PHYSICAL ACTIVITY AGAINST EARLY AGING AND NONCOMMUNICABLE DISEASES

International Scientific-practical Symposium
In collaboration with the European Group for Research into Elderly and Physical Activity
Book of Abstracts

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While there is sufficient evidence to acknowledge the benefits of physical activity across the human lifespan, many questions regarding physical activity in old age remain unanswered. These questions encompass basic philosophical issues related to aging and/or movement, questions seeking to examine the underpinnings of movement, and specific questions related to unique aspects of physical activity and movement in advanced age.

You are cordially invited to the International Scientific Symposium which will focus on the latest trends in research on active and successful aging. The aim of the Symposium is to bring together scientists who are interested in the field of physical activity, aging and health and to conduct an open dialogue that combines and connects research and practical issues in this field.

Rector of Lithuanian Sports University Assist. Prof. Dr. Diana RĖKLAITIENĖ

President of the European Group of Resarch into Elderly and Physical Activity (EGREPA),
co-Editor-in-Chief of the European Review of Aging and Physical Activity (EURAPA) Prof. Dr. Yael NETZ

Chief investigator of the project: Active healthy aging (2009–2020) Prof. Dr. Anita HÖKELMANN

THE SYMPOSIUM IS FUNDED BY THE RESEARCH COUNCIL OF LITHUANIA

Lithuanian Sports University (LSU), founded in 1934, is a specialised public higher education institution that has developed its unique traditions in sport, leisure and health sciences. With its mission to contribute to the sustainable development of society through international level research and academic excellence, LSU is known as a leading academic and research centre in sports science in the Baltic Sea region.

LSU is an important centre of Sports Science and a promoter of values and traditions of physical education and sport. It has trained 14.000 Physical Education teachers, highly qualified coaches of various sports, physical therapy professionals, tourism and sports managers, etc. A lot of famous scientists, world famous coaches and public figures graduated from the University. Moreover, a significant number of LSU students have become the winners of the Olympic Games, European and world champions and winners.

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EGREPA was born from the premise that the field of "Physical Activity and health for the older generation" is an interdisciplinary field of study which involves professionals and researchers from very diverse areas. These areas include Medicine, Biology, Education and Health Care Services. Among the diverse disciplines we could cite Epidemiology, Exercise Physiology, Geriatrics, Gerontology, Healthy Education, Nutrition, Physical Education, Physiotherapy, Psychology, Rehabilitation and Sociology. The European Group for Research into Elderly and Physical Activity is a non-profit making nongovernmental association (NGO) which aims to promote physical activity and health in the elderly through the carrying out and promotion of research and the collection and diffusion of information related to this field of interest. EGREPA is a scientific organization that is opened to work and co-operate with other organizations with common interests.

More information on the website: http://www.egrepa.org/

KEYNOTE SPEAKERS

Prof. Dr. Habil. Albertas SKURVYDAS
Lithuanian Sports University, Kaunas, Lithuania

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Wingate Institute, Israel

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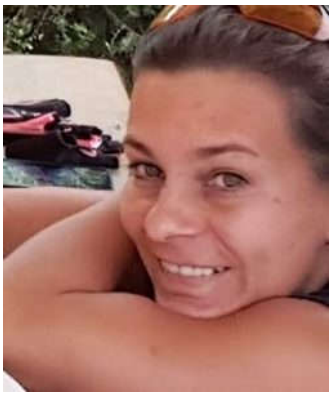

PhD Alena SKOTÁKOVÁ
Masaryk University, Brno, Czech Republic

3th October, 2019	
OPENING OF THE SYMPOSIUM **Lithuanian Sports University, Sporto str. 6** **Central building, 215 auditorium**	
9:00–10:00	**Registration**
10:00–10:30	**WELCOME SPEECH** **LSU Rector Prof. Dr. Diana RĖKLAITIENĖ** **EGREPA president Prof. Dr. Yael NETZ**
10:30–11:30	**PLENARY PRESENTATION** **Prof. Dr. Yael NETZ, Israel** **HISTORICAL AND PRACTICAL ASPECTS OF EXERCISE (AND COGNITION) IN OLD AGE**
11:30–12:00	**COFFEE BREAK**
12:00–13:00	**PLENARY PRESENTATION** **Prof. Dr. Anita HÖKELMANN, Germany** **EFFECTS OF CYCLIC AND ACYCLIC MOVEMENTS OR MOVEMENT COMBINATIONS ON THE BRAIN. EFFICIENT TRAINING PROGRAMMS FOR COGNITIVE AND MOTOR FUNCTIONS IN ELDERLY**
13:00–14:00	**LUNCH BREAK**
14:00–15:00	**PLENARY PRESENTATION** **Dr.Oron LEVIN, Belgium** **THE BENEFICIAL EFFECTS OF COMBINED VERSUS SINGLE EXERCISE INTERVENTIONS ON MOTOR AND COGNITIVE FUNCTIONS IN OLDER AGE: WHAT MAKES THE AGING BRAIN STRONGER?**
15:00–15:30	**COFFEE BREAK**
ORAL AND POSTER PRESENTATIONS **Moderators: Prof. Dr. Yael NETZ, Assoc. Prof. Dr. Nerijus MASIULIS** **Central building, 215 auditorium** **15:30–17:55**	
DISCUSSION "TAKE-HOME MESSAGE" **Moderator Assoc. Prof. Dr. Nerijus MASIULIS** **Central building, 215 auditorium** **17:55–18:15**	
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3th October, 2019	
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15:45–16:00	Miglė BACEVIČIENĖ[1], Rasa JANKAUSKIENĖ[1, 2], Vida ČESNAITIENĖ[1, 2] *Lithuanian Sports University, [1]Department of Social and Physical Education, [2]Institute of Sport Science and Innovations* **PERCEIVED CONSTRAINS TO EXERCISE AND AUTONOMOUS MOTIVATION IN ELDERLY WOMEN**
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17:15–17:30	Zbigniew M. OSSOWSKI[1], Magdalena ZDANEWICZ[2] *[1]Gdansk University of Physical Education and Sport, Poland, [2]Master's Studies Medical University of Gdansk, Poland* **RELATIONSHIP BETWEEN MUSCLE STRENGTH AND BODY BALANCE IN WOMEN WITH LOW BONE MASS: A PRELIMINARY STUDY**

