was performed of the world top five universities according to the QS World University Rankings 2015/16 and Lithuanian top five universities according to the Journal *Reitingai*, Issue 5, 2015.

Results: It was found that three out of the world top five universities meet all the set criteria, but the other two universities do not have guidelines for students to achieve certain physical activity indicators. This criterion has not been found in the top five Lithuanian universities and one university meets only one criterion, i.e. there are various sport teams and clubs taking part in competitions.

Conclusion: The study showed that physical education in the world top five universities is mainly implemented through formal organized and mandatory forms and less through freely elective and informal forms. In the Lithuanian top five universities, physical education is mostly implemented though freely elective and informal forms.

Keywords: *university, student, physical education, healthy lifestyle.*

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THE ATTITUDE OF PHYSICALLY ACTIVE HIGH SCHOOL SENIOR STUDENTS TOWARDS PE TEACHER IN RELATION TO GENDER

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Background. It is argued that one of the main motivating factors for students' physical activity is their physical education (PE) teacher. Hence a better understanding of the relationship between the PE teacher behaviour and his/her characteristics and students' approach to PE classes could lead to more effective dealing with the problems of PE at school. The aim of this study is to examine the attitude of physically active high school students from senior grades towards their PE teacher in relation to gender.

Methods. The study consisted of a survey using a questionnaire comprised of 14 questions and statistical data analysis. The SPSS 17.0 software package was used for statistical data analysis, whereas conclusions were drawn by using Chi-square test. The significance level was set at $p < 0.05$. The study was implemented in schools from Kaunas city in spring 2015. The respondents of the survey were 300 senior students (150 female and 150 male).

Results. The study showed that during PE classes both boys and girls favour the PE teacher who employs a variety of physical activities and maintains vitality during PE lessons. However, boys are more eager to demonstrate themselves during the lesson than girls who claim that PE lesson allows them to rest from other classes. The analysis of the students' attitude towards PE teacher's characteristics showed that both boys and girls distinguish such favourable PE teacher's characteristics as professional competence, friendliness, communication skills, and respect for students' opinion. On the other hand, in both male and female students' opinion, the unfavourable PE teacher's characteristics are requests to follow the standards, lack of the teacher's active involvement in physical activities during the lesson and disregard of students' requests and opinions.

Conclusion. The results of the study correspond to the data from the studies performed by other researchers (Galkienė, 2011; Freire, Miranda, 2014; McDavid et al., 2014; Van den Berghe et al., 2014) that the students' attitude to their PE teacher is highly dependent on such teacher's characteristics as his/her ability to communicate, and creative approach to PE lesson and a caring attitude towards the students during the lessons.

Keywords: *attitude towards physical education teacher, students, physical activity.*

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SELF-ACTUALIZATION AND SELF-ESTEEM OF WHEELCHAIR USERS IN THE PHYSICAL AND SOCIO-PSYCHOLOGICAL PERSPECTIVE

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Background. Increasing autonomy is important for the development of positive approach to personal skills and their educational perspective in order to empower people with disabilities. Therefore, decision of people with and without disabilities to act must be consciences and realistic (Hur, 2006). Self-actualization and full functioning of the disabled is based on the level of their independence, ability to develop existing skills and apply them in improving the quality of life. Our research aim was to establish the actually perceived opportunities of people with disabilities for self-actualization and their expectations of physical activity under the conditions of recreation, taking into account the severity and the characteristics of disability and their independence.

Methods. The study included 29 respondents – 8 women and 21 men aged 19 to 65 years. Due to different levels of spinal cord damage all persons were wheelchair users: 17 patients in physical rehabilitation hospital and 12 clients in the recreation centre. In order to ascertain personal empowerment and at the individual and the general level of the social environment, we applied a qualitative research method – a semi-structured interview; the independence was assessed by the Barthel and FIM indices.

Results. According to the research results, the independence of the research participants evaluated by FIM and Barthel indices, was different (Barthel from 69 to 73.2 points; FIM from 86 to 109 points) not only due to the level of injury or time period after the injury, but also because of socialisation aspects, which were additionally evaluated by the FIM index. The personal approach of paraplegics who participated in this study to physical activity was positive, and their expectations were associated with the recovery of physical abilities, new experiences, positive emotions and a better body image.

Conclusion. After the assessment of respondents' independence, physical experiences, and expectations for recreational, we found that regardless of the investigated parameters, respondents positively assessed personal physical activity for their self-expression and full functioning, but the expectations were different depending on the institution where the study was conducted.

Keywords: *self-actualization, physical activity, social environment, recreation.*

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REASONS OF STRESS IN PHYSICALLY ACTIVE STUDENTS FROM SENIOR CLASSES AND THE POSSIBILITY FOR REDUCING STRESS: EXPERIMENTAL CASE

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Background. Stress is one of the serious problems which affects students' lives and is reflected in students' social, academic and mental health. The reasons of stress in about three-quarters of teenagers are linked to the school and adolescent girls claim to experience stress more often than boys (Thawabieh & Qaisy, 2012). In the last three decades, the reasons of stress and coping with stress have become especially relevant, requiring measures to detect stress and effective coping with it. The aim of this study is to examine the reasons of stress in physically active senior students and the possibility for its reduction.

Methods. The questionnaire used in the study consisted of two parts. Stressors scale approved at Harvard University (2009) was used to identify students' stressors. The perceived stress scale (Cohen & Williamson, 1988) was used to assess how students experience stress. Statistical data analysis was performed using SPSS 17.0 software package, whereas conclusions were drawn by using Chi-square test. The significance level was set at $p < 0.05$. The study was carried out in X schools from Kaunas in January 2012 and the subjects were 360 senior students (207 girls and 153 boys, average age of 16.7 ± 1.2 years). During the experiment, students in six classes were introduced to the manifestations of stress, its effects on the body and learning the ways how to overcome stress.

Results. The study showed that senior students from a 12th grade are mostly influenced by personal stressors ($p < 0.01$), e.g. "I feel tension about the exams" or "I worry about the marks", whereas senior students from an 11th grade are more influenced by stressors of raising at home ($p < 0.01$) and stressors at school ($p < 0.05$). Comparing the results according to gender, it was found that girls experience stress more often compared to boys and are more exposed to stressors of raising at home ($p < 0.01$) and personal stressors ($p < 0.05$).

Conclusion. The study corresponded to the findings from the studies completed by Pierceall, E.A. & Keim, M.C. (2007), Shahmohammadi, N. (2011), and Thawabieh, M. & Qaisy, L. M. (2012). The pedagogical experiment had a positive impact ($p < 0.05$) on students' learning and game planning, attentiveness in the classroom and regular training. The number of respondents who reported to suffer unnecessary stress and to postpone learning decreased.

Keywords: *senior students, reasons of stress, reducing stress.*

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THE RELATIONSHIP BETWEEN ATHLETES' PERSONALITY TRAITS AND COPING STRATEGIES

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Background: Sport is inseparable from stress-evoking situations, such as pressure of failing, fear of injuries, overtraining, etc. To achieve high results in sports, athletes need to be able to deal with stressful situations by applying adaptive coping strategies. Personality traits and strategies to cope with stress affect person's reaction to the objective situation and the level of stress evoked by the situation. For instance, M. S. Allen et al. (2011) determined that athletes with low levels of openness are more prone to using avoidance coping strategies. The aim of this study was to examine the relationship between personality traits and strategies for coping with stress in athletes from individual and team sports.

Methods: Subjects of this study were 85 athletes (64 males and 21 females) from individual sports (n = 50) and team sports (n = 35). HEXACO-100 personality inventory consisting of six scales (honesty-humility, emotionality, extraversion, agreeableness, conscientiousness and openness to experience) was used to assess athletes' personality traits. Each of these 6 scales has 4 subscales (Truskauskaitė-Kunevičienė et al., 2012). To assess stress-coping strategies, Grakauskas-Valickas' four-factor questionnaire was employed containing 4 scales: social support, problem solving, emotional venting and avoidance (Grakauskas, Valickas, 2006).

Results: Statistically significant positive relationship was found between social support and problem solving strategies and openness to experience. No significant correlations were identified between stress-coping strategies and such personality traits as honesty-humility, extraversion and conscientiousness. Significant positive correlation was also found between social support and dependence, sociability and perfectionism; between problem solving strategies and perfectionism, aesthetic appreciation and inquisitiveness. However, statistically significant negative correlation was found between avoidance and social self-esteem. The study showed that athletes from individual sports are more conscientious and open to experience than athletes from team sports. The results of the present study support the findings reported by D. Lee-Baggley et al. (2005).

Conclusion: The findings of this study suggest that conscientiousness and openness to experience as well as aesthetic appreciation in athletes representing individual sports are higher than in athletes from team sports.

Keywords: *stress, personality traits, HEXACO model, coping strategies, athletes.*

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PHYSICAL ACTIVITY AS A DETERMINANT OF SUBJECTIVE HAPPINESS

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Background. It is clear that happiness is the aim for individuals living in a high demanding society. Although, various types of behaviour may result in perceived subjective happiness, it is thought that physical activity is one of those factors. In this respect, the aim of this study was to investigate participants' subjective happiness as a result of their level of the amount of exercise they take part in, as well as other secondary measures (gender, body mass index, sports facilities and sports participation of family members).

Methods. The study sample consisted of 312 undergraduate students (114 females and 198 males). Exercise Stages of Change Questionnaire (ESOCQ) and Subjective Happiness Scale (SHS) were used as a data collection tool in the study. Data was analysed using the one-way analysis of variance (ANOVA) and χ^2 (Chi-Square) tests.

Results. The results indicated that subjective happiness of undergraduate students was dependant on how physically active they were, particular in males, with normal body mass index and also those who were members of sports centres and whose parents were also physically active.

Conclusion. This study showed that university students who participated in physical activity showed subjectively higher levels of perceived happiness. Furthermore, factors determining these relationships were determined by gender, body mass index, sports facilities and whether or not close family members were also physically active.

Keywords: *physical activity, subjective happiness, university students.*

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THE ROLE OF PHYSICAL ACTIVITY IN PSYCHOLOGICAL RESILIENCE

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Background. Existing research indicates that both teachers and prospective teachers who are physically active in comparison with inactive ones generally easier cope with physical and psychosocial problems. This topic, particularly psychosocial development of individuals and their participation in sports, has attracted the attention of researchers in recent years. There is a lot of research on this issue, but less is known about the relationship between physical activity participation and psychological resilience. Therefore, the purpose of this study was to determine the association between experience of physical activity and psychological resilience of prospective teachers according to some variables.