3th October, 2019	
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17:25–17:35	L. ŽLIBINAITĖ[1, 2], R. SOLIANIK[1], A. SKURVYDAS[1] *[1]Lithuanian Sports University, Kaunas, Lithuania* *[2]Kaunas University of Applied Sciences, Kaunas, Lithuania* **IMPACT OF A 6-MONTH AEROBIC EXERCISE PLUS CALORIC RESTRICTION INTERVENTION ON RESTING METABOLIC RATE, SUBSTRATE OXIDATION AND METABOLIC SYNDROME COMPONENTS IN OVERWEIGHT AND OBESE WOMEN**
17:35–17:45	Ligita SILINE[1, 2], Arvydas STASIULIS[1], Loreta STASIULE[1] *[1]Lithuanian Sports University, Lithuania, [2]Kaunas University of Applied Sciences, Lithuania* **BETTER EXECUTIVE FUNCTION IS ASSOCIATED WITH FASTER ON-TRANSITION OF AEROBIC METABOLISM IN ELDERLY PEOPLE**
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10:30–11:30	PRACTICE SESSION Prof. Dr. Anita HÖKELMANN, Germany DANCING FOR NEURO FLEXIBILITY AND AGAINST LOSS OF MEMORY
11:30–12:30	PLENARY PRESENTATION Assoc. Prof. Joanna BOROWIEC, Poland QUALITY OF LIFE OF SENIORS PARTICIPATING IN DANCE CLASSES COMPARED TO THOSE PRACTICING OTHER FORMS OF PHYSICAL ACTIVITY
12:30–13:30	PRACTICE SESSION Assoc. Prof. Joanna BOROWIEC, Poland AFRO DANCE FOR SENIORS
13:30–14:30	LUNCH BREAK
14:30–15:30	PLENARY PRESENTATION PhD. Alena SKOTÁKOVÁ, Czech Republic THE EFFECT OF DANCE INTERVENTION PROGRAM ON DIFFERENT ABILITIES (MOTOR AND COGNITIVE) IN HEALTHY ELDERLY AND THE ELDERLY WITH MILD COGNITIVE IMPAIRMENT
15:30–16:30	PRACTICE SESSION PhD. Alena SKOTÁKOVÁ, Czech Republic POSSIBILITIES OF THE DANCE PROGRAM FOR THE ELDERLY

For practical sessions, we recommend you to have sportswear and shoes.

Abstracts

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HISTORICAL AND PRACTICAL ASPECTS OF EXERCISE (AND COGNITION) IN OLD AGE

Yael Netz
The Academic College at Wingate, Israel, the European Group of Research into Elderly and Physical Activity (EGREPA)

The "evolution of sedentarism" vs the "evolution of purposeful exercise" – Aerobic, strength and balance training

The history of movement has faced a crisis relationship between two elemental human phenomena: on one hand is the principle of economy – the human aspiration to reduce physical and mental efforts to a minimum, on the other hand is the adaptation principle – the natural dependence of human beings on movement. The principle of economy has led to the development of cutting-edge technology which "went too far" in reducing physical and mental efforts ignoring the dependence of human beings in movement. While in the past there was no need for purposeful exercise as survival forced human beings to be in motion, the overwhelming reduction in daily energy expenditure in the 20th century, along with the increase in chronic diseases caused by the movement reduction, generated the promotion of purposeful exercise as a need for survival and health. Specifically, purposeful exercise comprises of assorted sets of movements aiming at enhancing various body systems.

Historically, **aerobic** exercise was the first exercise mode to be explored in relation to cognitive functioning. After aerobic exercise it was **strength** (resistance) training that was explored and promoted in elderly population. The importance of **balance** and coordination exercise evolved only later on, when life expectancy increased, and the issue of falls in old age came into focus.

The evolution of exercise and cognition – the metabolic (aerobic and strength) vs the neuromuscular (balance) activities

The physical (metabolic) activities and cognition

In the aerobic exercise studies older adults are exposed to moderate intensity aerobic exercise and compared to light – mostly stretching and toning – control groups. The intensity of training is pre-determined, based on individual aerobic capacity (estimated or measured VO_2 max – maximal oxygen consumption), and well-controlled during the training. Importantly, all these studies have reported a significant improvement in fitness in addition to improvement in cognitive functioning, mainly executive functions.

Once the link between aerobic exercise and cognition has been clearly established, scientists and neuropsychologists moved to strength training as a potential enhancer of cognitive functioning. These studies reinforced the aerobic exercise studies reporting that strength training is also effective in altering measures of executive functions.

The motor (neuromuscular) activities

A shift in this line of research came up with the notion that typical balance and coordination training such as moving with a narrow base of support, eye-hand coordination or arm-leg coordination rely more on neuromuscular demands than the highly automatic movements typical to aerobic or strength training. This notion inspired the assumption that these movements may stimulate changes in information processing, specifically the ability to handle visual and spatial information.

This pattern of results implies two mechanisms for physical activity affecting cognitive functions via two different pathways. Both training categories affect neuroplasticity and consequently cognitive functioning. However, there are two main differences: 1. Physical training affects cognition via improvement in cardiovascular fitness whereas motor training affects cognition directly. 2. Physical training affects neuroplasticity and cognition in a global manner, while motor training is task specific in increasing brain neuroplasticity and in affecting cognition.

Examining the underlying forces behind the two training categories in altering neuroplasticity and cognition reveals that in the physical training it is the **intensity** of training that enhances neuroplasticity and

consequently improves cognition whereas in the motor training it is the motor **complexity** that affects the relationship between exercise and cognition. While intensity is measureable, complexity is hardly measurable, thus dose-response effect of motor activities on cognition is difficult to determine.