Methods. A sample of 331 last year student teachers (134 females and 197 males) who study at the Faculty of Education at Karadeniz Technical University in northeast Turkey was evaluated. We used Childhood and Adolescence Physical Activity Levels Questionnaire to determine the physical activity experience. Besides, we applied the Brief Resilience scale to analyse the psychological resilience. The data was analysed by using the Pearson's Correlation Coefficient, Simple Linear Regression and Independent Sample *T*-Test.

Results. The research findings show that there was positive and significant relationship between psychological resilience and physical activity experience of prospective teachers. Regression analysis revealed that participation in physical activity was found to be a significant predictor to be resilient. In addition, both physical activity levels and resilience of prospective teachers with respect to gender, department and licensed sports participation status were found significant.

Conclusion. Physical activity has numerous beneficial psychological effects. Furthermore, current research results suggest that experiences of physical activity play a role in psychological resilience of prospective teachers. It was also concluded that prospective teachers should be encouraged to participate in physical activity. The development of this aspect of the policy can contribute to psychological resilience of prospective teachers.

Keywords: *physical activity, psychological resilience, teacher education.*

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INFLUENCE OF PEER PRESSURE ON EATING BEHAVIOURS OF ADOLESCENTS IN NORTHERN JORDAN

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Background. The prevalence of Disordered Eating Behaviours (DEB) has increased worldwide (Delisle, 2005). It is estimated that about 31.6% of Jordanian adolescents developed DEB (Musaiger et al., 2012). Engaging in peer groups is a prominent event in which adolescents try to belong to peers as part of exploring their social identity (Stang & Story, 2005). The main objective of this study was to assess the relationship between disordered eating behaviours and peer pressure among male and female adolescents in Jordan and to investigate the prevalence of disordered eating behaviours.

Methods. A descriptive correlational cross-sectional design was used with multi-stage sampling technique to recruit participants from schools in Jordan. A self-administered questionnaire was used to collect data. Descriptive statistics, t-test, and multiple logistic regression analyses were used. A total of 738 participants (330 boys and 408 girls) completed the online survey. Data was collected from public and private schools in Irbid governorate. Target population was all Jordanian school adolescents in grades 8th to 10th in Northern Jordan. Inclusion criteria included male and female Jordanian school adolescents from 13 years old to 17 years old. Four districts were selected from a list of nine districts.

Results. The difference in overall mean I-PIEC between adolescents with disordered eating behaviours and normal eating behaviours states was statistically significant ($p < .001$). Interaction peer pressure mean scores were statistically higher for girls than boys. Likability mean scores were statistically higher for boys than girls ($p = .001$).

Conclusion. Findings have implications for the primary prevention of disordered eating behaviours. School nurses are in the best position to conduct school-based primary prevention for disordered eating behaviours**.** Findings also suggest a further primary prevention program such as educational intervention or peer led program to prevent DEB.

Keywords: *peer pressure, eating behaviours, adolescents.*

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e-POSTER SESSION 2

Chairs: **Assoc. Prof. Dr. Nauris Tamulevicius (USA)**
Prof. Dr. Jonas Poderys (Lithuania)

EFFECTS OF A TWELVE-WEEK PROGRAMME OF SPINE-STABILIZING EXERCISES ON TRUNK MUSCLE AREA, STRENGTH AND FUNCTION IN WOMEN WITH CHRONIC LOW BACK PAIN

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Background. The aim of the research was to evaluate the effects of the programme of spine-stabilizing exercises (PLSE) on cross-sectional area and strength of trunk muscles in women with chronic low back pain (cLBP).

Methods. Reliability and validity study was applied. The subjects' isometric trunk flexion and extension force was tested with Biodex Medical System PRO 3 dynamometer. Cross-sectional area (CSA) of the multifidus muscle was measured from L2 to L5 vertebral segments with ultrasound "TITANTM". Oswestry Questionnaire was used to evaluate the influence of intensity cLBP. cLPB intensity was evaluated using a visual analogue pain scale. Female volunteers with cLBP were divided into an experimental group (EG, n = 25) and a control group (CG, n = 11). PLSE were performed twice per week; the duration of each session was 60 minutes. The program lasted for 12 weeks, thus patients underwent a total of 24 exercise sessions.

Results. After completing the 12-week PLSE, trunk extension (41.25 ± 9.25%) and flexion (21.53 ± 4.48%) strength increased (p < .001) in the EG. This increase in strength remained after 1 and 2 months (p < .05). This increase in multifidus muscle CSA was maintained after 1 month (right side: 8.26 ± 0.6 cm^2; left side: 8.41 ± 0.7 cm^2) (p < .05) and 2 months (right side: 7.45 ± 0.6 cm^2; left side: 7.53 ± 0.7 cm^2) (p < .05).

Conclusion. The 12-week PLSE increased multifidus muscle CSA, trunk extension and flexion strength. This increase in strength was maintained for two months, but the decrease in cLBP and improvement in functional condition continued for one month only.

Keywords: *lumbar stabilization exercise program, chronic low back pain, isometric trunk flexion and extension.*

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VISION AND LOCOMOTION SPEED DECREASES WITH AGING IN THE COMMUNITY OF ELDERLY

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Background. Fall is one of injury risk for the community of elderly. Elderly often fall down during locomotion walking, which is one of essential movements in daily life. Walking is considered as a condition that elderly is moving while other objects are stable. In this case, dynamic visual acuity would be influenced by correction and prescription of detecting useful information. Furthermore, dynamic visual acuity is a critical factor to keep balance during walking. It easily causes elderly people's falls when walking speed is faster that visual function can deal with information. Vision and locomotion speeds are two critical factors for elderly to fall. Therefore, the purpose of this study was to investigate the changes in dynamic visual acuity and locomotion speed with aging in the community of elderly.

Methods. Sixty elderly persons over 65 years old who could walk normally were participants in this study. The Visual System was used to measure dynamic visual acuity. The JVC high-speed camera and the Silicon-coach motion analysis software were used to measure and analyze the comfortable locomotion speed and the fastest locomotion speed.

Results. The results revealed that dynamic visual acuity, comfortable locomotion speed, and fastest locomotion speed decreased by ageing ($p < .05$). The decline of dynamic visual acuity was greater than comfortable locomotion speed and fastest locomotion speed ($p < .05$). It showed that dynamic visual acuity might not respond accurately to locomotion demands in the community of elderly.

Conclusion. It was concluded that dynamic visual acuity and locomotion speed decreased with age in the community of elderly who were over 65 years old. The decline of dynamic visual acuity was greater than comfortable locomotion speed and fastest locomotion speed. In order to enhance safety of locomotion for the elderly or reduce risk of falling, the elderly should maintain the dynamic visual acuity or do locomotion slower.

Keywords: *aging, visual acuity, fall.*

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BALANCE CHANGES AFTER EXERCISE PROGRAM AT HOME IN PATIENTS WITH PARKINSON'S DISEASE

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Background. Parkinson's disease is the most common neurodegenerative disorder, which is characterized by numerous non-motor and motor features, including gait and balance dysfunction (McNeely et al., 2015; Lotzke et al., 2015). Exercise for patients with Parkinson's disease helps to alleviate clinical symptoms such as tremor, balance instability, gait dysfunction, and rigidity Exercise therapy is a common intervention for improving postural stability (Klamroth et al., 2016). The aim of this study was to determine the effective balance changes after a home exercise program in patients with Parkinson's disease.

Methods. Nine patients (men and women) (aged 71.3 ± 3.71 years) diagnosed with Parkinson's disease (disease duration 12.8 ± 3.42 years) participated in this study. The subjects were required to perform exercise program at home three times a week for 4 weeks, 40 minutes per session. Static and dynamic stability were measured using the Berg Balance Scale and Timed Up and Go test before and after exercise program at home.

Results. The Berg Balance scale and "Timed Up and Go" test did not reveal changes ($p > .05$) before and after exercise program at home.

Conclusion. The results showed that after 4 weeks of the home exercise program patients with Parkinson's disease did not change static and dynamic balance.

Keywords: *Parkinson's disease, static and dynamic balance, home exercise program.*

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THE INFLUENCE OF FOUR WEEKS ENDURANCE TRAINING AND HEAT EXPOSURE ON CHANGES IN LEUKOCYTE SUBSETS IN RESPONSE TO EXERCISE IN JOGGING AMATEURS

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Background. Endurance training and heat acclimation have an effect on physiological responses to exercise in trained and untrained subjects (Pilch et al. 2013; Pokora & Żebrowska, 2016) We investigated physiological responses and changes in circulating leukocytes following the exercise tests in two groups of jogging amateurs. The study group contained jogging amateurs (*n* = 9; TR + HA) who completed four weeks endurance training with the addition of heat stress (a sauna bath; at 90^{o}C; twice a week). The control group contained jogging amateurs (*n* = 9; TR) who completed four weeks endurance training without heat stress.

Methods. We studied jogging amateurs (men and women, age 35 ± 6 years, body mass 73 ± 1.1 kg, height 177 ± 7.9 cm, BMI 23 ± 1.9, VO2max 51 ± 5.2 ml/kg/min) who had been running at a recreational level at least two years. We compared the responses to exercise before (PRE) and after (POST) four weeks in both groups (TR + HA and TR). Two exercise tests were performed in the laboratory in two series; before (PRE) and after four weeks (POST) in TR+HA and TR group. During exercise all subjects performed a step increasing intensity exercise test to volitional exhaustion in a thermoneutral environment. During each exercise, physiological variables (heart rate; HR, oxygen uptake VO2, blood lactate LA) were measured. Blood samples were taken 2h before (RS), immediately after exercise test (MAX) and at 2 h of the recovery (RC) in PRE and POST series. Electronic cytometry was used to determine total amount of white blood cells (WBC) and leukocyte subsets (neutrophils, monocytes, and lymphocytes). To determine changes in leukocyte overall and leukocyte subsets following the exercise stress, total amount of WBC and leukocyte subsets were corrected for changes in plasma volume (D PV%).

Results. HR at rest and during exerciser were lower after TR+HA and TR as well (main effect of time; $F = 16.14$, $p = 0.001$), whereas there were no significant changes of VO2max (main effect of time; $F = 3.86$, $p = .071$) and LA max ($F = 0.26$, $p = .617$) in the study group and in the control group. Total WBC increased after exercise in PRE and POST in both groups. The increase of WBC was primarily due to neutrophils and lymphocytes. However the profile of this change depends on study group and the part of the experiment (effect of time, X group $F = 2.18$, $p = .055$ for neutrophils and time X group $F = 3.2$, $p = .008$ for lymphocytes). After exercise, the total number of WBC and neutrophils was lower in TR + HA compared to TR group.

Conclusion. It may be concluded that both four weeks endurance training with the addition of heat stress and the endurance training affect white blood cells profile after exercise. However the subtle differences in pattern of neutrophils and lymphocytes in the study and control groups were observed.