One way to control and quantify complexity is the dual-task activities. The **dual-tasks activities** include a controlled combination of two tasks or activities, performed simultaneously, and arbitrarily designed as a means to promote basic motor system such as postural control, or cognitive functioning. Dual-task training which includes cognitive demands in addition to physical or motor activity has proven more effective in preserving or improving cognitive functioning than a single task.

The evolution of personalized exercise – a new project

The official bodies of health have published general evidence-based guidelines for exercise specifically aimed at people aged 65 and over, comprising ≥ 150 minutes a week of moderate-intensity aerobic exercise, ≥ three times a week balance exercise, and ≥ twice a week strength training. And yet, despite the known health benefits associated with physical activity, older adults remain highly inactive, being in fact the most sedentary segment of society.

In order to meet the challenge of promoting exercise among older people, and considering the wide range of variability among the aged population, we propose a novel approach using a **personalized exercise program**. Based on the one hand according to the principles of the official exercise guidelines for older adults, but tailored to address specific parameters of fitness and movement, as well as preferences of the individuals themselves, we propose a program which would integrate exercises for improving all movement components. Advancing technology, data collection, and increasingly sophisticated data retrieval and analysis, all make **mobile smartphones** an attractive and powerful tool to accurately assess, monitor and provide dynamic feedback according to personal progress – all in the convenience of people's own **home environment. The idea of personalized exercise stems from the concept of personalized preventive medicine.**

The aim of our project is to develop a novel digital smartphone application which will enable self-assessment of fitness components, and will provide personalized comprehensive exercise programs which will be updates at regular intervals according to changes in fitness levels.

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CORTICAL MODULATION AND PHYSICAL ACTIVITY

Anita Hökelmann[1], Tariq Ali Gujar[1], Kathrin Rehfeld[1], Patrick Müller[1, 2]
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Introduction. Physical activity is a potent inducer in mediating the structural and functional changes in the brain, and its benefits for cognitive development and performs motor skills (Mandolesi et al., 2018). Lifelong learning of motor skills (Cameron, Cottone, Murrah, & Grissmer, 2016), a mixture of cyclic and acyclic motor skills with high complexity facilitate the development of cognitive abilities (Balgaonkar, 2010; Verret, Guay, Berthiaume, Gardiner, & Béliveau, 2012). Postural balance is one of the motor skills which needs sensory integration of somatosensory, visual and vestibular system. The aim of these studies was to establish 1. the effectiveness of sensory integration on postural balance, 2. cortical modulation during cyclic and acyclic motor skills and its learning process to determine the effect on cognitive abilities, and 3. effects of multimodal dancing in comparison to aerobic physical activity on cognitive function, neuroplasticity and fall prevention.

Methods. *Study 1***.** The effect of sensory influence on postural balance was determined by 20 subjects 24.64 ± 2.47 years of age underwent a sensory organisation test (SOT) with Balance Master (NeuroCom® International, Inc., USA), along with coupled 32-channel wireless MOVE EEG 10/20 system. The cortical modulation during cyclic and acyclic movements was assessed by 12 young aged 19.92 ± 0.76, who performed unknown cyclic and acyclic movements for 120 sec. Meanwhile, kinematic data was recorded with the VICON motion system, and 32 channel wireless MOVE EEG 10/20 system was used to measure the EEG activity during pre and post-test. The participants had two days to get familiar with the movements; thereafter, post-test was performed. The power spectrum and functional localisation were analysed in the alpha, beta and gamma frequency bands. The exported data of the EEG was analysed with SPSS 20. The effect of multimodal dancing was found by 18-months training by 14 seniors dance group (67.21 ± 3.78 years), and 12 seniors of the fitness group (68.67 ± 2.57 years).

Study 2. Another study was designed as an 18-month controlled intervention. Sixty-two healthy elderly individuals (63–80 years) recruited via announcements in local newspapers were screened for the study. The exclusion criteria were claustrophobia, tinnitus, metal implants, tattoos, diabetes mellitus, depression (Beck-Depressions Inventory, BDI-II > 13), cognitive deficits (Mini-Mental State Examination, MMSE < 27), neurological diseases and regular exercising (≥ 1 h/week). The remaining 52 participants were then randomly assigned to either the dance or the sport group by using the website www.randomization.com and controlling for age, MMSE status and physical fitness. Assessments were performed at baseline, after 6 and after 18 months of training. Twenty-two participants completed the entire intervention and all measurements. No group differences regarding the demographic data were found.

Results. *Study 1.* The participants of the study showed significant ($p < .05$) better postural balance abilities under somatosensory and visual influence compared with vestibular influence. Cortical modulation showed significant ($p < .05$) higher alpha activity under somatosensory and gamma activity under the visual influence in the frontal, temporal, central, parietal and occipital lobe. In the comparative study of cyclic and acyclic motor skills, acyclic activity showed significantly higher beta activity in the parietal and occipital lobe, whereas gamma activity was also significantly higher in central lobe ($p < .05$). Along with this significantly ($p < 0.05$) robust beta, connectivity was found between the supplementary motor area with parietal, temporal and occipital lobes as compared with cyclic activity. The learning effect showed a significant decline in gamma activity ($p < .05$) in the frontal lobe during post-test of acyclic activity and no significant difference was found in the post-test of cyclic activity. The effect of multimodal dance showed improvement in cognitive abilities like verbal memory and significantly increased in grey matter volume in the anterior, the medial cingulate cortex, the left supplementary motor area, the left precentral gyrus, the left medial frontal gyrus, the left insula, the left superior temporal gyrus, the left postcentral gyrus and hippocampus. Besides, this dance group also showed improvement in postural balance abilities.

Study 2. In this study, we compared the effects of participation in either a dance program or a conventional physical fitness sport program on brain function and volume in healthy seniors. The dance program was a newly designed intervention that required constantly learning new dance choreographies.

The conventional sport program focused mainly on repetitive motor exercises. As a main finding, we observed that after 6 months of training, the volumes in the left precentral gyrus of the dancers had increased more than those in the sport group. After another 12 months of training, an additional volume increase was observed in the right parahippocampal gyrus of the dancers. BDNF levels increased during the first 6 months of dance training and returned to the pre-treatment values after 18 months. In the conventional sport group, a similar increase in BDNF was not evident. Because the cardiovascular fitness levels over the course of the interventions remained constant in both groups, the observed effects could not be attributed to improvements in physical fitness but instead seemed to be related to the specific features of the dance program. These features included the requirement to constantly learn new choreographies (i.e., memory), to integrate multisensory information, to coordinate the whole body and to navigate in space.