Keywords: *exercise, heat stress, endurance training, white blood cells.*

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INDIVIDUALIZATION OF EXERTION WHILE MONITORING FUNCTIONAL STATE DURING EXERCISING

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Background. Individualization in workloads is important as to get optimal benefits of exercising and long-term adaptation. Monitoring of heart rate (HR) during exercising could be valuable for the fed-back formation. The HR at state of absolute rest, i.e. after of 8 hours of sleep, differs from values calculated at state of relative rest. This study was designed to determine individualization of workloads while the task of training session is to develop functional abilities of cardiovascular system.

Methods. The participants of the study were 76 healthy adults who had to perform the same pulse rate, i.e. HR self-examination at absolute and relative rest states. In order to evaluate the difference of HR between the real and relative rest, participants had to calculate their pulse for 30 seconds at each 5 days. The results obtained during the study were analysed according to age and gender by performing calculations of HR Reserve, and the recommended intensities of exercising at 50% of HR Reserve; 70% of HR Reserve; 85% of HR Reserve, and calculation of sum of HR for 40 minutes training session was performed.

Results. Significant difference was found while comparing the averaged values of HR obtained at real and relative rest; greater difference between relative and real resting conditions was observed in younger age groups. While calculating the recommended HR values for choosing the intensity of exertion, evaluating the real and relative rest, it can be noted that the recommended HR meanings during exercising significantly differed. In order to get the effect of training when HR should be 50% of HR Reserve, or when HR should correspond 70% of HR Reserve.

Conclusion. The algorithm for feed-back formation could take into account the initial values of HR corresponding to the state of absolute rest, i.e. after of 8 hours of sleep. The HR at relative rest state is different than in real rest state why the algorithm for feed-back formation should take into account this difference, i.e. the corresponding correction of such HR meanings has to be installed.

Keywords: *health promotion, cardiovascular system, individualization.*

AN INVESTIGATION OF THE RELATIONSHIP BETWEEN MULTIPLE REACTION TIME AND ISOKINETIC BALANCE

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Background: The aim of this study is to compare the multiple reaction time and static and dynamic balance performances of sedentary.

Methods: In this study, 200 male academy students who were 22 years old, did not have visual-sensory impairments and were not professional athletes participated in the study voluntarily. In addition, the subjects who were chosen for the study were required not to have undergone injury in the lower extremities during the last year and not to have a history of diseases related to cerebral pathology, cerebellum or inner ear pathway nerves which could influence balance. The measurements were made by CSMİ Prokin TecnoBody isokinetic measuring set, and the reaction times were calculated by MOART lafayette measuring set.

Results: When the data obtained were reviewed, no significant relationship was found between static and dynamic balance performance and reaction time except for some differences ($p > 0.05$). The static balance properties with differences were observed through right left resonance ($p < 0.05$). A significant relationship was observed between left hand reaction time and static and dynamic balance. No other significant relationship was found besides this. Other works of literature support these results.

Conclusion: Since balance development is an important factor, it can be developed by increasing the students' participation in physical training and sports activities in undergraduate schools.

Keywords: *activity, balance, reaction time.*

PREVALENCE OF GENERALIZED JOINT HYPERMOBILITY AMONG STUDENTS FROM THE UNIVERSITY SCHOOL OF PHYSICAL EDUCATION AND SPORT

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Background. Generalized Joint Hypermobility (GJH) occurs very frequently in populations and manifests itself through range of motion in joints that exceeds normal limits. This condition may be a single symptom, but when is related to other symptoms like chronic joint pain or several extra articular symptoms, it is an important sign of Hereditary Connective Tissue Disorder. Increased range of movement is often a benefit in various sports disciplines. However, according to literature, persons with GJH are prone to injuries like sprains and dislocations. This research assessed the prevalence of GJH and its possible correlation to injuries in the group of students of Bronisław Czech University School of Physical Education and Sport in Kraków (USoFES), Poland.

Methods. The sample included 200 participants. They were examined with Beighton Scale. Range of extension in knee joint and elbow were measured using goniometer. Body height and weight was measured using a medical scale. Body Mass Index was calculated. Data about acute injuries, chronic pain and information about physical activity was collected with a self-reported questionnaire.

Results. Even 30.6% of participants were considered hypermobile (25% of men and 31.6% of women). They achieved 4 or more points in this scale. Some researchers use 5 point cut-off to proclaim hypermobility. In this study 17.9% of men and 21.1% of women achieved 5 or more points. Among participants who had regular training (more than 2 training sessions per week) 31% achieved 4 or more points. Using this 4 point cut-off, 27% of participants with lower level of physical activity were hypermobile. This difference was statistically significant; 25.8% of participants showed a range of extension in knees equal or higher than 10°.

Conclusion. Prevalence of GJH among students from USoFES appears to be similar to general population according to current literature. Higher level of physical activity is a plausible cause of higher prevalence of GJH in the group of athletes. This research will be extended to determine more correlations between the prevalence GJH and, for example, the number and the type of injuries.

Keywords: *hypermobility, range of motion, Beighton scale.*

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OXYGEN UPTAKE KINETICS DURING TREADMILL WALKING IN 6-19-YEAR-OLD CHILDREN WITH DIFFERENT PHYSICAL ACTIVITY

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Background. The pulmonary oxygen uptake (pVO2) kinetic response at the onset of exercise provides a non-invasive method of evaluating aerobic metabolism in muscles during growth and maturation (Armstrong & Barker, 2009). However, to date only limited research has been devoted to investigating the pVO2 kinetics during exercise in children with different physical activity. The aim of this study was to compare the oxygen uptake kinetics in physically active (PA), non-physically active (NPA) and overweight (OW) 6–19-year-old children.