Brain Changes. The precentral gyrus is essential for the control of voluntary motor functions. The increase in gray matter volume in the precentral gyrus in the dance group may, therefore, have been based on the complex and ever-changing movement patterns that the dancers had to perform. These movements required the simultaneous coordination of several parts of the body in different directions and adjustment to the varying rhythms of the music (polycentric and polyrhythmic). Reflecting on these complex coordination requirements, Brown et al. (2006) have reported dance-induced activations in the putamen, the primary motor cortex and the supplementary motor area (SMA), as shown by PET. Other studies have indicated an association between coordination demands (e.g., balancing, juggling) and neuroplasticity in the precentral region (Boyke et al., 2008; Taubert et al., 2010). Hence, the dance-related volume increase in this area was consistent with expectations based on the literature.

Discussion and conclusion. It is generally thought that motor training initially induces brain volume increases. The results of postural balance abilities explained that the postural balance is challenging under the influence of vestibular system and cortical modulation also showed higher alpha activity under the vestibular influence which demonstrated less cortical modulation (Zappasodi, Marzetti, Olejarczyk, Tecchio, & Pizzella, 2015), which is trainable. The results of cyclic and acyclic motor skills cortical modulation revealed that acyclic activity needs higher cortical sources, including internal processing and higher sensory-motor integration, to accomplish the task. Beta connectivity is the predictor of integrating neural networks across brain structures in case of cognitive processes (Ahnaou, Huysmans, Van de Casteele, & Drinkenburg, 2017), which was found during acyclic activity. Besides that, acyclic activity exhibited adaptation even after two days of training. In consideration of finding of the study, the effect of multimodal dancing training also showed a positive effect on the structure and cognitive abilities and postural balance. It is proposed that new acyclic rhythmic structured and coordinated movement are more useful for the development of cognitive abilities.

However, prolonged training leads to automatization, which may have the opposite effects on cortical volume, because less cortical control is needed after the motor skills have been fully established (Taube, 2008). Our dance training program, therefore, was specially designed to avoid such automatization, which may explain why, at least within 18 months, no cortical volume decreases were observed in our study.

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THE EFFECTS OF DIFFERENT EXERCISE INTERVENTIONS ON MOTOR AND COGNITIVE FUNCTIONS IN OLDER AGE: WHAT MAKES THE AGING BRAIN STRONGER?

Oron Levin[1,2]
[1]*Movement Control and Neuroplasticity Research Groups, KU Leuven, Leuven, Belgium,*
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The decline in cognitive and motor functions with age affects the performance of the aging healthy population in many daily life activities. Physical activity (PA) appears to mitigate this decline or even improve motor and cognitive abilities in older adults. However, the mechanisms associated the beneficial effect of PA on cognitive and motor functioning in older adults are poorly understood. In a recent systematic review we explored the dual effects of different types of physical training on cognitive and motor tasks in older adults with no known cognitive or motor disabilities or disease. The main findings from this systematic review were: (1) Multi-component exercise training or combined physical-cognitive training were found to improve a larger number of physical, motor, and cognitive outcome measures than a single exercise intervention. Physical-cognitive training was found to be the best intervention strategy; (2) Multi-component exercise training was found to be beneficial for improving gait and processing speed, whereas combined physical-cognitive training was found to be most beneficial for psychomotor speed, processing speed, attention and dual task cost; (3) Pre-post gains in mobility and psychomotor speed were strongly associated with pre-to-post gains in processing and dual task cost. However, these associations were more prevalent when intervention consisted of combine physical-cognitive training. Taken together, the abovementioned findings advocate the use of multimodal exercise paradigms as most optimal training protocol to improve cognitive-motor abilities in older age. Therefore, my talk will also examine the possible effects of cognitive-physical training on (1) structural and functional changes in specific brain areas that may underlie the beneficial effect of training on brain and performance, as well as on (2) interactions between functionally interconnected brain networks such as the prefrontal-basal ganglia network and the hippocampus.

Key words: aging, exercise, motor functions, cognitive functions, cognitive-physical training, brain, basal ganglia, hippocampus.

EXERCISE IS MEDICINE

Prof. Dr. Habil. Albertas Skurvydas
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The health benefits of exercise are well known and confirmed by modern science. Physical activity can greatly reduce risk of heart disease, stroke, type 2 diabetes, breast and colon cancer, depression, and falls. The human body was designed so that all physiological functions are optimal when we move. Scientists have discovered that during exercising, muscles release natural substances that help relax blood vessel walls, lower blood pressure, reduce "bad" LDL cholesterol, increase "good" HDL cholesterol, move glucose out of the bloodstream and into the cells where it is needed, lower insulin levels, and reduce inflammation. All of these functions together help protect us against heart disease (Cornelissen & Smart, 2013), stroke, type 2 diabetes (Liubaoerjijin, Terada, Fletcher, & Boulé, 2016), and some cancers (Moore et al., 2016).

There are some main aspects of prescribing physical activity to prevent chronic noncommunicable diseases. One of the most important factors is the specificity and accuracy of the exercises. Exercise alone can hardly help achieve the desired outcomes, but combining it with nutrition and stress reduction techniques increases the impact of exercise on human health. When prescribing exercises, it is necessary to consider the individuality of the person and choose the exact dosage to achieve the desired goal. Excessive intensity can also have a negative impact on well-being and health. Exercise effectively reduces visceral fat and systemic inflammation as well as its consequences. Undoubtedly, physical activity also benefits human mental health (Chekroud et al., 2018). It is recognized that physical activity helps reduce anxiety and depression syndromes (Schuch et al., 2018). Regular aerobic exercise appears to boost the size of the hippocampus, the brain area involved in verbal memory and learning. Even small increases in activity, such as a faster walking pace or more time spent gardening or doing other leisure activities, can improve heart function.