Methods. Two consecutive treadmill exercise sessions (separated by one hour) were performed. During each session pVO2 data were collected at subjects rest and during walking (at 6 km/h and a 4% grade treadmill) for 6 minutes. The kinetics of pVO2 during exercise was analysed by applying mono exponential function. Participants: group I: ten PA (aged 8 ± 1.6 years), ten NPA (aged 8 ± 1.4 years) and five OW (aged 8 ± 1.7) children; group II: ten PA (aged 12 ± 1.9 years), ten NPA (aged 12 ± 2.0 years) and five OW (aged 12 ± 1.8 years) children; group III: ten PA (aged 16 ± 1.4 years), ten NPA (aged 16 ± 2.2 years), five OW (aged 16 ± 2.1 years) children.

Results. The time constant of pVO2 was significantly slower in all OW and NPA groups compared to the PA groups ($p < .05$). The amplitude of pVO2 response was similar in OW and NPA groups.

Conclusion. These findings demonstrate that children who are non-physically active or have overweight demonstrate slower pVO2 response at the start of exercise.

Keywords: *physical activity, children, oxygen uptake.*

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ESTIMATION OF CHANGES IN SELECTED MOTOR COORDINATION ABILITIES DURING RECREATION-SURVIVAL TRAINING OF STUDENTS OF UNIVERSITY OF PHYSICAL EDUCATION

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Background. Very often the Armed Forces have to work long-term in changing environmental conditions. The aim of this study was to estimate the changes in selected motor coordination abilities during long lasting survival training.

Methods. Research participants were 12 male students of the specialization "Physical Education in Uniformed Services" from the University of Physical Education. Their average age was 21, body height 179 cm and body mass 74.6 kg. The study took place during the summer. The students together walked about 12 km, paddling boats took six hours, kayaking took four hours. The constant training lasted 36 hours. Tests were conducted before training (M1), after 24 hrs (M2), after the training - 36 hrs (M3) and after 12 hrs of the rest (M4). The following tests were conducted: strength of forearm muscles and ability of its differentiation, running motor adjustment test (Tomczak, 2013) and shooting.

***Results*.** There were no differences in running motor adjustment test. Speed adjustment index with subsequent measurements: M1 – 5.29 ± 0.98, M2 – 5.54 ± 0.97, M3 – 5.02 ± 1.19, M4 – 5.32 ± 0.92. There were no differences in shooting performance with subsequent measurements: M1 – 39.7 ± 12.6, M2 – 43.8 ± 16.8, M3 – 43.4 ± 16.7, M4– 39.1 ± 14.8. Statistically significant differences were found in strength of forearm muscles between M1, M2, M3 and M4 (M1 – 402 ± 58N; M2 – 404 ± 163N, M3 – 403 ± 66N, M4 – 379 ± 65N). Significant differences were found in ability of its differentiation (Abs. error 50% between M1 and M2; M1 – 15 ± 14, M2 – 27 ± 13, M3 – 14 ± 14, M4 – 18 ± 12).

Conclusion. Summer recreation–survival training of moderate physical activity combined with limited possibilities for sleep resulted in changes in the ability to differentiate forearm muscle strength.

Keywords: *coordination motor abilities, survival, students.*

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THE EFFECT OF PILATES EXERCISES ON THE 10–14 YEARS OLD AEROBIC GYMNASTICS ATHLETES' BALANCE AND CORE MUSCLE ENDURANCE

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Background. Pilates exercise method is popular in the general population (Critchley et al., 2011) and clinical as well as fitness areas (Segal, 2004). Pilates is suggested at the end of training to improve flexibility and dynamic balance and to enhance muscular endurance (Critchley et al., 2011). Core strengthening is the focal point of Pilates method (Di Lorenzo, 2011). Core muscle is important in many functional and athletic activities because core muscle recruitment should enhance core stability and help provide proximal stability to facilitate distal mobility (Wilk et al., 2010). Aerobic gymnastics athletes continuously perform high-intensity and complex movements following music patterns which require high levels of fitness, strength and flexibility (Alves et al., 2015). The aim of this study was to evaluate changes in balance and core muscle endurance in aerobic gymnastics athletes after 13 weeks of Pilates training.

Methods. Research involved 33 aerobic gymnastics athletes (height 159.64 ± 7.92 (cm), weight 46.35 ± 7.24 (kg)). They were divided into three groups: group I performed Pilates exercises with soft gym balls, group II – without soft gym balls, group III – control group. Global (test described by McGill, 2007) and local ("Stabilizer" device) trunk muscle endurance, static ("Flamingo" test) and dynamic (modified "Star" test) balance were measured before and after 13 weeks of Pilates exercises.

Results. Thirteen weeks of Pilates exercises showed better results in static balance, significant changes in all movements in dynamic balance test and local trunk muscle endurance (e.g. transversus abdominal muscles: before Pilates exercises of group I – 69.92 (28.9) s, after – 133.59 (19.72) s (p = .0004); group II – 64.25 (30.71) s, after – 103.67 (20.98) s (p = .005), multifidus muscle of group I – 40.8 (16.89) s, after – 68.92 (14.46) s (p = .0001), group II – 45.08 (21.33) s, after – 61.25 (20.62) s (p = .04); global trunk muscle endurance significantly changed after Pilates exercises with soft gym balls (e.g. abdominal muscles 136.42 (26.02) after 213.75 (24.75) (p = .0009); back muscle 127.33 (33.24) after 205.33 (27.8) (p = .0001), etc.). There were no changes in the control group.