What are the challenges?

1) Good scientific evidence (complexity of the interdiciplinarity of science);
2) Individual programs (precision exercise, medicine);
3) Political/economic education and interventions;
4) Cultural/social change.

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QUALITY OF LIFE OF SENIORS PARTICIPATING IN DANCE CLASSES COMPARED TO THOSE PRACTICING IN OTHER FORMS OF PHYSICAL ACTIVITY

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Introduction. Quality of life (QoL) is an individual's perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It was observed that older adults dissatisfied with their lives who reported low QoL, tare twice as likely to die in the next 10 years (Lyyr et al., 2006). To preserve good QoL in older adults, it is particularly important to support cognitive functions. Researches were undertaken whether this could be achieved through physical activity.

Progress in research methods has enabled observation of activity and changes occurring in the brain during physical activity. For a long time, most researchers focused on the relationship between physical activity and the functioning of older people in the various subdominants of the QoL. Later studies examined how various forms of physical activity affect the functioning of older people and their QoL.

Aim. The aim of the presentation was to analyze how dance and other forms of physical activity affect the QoL of older people?

Results. Dance is supporting the functioning and health of the elderly and improving their QoL differently than other forms of physical activity. The most commonly used questionnaires of QoL used the models which were not normed on older adults.

Conclusions. Future researches should analyze the relationships and their directions between QoL of older adults and physical and mental changes caused by participation in dance (compared to other forms of PA). Also standardized questionnaires adapted to older adults should be used in the researches.

THE EFFECT OF INTENSIVE DANCE-EXERCISE INTERVENTION ON COGNITION AND BRAIN PLASTICITY IN HEALTHY SENIORS AND PATIENTS WITH MILD COGNITIVE IMPAIRMENT

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Relevance of the research. The main aim of the study was to create a structured dance-movement program for healthy seniors and patients with mild cognitive impairment (MCI) and to evaluate the effect of the intervention program on structure and function of the brain of these people. We have also tried to find functional fitness and postural stability.

Research methods and organization. There were 120 participants in the study (aged > 60), randomly assigned to either a dance intervention (DI) group or a life as usual (LAU) group. The 6-month intensive dance-exercise program was carried out three times a week and included 50 dance exercise sessions, each lasting for 60 min. Three subtests of Senior fitness test (6 Min Walk Test, Chair Stand test, 8 Foot Up and Go test) were used to determine the level of functional fitness. The static posturography method assessed the level of balance abilities in one position, BMI measurement, detailed neuropsychological testing and brain MRI encompassing T1 structural and diffusion tensor imaging (DTI). The measurements were performed at baseline and after 6 months.

Results and discussion. The practical improvement in results of static posturography (COP, forward backward deflection, right-left deflection) was found in the group with MCI which practiced dance. We found improvement in both groups in 6 minutes test after the intervention program. The positive effect was also found in the healthy elderly in Chair Stand test and 8 Foot Up and Go test after the dance intervention.

In DI group, we found a cortical thickening in inferior temporal gyrus and lateral occipital gyrus of right hemisphere; and the increase in frontoparietal control network intranetwork connectivity. The posterior inferior temporal cluster is broadly connected to regions associated with modality-specific processing in the visual, auditory, and motor domains engaged in the ventral visual, auditory-motor, and dorsal attention networks, all implicated in learning new skilled dancing movements

Conclusions. We can suggest that the dance intervention program has a positive influence on balance in MCI group. The dance intervention program may have influence on the level of endurance in the elderly of both groups (health and MCI). For lower-body strength, agility, and dynamic balance, we found positive influence only in the healthy group. The increase in FPCN connectivity in the DI group suggests positive influence of the dance-exercise program on attention and executive functions and the switching of attention between internal and external stimuli.

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ANALYSIS OF FACTORS RELATED TO PHYSICAL ACTIVITY IN ELDERLY WOMEN

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Introduction. Regular physical activity plays an important role in improving and maintaining health and quality of life, especially in aging individuals (McPhee et al., 2016). However, the majority of older adults report sedentary lifestyles (Harvey, Chastin, & Skelton, 2013). Thus, analysis of factors associated with physical activity are of the great importance. For this reason, the aim of this study was to analyze factors related to physical activity in a sample of elderly women.

Methods. Elderly women (n = 127, mean age 69.7 ± 5.5, range 60–84 years) completed questionnaires measuring physical activity (Rapid Assessment of Physical Activity, (RAPA), Topolski & LoGerfo, 2006) and exercising motivation (Self-Regulation Questionnaire, Motivation for Exercise (SRQ-E), Ryan & Connell, 1989). The scale developed and adopted for Lithuanian population was used to measure Perceived Constrains to Exercise (PCES, Bacevičienė & Ališauskas, 2013). Depressive symptoms were assessed using Center for Epidemiological Studies Scale (CES-D, 10 items, Björgvinsson & Kertz, 2013) and the list of health complaints, developed for the national survey (Klumbienė & Veryga, 2015) was filled in to indicate perceived-health.

Results. Majority of the sample was of normal body mass (34.6%) or overweight (48.0%); 73.2% of the sample was insufficiently physically active. Lack of time and interest, fear of falls and negative experience during exercising, lack of knowledge, poor health and unsuitable environment were the most important constraints to exercise. Path model (GFI = 0.978, AGFI = 0.909, RMSEA = 0.076) demonstrated that BMI (β = 0.13; p = .07), depressive symptoms (β = 0.44; p < .0001) and indicated number of health complaints (β = 0.23; p = .008) accounted for 42% of the variance of physical activity constraints. Furthermore, physical activity constraints negatively predicted autonomous motivation for physical activity (β = -0.20; p = .024) and physical activity itself (β = -0.22; p = .012). Autonomous motivation was negatively related to physical activity (β = -0.16).

Conclusions. Physical activity constraints and autonomous motivation are important variables of elderly women's physical activity. Future studies in larger elderly samples of both genders are important to test our findings.

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PERCEIVED CONSTRAINS TO EXERCISE AND AUTONOMOUS MOTIVATION IN ELDERLY WOMEN

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Introduction. Regular physical activity produces major and extensive health benefits in both younger and older adults (WHO, 2010). However, older adults live mostly sedentary lifestyles. The main constraints to exercise for elderly women are individual (poor perceived health, negative experiences, lack of time or interest) and environmental (Bacevičienė & Ališauskas, 2013; Burton et al., 2017). Autonomous motivation is the background of continuous physical activity (Vansteenkiste, Niemec, & Soenens, 2010). However, there is lack of studies explaining how perceived barriers to exercise are associated with autonomous motivation for physical activity in elderly women.

The aim. This study examined how perceived barriers to exercise were associated with autonomous motivation in the group of elderly women.

Methods. Elderly women (n = 127, mean age 69.7 ± 5.5, range 60–84 years) completed questionnaires measuring exercising motivation (Self-Regulation Questionnaire, Motivation for Exercise (SRQ-E), Ryan & Connell, 1989), Perceived Constrains to Exercise Scale, PCES (Bacevičienė & Ališauskas, 2013) and Rapid Assessment of Physical Activity questionnaire (RAPA), Topolski & LoGerfo, 2006).

Results. 73.2% of the sample was insufficiently physically active. Lack of time and interest, fear of falls and negative experience during exercising, lack of knowledge, poor health and unsuitable environment were the most important constraints to exercise. Elderly women reported identified motivation as the most important motivational regulation. Identified regulation means that a person is consciously valuing a behavioral goal or regulation, such as the action accepted or owned as a personally important or, in other words, an individual's engagement in physical activity governed by some distinguishable consequence (Deci & Ryan, 2008; Standage, Sebire, & Loney, 2008). However, identified regulation is the mildest type an external motivation: elderly women reported exercising because of the need to exercise, or to avoid pain or other sedentary lifestyle-related outcomes. Furthermore, liner regression analyses showed ($R = 0.459$, $R^2 = 0.211$) that fair of falls and negative experience during exercise decreased ($\beta = -0.481$, $p < .0001$) autonomous motivation (RAI index), whereas poor health was the constraint which increased autonomous motivation in elderly women ($\beta = 0.24$, $p = .022$).

Conclusions. Results highlight the importance of understanding the motivation for exercise and its associations with perceived constraints to exercise. Future studies should test our findings in larger elderly samples of both genders.

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ASSOCIATION BETWEEN DIET AND HANDGRIP STRENGTH. CROSS-SECTIONAL FINDINGS FROM THE UK BIOBANK STUDY

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Healthy ageing is associated with a loss of muscle strength, which has been shown to be associated with adverse health outcomes. Furthermore, muscle strength is affected by diet and specific dietary components, which play an important role in the age-associated decline (1–3). However, current data investigating the association between diet and muscle strength are limited to small studies. UK Biobank, a large dataset, offers the possibility of investigating the relationship between diet and handgrip strength (4–6). The aim of the current study, therefore, was to investigate the association between diet and handgrip strength.

In this study 68,002 participants (age 63.8 ± 2,7 years, 50.3% women, 49.7% men) from UK Biobank, a prospective population based-study were included. The participants provided data on diet, nutrition and handgrip strength. Associations were compared using regression analyses using STATA 14 statistical software, with adjustment for age, sex, monthly assessment, ethnicity, deprivation index, height, comorbidities and total energy intake. All analyses were carried out stratified by sex.

Current data demonstrates that there were negative associations ($p < .01$) between processed meat, carbohydrates and handgrip strength in both sexes. Similarly, positive associations ($p < .01$) between non oily/oily fish, fruits, vegetables, carotene, retinol, potassium, vitamin B12, iron, protein, magnesium and grip strength were seen in both sexes. In women, only positive associations ($p < .01$) were observed between unsalted nuts, cheese, red meat, vitamin C, foliate, vitamin E and hand grip strength. In men only negative associations ($p < .01$) seen between bread and hand grip strength. The current study highlights the main dietary factors which are associated with handgrip strength in men and women aged ≥ 60 years old. Furthermore, appropriately designed trials are need to confirm if these associations are casual.

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EFFECT OF 3 MONTHS OF DETRAINING PERIOD ON FUNCTIONAL FITNESS TESTS, BODY MASS AND WAIST-TO-HIP RATIO INDEX AND BODY FAT MASS IN OLDER WOMEN AFTER PERFORMING PROGRESSIVE 12 WEEKS STRENGTH TRAINING-PILOT STUDY

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Relevance of the research. At present, it is already proven that physical activity, and especially strength training, has a positive effect on numerous health-related outcomes in older individuals. There is a lot of evidence that regular strength training can positively affect muscular strength, functional fitness tests as walking, stair climbing or standing up from the chair (1, 2). Among others, research also showed increases in muscle mass (3), decreased fat mass (4) and also there is evidence that exercising can positively affect various biochemical parameters (5). However, less is known how prolonged detraining can influence acquired level of physical conditioning as well as body composition of older women who performed 12 weeks of strength training followed by 3 months of detraining. Some studies included detraining period into their training program and found that after 3 weeks of detraining, only maximum strength declined (1), in another study after 6 weeks of detraining agility, dynamic balance, chair stands and flexibility significantly worsened (6). Some studies found also decreases after 3 months of detraining in quality of life, and functional fitness tests (7).

The **object** of the research is to verify and extend current knowledge regarding neuromuscular adaptation as well as body composition after prolonged period of detraining in older woman, and the **aim** is to determine the effect of 3 months of detraining on functional fitness tests, body mass and waist-to-hip ratio index, and body fat mass level.

Research methods and organization. Twenty older women participated in this study (age: 66 ± 4 years, body weight: 77 ± 14 kg, body height: 161 ± 4 cm). Participants underwent 4 supervised familiarization sessions before the beginning of 12 weeks of progressive strength training. One week before the beginning of the training, subjects performed pre-testing, one week after 12 weeks of strength training performed post-testing followed by 3 months of detraining. Training program consisted of 2 sessions per week of progressive strength training. Battery of tests consisted of: chair stand (ChS), biceps curls (BC), 8 foot-up-and go (8 foot), step test (ST), body mass and waist-to-hip ratio index (BMI and WHR), fat mass in kilograms (FMkg) and percentage fat mass (FM%).