Conclusion. Thirteen weeks of Pilates exercises were effective in generating aerobic gymnastics athletes' core muscle activity and balance.

Keywords: *Pilates, aerobic gymnastics, global, local trunk muscle, balance.*

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MOTOR SKILLS AND BODY MASS INDEX IN A GROUP OF PORTUGUESE CHILDREN AGED EIGHT YEARS

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Background. Improving coordination in childhood is influenced by several factors. The relation between obesity and motor skills in children aged 4–6 years alternates according to the type of skills in question (Castetbon & Andreyeva, 2012), obesity directly influences dependent skills on body weight (Castetbon & Andreyeva, 2012). According to D'Hondt et al. (2014), there is a causal relation between the weight of children and their level of motor coordination. Freitas et al. (2016) have reported that young overweight track athletes demonstrate lower levels of motor coordination.

Methods. Data were collected from 3rd grade 20 children (8 boys and 12 girls) aged 8 years, of a in the region of Aveiro (Portugal) including their BMI (weight, height), abdominal girth and two tests KTK battery (side jump and lateral transposition), and analysed in terms of descriptive statistics.

Results. The overall results show an average of BMI within the normal range (19.31 kg/m^2 ± 7.01), but girls almost fall to the low weight percentile (18.25 kg/m^2 ± 2.89) well differentiated from boys (21.1 kg/m^2 ± 10.96) that stand out for the high standard deviation. As to the abdominal girth of boys (68.38 cm ± 17.24) girls stand out (63.8 cm ± 12.5) not only by the higher average value, but also by the standard deviation. At the level of motor coordination, values between boys and girls vary little: in the lateral jumps (boys = 36.75 ± 15.32; girls = 35.33 ± 8.6) and side transposing the boys (16.13 ± 3.44) with values above the group average (15.1 ± 3.4) and girls below (4.42 ± 3.36).

Conclusion. The group of girls seems to have more uniform results consistently than boys, although these stand out positively in comparison. This rather heterogeneous group shows results within each group, especially at the level of BMI, abdominal girth and lateral jumps test motor coordination. These results highlight the need for stimulation of these children through physical activity and structured coordination practices. Low levels of coordination at these ages contribute to inactivity and obesity, so it is important to promote inclusive practices independently of each child's level of development.

Keywords: *motor skills, body mass index (BMI), obesity.*

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MUSCLE DAMAGE AND BLOOD ANTIOXIDANT CAPACITY IN THREE PHASES OF KARATE TRAINING

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Background. Muscle damage as well as blood antioxidant capacity should be monitored throughout the whole season of training to timely detect the risk of oxidative damage to avoid adverse health outcomes and reduction of sports performance (Radak, Chung & Goto, 2008; Radak, Chung, Koltai et al., 2008). Therefore, the aim of this study was to examine whether the regular karate training performed during the general preparation (GPP), the pre-competitive (PCP) and the competitive (CP) phases affected blood antioxidant capacity in male karate fighters (*n* = 7; age 30.3 ±2.6 years) enrolled in this study.

Methods. Blood samples were collected at rest during each phase of the training. Blood antioxidant capacity was evaluated based on the activities of antioxidant enzymes (superoxide dismutase-SOD, catalase-CAT, glutathione peroxidase-GPx), reduced glutathione (GSH) and malondialdehyde (MDA) concentrations, ferric reducing ability of plasma (FRAP) level, activities of creatine kinase (CK) and lactate dehydrogenase (LDH) as muscle damage markers.

Results. Although no statistically significant differences were found, there was a clear trend to increased activities of CK, LDH, SOD, CAT, GPx, MDA concentration and FRAP level throughout of the training phases. The effect of the training phases, revealed by two-way ANOVA, appeared to be significant.

Conclusion. Our study showed that the pre-season training imposed on karate fighters did not cause disruption of prooxidant-antioxidant homeostasis in the competitive phase (CP) due to a moderate improvement in the blood antioxidant defence capacity.

Keywords: *karate training, oxidative stress, muscle damage, antioxidant capacity.*

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ESTIMATION OF CHANGES OF THE EFFECT OF DIVIDED ATTENTION DURING SURVIVAL TRAINING OF STUDENTS OF THE ACADEMY OF PHYSICAL EDUCATION

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Background. The measurements of changes in psychomotor performance indicators during the completion of various tasks and professional sports are a common area of interest for researchers (Dąbrowski et al. 2012; Tomczak 2015). This study is aimed to assess the effect of changes of divided attention during training and recreation – survival for 36 hours.

Methods. Participants of the study were 12 male students from specialization "physical education in uniformed services" studying at the University of Physical Education. Their average age was 21, body height – 179 cm and body mass – 74.6 kg. The research took place for 36 hours during the summer. The students had to perform walking for about 12 km and, paddle boats for six hours and kayaking for four hours. The computer test of divided attention was applied. The tests were performed before training (M1), after 24 hrs (M2), after ending the training – 36 hrs (M3) and after 24 hrs of the rest (M4). It was conducted to test the effect of divided attention (Tomczak 2013, Tomczak 2015). Calculated indicator perception.

Results. There was no deterioration of divided attention observed during the training. Improvement of the results was observed after rest. The following results were obtained: M1 – 50.83±12.40; M 2 – 47.92±16.25; M 3 – 57.75±13.54; M 4 – 65.67±18.20 ($p < 0.05$ (M1, M2 vs. M4)).

Conclusion. Summer recreation-survival training of moderate physical activity, connected with limited possibilities of sleep will not impair the divided attention.

Keywords: *divided attention effect, survival school, students.*

Acknowledgments: *The study was realized in the frame of the research project No. 202 University of Physical Education in Warsaw, Branch in Biała Podlaska.*

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COMPARISON OF SERVE KINEMATICS BETWEEN ELITE AND LEISURE TENNIS PLAYERS WITH INERTIAL SENSORS

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Background. The inertial sensor has been widely applied to sports goods to collect kinematics of human movement. Coaches could receive real-time information from the inertial sensor and then give a correct instruction as well. In order to determine the relationship between the data of inertial sensors and successful tennis serves, the purpose of this study was to investigate the kinematic difference of upper extremities between successful and unsuccessful tennis serves in elite and leisure players with inertial sensors.

Methods. Twelve elite and six leisure tennis male players were recruited as subjects, who were asked to perform the tennis serve for 10 times. Two gyro sensors were attached on their dominant hand and forearm to collect the triaxial angular velocities. The serve results (IN and OUT) were also recorded for statistical analysis.

Results. The elite group had higher angular velocities of wrist supination, adduction and elbow extension during the acceleration period than the leisure group. The elite group had the higher angular velocity of wrist flexion as IN than as OUT, and the lower angular velocity of forearm abduction as IN than as OUT during the following period; the leisure group had higher angular velocities of wrist flexion, elbow extension and wrist/elbow supination as IN than as OUT during the acceleration period. The angular velocities between hand and forearm had more relationships in the elite group than the leisure group.

Conclusion. The inertia sensor could be used for tennis serve technical evaluations. Both gyro sensors attached on hand and forearm could also determine the different motion during tennis serve. Furthermore, the elite players should focus on the technology during the following period, but on the contrary the leisure players should enhance the angular velocity of upper extremities during the acceleration period.

Keywords: *gyro sensor, accelerometer, first serve.*

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DIFFERENCES OF BASEBALL HARDNESS AMONG VARIOUS AGES USAGE

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Background. Baseball is a very popular sport and highly technical level sports event in the world. The game ball of baseball plays an important role in this sports event. Previous studies indicated that increased ball hardness has also been linked to decreased deformation during impact, increased stress transmitted to bone and increased chance of and severity of head injury (Heald & Pass, 1994; Viano & Lau 1988). The soft-core centred baseball would more likely than reduce the severity of head injury in comparison to a traditional baseball (Beaumont, 2000). Therefore, the purpose of this study was to compare baseball hardness among the game balls of various age stages.

Methods. As many as 24 game baseballs were collected from the 12U and 18U World Cup which were held by International Baseball Federation. The compression displacement (C-D) was measured according to the ASTM1888-09 standard method.

Results. The results showed that the 12U game baseball had larger circumference and the softer hardness compared to the 18U game baseball. The hardness of the game baseball was determined by the value of compression-displacement. The results of this study revealed that the game baseball used for elementary students (U12) had softer hardness than those used for high-school students (U18) by about 23.3%.

Conclusion. The finding suggests that baseball players of lower the age use a baseball of lower hardness which can reduce the severity of injury in case of collision.

Keywords: *injury, compression, ball.*

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THE IMPORTANCE OF PHYSICAL FITNESS FOR THE RELATIONSHIP OF BDNF WITH OBESITY MEASURES IN YOUNG NORMAL-WEIGHT ADULTS

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Background. Brain derived neurotrophic factor (BDNF) is essential for cognitive function. It is also found in non-neuronal tissues with various regulatory actions, including metabolic. Physical fitness is associated with improved synthesis and secretion of BDNF and reduced obesity. However, the importance of physical fitness for the relationship of BDNF with obesity has not been investigated. This study aims at examining the relationship of physical fitness with BDNF and obesity in 174 young (age = 25.30 ± 9.2 years) healthy adults.

Methods. Serum BDNF was evaluated using ELISA, while obesity was determined using body weight (BW), BMI, and waist circumference (WC). Six minute walk distance (6MWD) test was used to estimate physical fitness.

Results. Serum BDNF was greater (p = .000) in the participants with high (Hi6MWD) versus low (Lw6MWD) physical fitness group. Additionally, 6MWD explained 6.8% of serum BDNF. Obesity measures were greater (p < .05) in the participants with low versus high BDNF. In regression analyses, serum BDNF explained 4.7% of BW (p = .004), 3.8% of BMI (p = .011), and 6.2% of WC (p = .001). However, when the participants were divided into Hi6MWD and Lw6MWD, BDNF explained 8.2% of BW (p = .009), 6.0% of BMI (p = .03), and 7.0% of WC (p = .013), only in the Hi6MWD, but not in the Lw6MWD (p > .05) groups.

Conclusion. The finding confirms the relationship of BDNF with obesity. Additionally, it further suggests the importance of physical fitness level to this relationship among young adults. Future studies are needed to confirm these findings.

Keywords: *exercise, brain derived neurotrophic factor (BDNF), obesity**.***

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