Results and discussion. Normality of distribution and sphericity of data was fulfilled. Repeated measures ANOVA revealed significantly improved performance in ChS, BC, 8foot, ST from pre- to post-training ($p < .001$). Also, significant decline was observed in FMkg ($p < .01$), FM% ($p < .01$), BMI ($p < .001$) and WHR ($p < .01$) from pre- to post-training. After detraining period, there was a significant decline in ChS from post-training to detraining ($p < .01$). In BC, significant increase from pre- to detraining ($p < .01$) and significant decline from post- to detraining ($p < .001$) were found. In 8 feet, significant increase from pre- to detraining ($p < .001$) and significant decline from post- to detraining ($p < .05$) were determined. In ST, significant decrease from post- to detraining ($p < .01$) was observed. No significant declines after detraining period were observed in BMI, WHR, FMkg, and FM% ($p > .05$).

Conclusions. Results of this study suggest that even if the performance outcomes declined after 3 months of detraining, the most significant declines were recorded from post- to detraining period and did not fall below the pre-training level. Interesting findings of this study are that all body composition measures were not significantly affected by detraining period and remained unchanged, which could possibly suggest that neuromuscular performance is more sensitive to period without training compared to body composition characteristics. This work was supported by Slovak Grant Agency (VEGA 1/0557/19).

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PERCEIVED BENEFITS AND BARRIERS OF PHYSICAL ACTIVITY BY OLDER ADULTS IN ASSISTED LIVING: A QUALITATIVE STUDY

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Background. Physical activity is important for people of all ages because it has straight effect on health. Nowadays an opposite trend is increasing as well. According to the World Health Organization (WHO, 2010) physical inactivity is the fourth leading cause of death worldwide. In turn, physical inactivity is a major risk factor associated with a large number of lifestyle-associated non-communicable diseases such as cardiovascular disease, cancer, type 2 diabetes, osteoarthritis and obesity (WHO, 2018). Research from the WHO shows that in the past few decades, there has been a progressive decline in the levels of physical activity in people's daily lives. This decline is especially seen in developed countries due to less physical effort in work, domestic chores and transportation.

The population is aging rapidly, which means that some older people require more assistance when their physical and cognitive abilities are impaired. According to the research, physical, cognitive and psychosocial status as depression and fear of falling are factors related with sedentary behaviour. Many people do not meet recommended physical activity level due to low perceived benefits and high perceived barriers to exercise. Older people do not exercise enough, which is influenced by many variables including personal, interpersonal, environmental and policy determinants (Lovell, El Ansari, & Parker, 2010). Thus, **research aim** was to examine the perceived exercise benefits and barriers of elderly people who live in a Nursing home/ Assisted living.

Research methods. Data collection method was semi-structured face-to-face interview. Data analysis method was qualitative content analysis.

Main results. The research results show that most of the participants in assisted living were not engaged in the sufficient amount of physical activity. According to the interviews, most of the participants would like to have more physical exercise during the day. Physiotherapy, handwork, outdoor exercise, household chores and daily routines were cited as most common every day activities among nursing home residents. Nursing home's activity level is low due to inadequate care of staff and facilities which do not allow elderly people to stay active.

Conclusions. Elderly people in assisted living have quite high health literacy as they are aware of benefits of physical activity. Major perceived health benefits were maintaining physical activity level, maintaining good health condition, increasing physical strength, improving mental health, relaxation and pleasure.

The most common health perceived barriers to physical activity were poor physical condition, inadequate mental condition and age-related restrictions. Some of these barriers are modifiable and can be healed via exercise.

Elderly people are willing to participate in physical activity if they perceive more health-related benefits than barriers. According to results, they have high health literacy and are aware of the benefits but at the same time poor health condition was mentioned as a barrier to exercise which does not allow to maintain physical activity. Participants reported that they overcome personal barriers by forcing themselves to do PA because they recognized its importance in maintaining health and physical function. According to the respondents, the staff of the nursing home could also be more helpful in increasing PA of the elderly.

Keywords: elderly, physical activity, benefits, barriers, promotion.

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BETTER EXECUTIVE FUNCTION IS ASSOCIATED WITH FASTER ON-TRANSITION OF AEROBIC METABOLISM IN ELDERLY PEOPLE

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Relevance of the research. Cognitive decline as a function of normal aging represents one of the most prominent causes of autonomy loss in the aging population (Albinet et al., 2016; Gajewski & Falkenstein, 2016). Among all cognitive functions, the executive function (EF) is one of the most altered cognitive function due to aging (Albinet et al., 2012). Furthermore, normal aging is associated with a decrease in the intensity and frequency of physical activity (PA) (Milanović et al., 2013) and reduced aerobic fitness (George et al., 2018). Studies showed that PA is important in the reduction of cognitive function with age (Erickson et al., 2013; Mandolesi et al., 2018).

In a longitudinal correlational study of about 1400 participants aged 19–94 years, Wendell et al. (2014) found that the EF was positively associated with maximal oxygen consumption ($\dot{V}O_{2max}$). Similarly, other authors indicated that higher $\dot{V}O_{2max}$ is associated with better interference, greater accuracy, and greater task relevant activation in the prefrontal cortex (Chaparro et al., 2019; Dupuy et al., 2015; Prakash et al., 2011). Furthermore, Gajewski and Falkenstein (2015) found a moderate negative correlation between the interference score and the ergometric relative and absolute maximum power. Hyodo et al. (2016) found a moderate negative correlation between the first ventilatory threshold (VeT_1) and the interference score in older men. However, how the EF is related to oxygen uptake ($\dot{V}O_2$), heart rate (HR), and muscle deoxygenation ([HHb]) kinetics is not clear yet.

The **object** of the research is association between EF and aerobic fitness variables in elderly people, and the **aim** is to determine relationships between EF and variables of aerobic fitness in elderly people.

Research methods and organization. Participants included 32 healthy elderly people (65.1 ± 6.6 years). The VeT_1 and the kinetics of $\dot{V}O_2$, HR, and [HHb] were measured during walking exercises on a treadmill with either constant, moderate intensity, or increasing intensity. The EF was assessed using a computerized Stroop test. The outcome measures of the Stroop test were correct answers, reaction time, and percent interference. Percent interference was calculated as the average incongruent trial reaction time minus the average congruent trial reaction time, divided by the average congruent trial reaction time, and, then, multiplied by 100. On their first visit, participants were interviewed to confirm that they were in good health, and their body height, weight, and composition were measured. Participants completed questionnaires and a series of practice trials of the cognitive tasks to reduce learning effects. After that, participants performed a walking test with increasing intensity to determine their VeT_1. The second visit was separated from the first by 7 days. The participants performed two identical constant-load walking tests at a work rate corresponding to 80% of their $\dot{V}O_2$ at VeT_1. Between walks, 1 h of passive rest was given to allow the cardiovascular and metabolic variables to return to pre-exercise baseline conditions. Each subject performed a Stroop test before each constant-load walking.

Results and discussion. The Stroop interference score was negatively associated with the VeT_1 (r = –.387, p = .031) and positively with the on-transition of the aerobic metabolism time constant (τ) of HR (r = .519, p = .003), $\dot{V}O_2$ (r = .454; p = .010), and [HHb] (r = .644, p = .001). Correct responses were negatively related with τHR (r = –0.372, p = 0.039) and $\tau\dot{V}O_2$ (r = –.500, p = .004). The average congruent and incongruent reaction times were positively related with τ[HHb] (r = .507, p = .010; r = .437, p = .029; r = .558, p = .004, respectively). Our results are consistent with studies reporting that higher aerobic fitness is related with better EF (Chaparro et al., 2019; Dupuy et al., 2015; Prakash et al., 2011). In healthy older adults, regular physical exercise has been reported to improve attention, inhibition (Eggenberger et al., 2016), and processing speed (Voelcker-Rehage & Niemann, 2013). Neural and vascular adaptations to physical exercise improve cognitive function through the promotion of neurogenesis, angiogenesis, synaptic plasticity, decreased pro-inflammatory processes, and reduced cellular damage due to oxidative stress (Rasmussen et al., 2009). Physical training could be effective in preventing brain atrophy and maintain (or even improve) cognitive and motor abilities in aging (Levin et al., 2017). Positive training effects on attention could indicate

an adaptation of a shared attention inhibition substructure, for example, the dorsolateral prefrontal cortex or the prefrontal-basal ganglia network (Wong et al., 2015).

Conclusions. Better EF is associated with faster on-transition of aerobic metabolism and higher aerobic fitness in elderly people.

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LITHUANIAN OLYMPIANS MENTORING FOR THE ELDERLY

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Relevance of the research. Approximately 20% of Lithuania's population are senior citizens. Many of them live alone or in homes for the elderly. In Lithuania, there are more than a hundred assisted living facilities for adults, accommodating more than 5000 residents. Statistics show that the least happy people in Lithuania are senior citizens. Lithuanians are in 54th place in the world on the happiness index and show a dramatic drop from the leading nations. Seniors confirm that they would be happier if they were healthier and had more opportunities to socialize (Oswald & Blanchflower, 2008). It is true that the healthier you are, the easier it is to be happy. Health can be defined as physical, mental and social wellbeing and as a resource for living a full life (Oswald & Blanchflower, 2008). It is the desire of the Lithuanian Olympic Association to promote fitness, motivate seniors to be more active and diversify the lives of the elderly, orphans and disabled persons through sports and physical activity.

The **object** of the research is monitoring the activities of Lithuanian Olympic Association as they initiate and engage various social projects in Lithuania. Their aim is to promote, activate and diversify the lives of the elderly through sports and physical activity, to brighten the lives of senior Lithuanians living in assisted living facilities, to motivate former Lithuanian Olympians to become involved in order to help the seniors to recall the athletic achievements and the ideals of Lithuanian Olympians.

Research methods and organization. Discussions, talks, study of literature sources and summaries. LOA's governing body compiles and approves its annual plan of activities. We studied their activities for the past 10 years, summarized them, reached conclusions and made suggestions. We spoke to Lithuanian Olympians and members of Lithuanian Olympic Association. We summarized the obtained data.

Results and discussion. At present, there are approximately 400 Lithuanian athletes who have participated in the Olympic Games, 50 of them are members of LOA. Its members are former Olympians who have applied for LOA membership and participate in its activities, LOA was founded in 2003 and is a member of World Olympic Association. The average age of LOA member is 55 to 60 and older. Younger former Olympians are sufficiently pre-occupied with studies, work and raising families, making it difficult for them to become active LOA members. Senior Olympians wish to be active and would like to be more useful and not be forgotten by young athletes and senior citizens. The Olympians understand that they have great life experiences and can be of help to others and perhaps even themselves. In LOA's plans, which are approved at the LOA conference, there are 40 activities, many of them are projects directed to young people, as a result there are not enough projects directed to seniors. It is for this reason the new project, proposed and approved this year and recognized by World Olympic Association, called 'Olympian Life Mentoring' assumes a greater significance activating senior Olympians and ordinary seniors. Governed by the project's guidelines, LOA members as well as specialist from other areas visit homes of the aged persons, tell them about their road to sports and their physical activities at the end of their sporting career. Health professionals and specialists present talks about healthy aging, lead them in exercises, teach dance steps and morning exercises, teach them to swim and assist in life saving. Olympians visited Viesiejai, Prienai, Kaunas cities. More than 100 seniors already participate in this project with its results being provided in various publications, newspapers and the internet.

Conclusions. LOA's activities related to interaction between seniors and Olympians has shown that Lithuania's seniors feel satisfaction by being engaged. The Olympians participating in this project become more active and morally more satisfied at the end of the day spent with ordinary seniors. They understand each other. In summary, it can be said that senior Olympians can be more active and receive positive emotions by socializing with seniors and being members of LOA.

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INVESTIGATING THE RELATIONSHIP BETWEEN LONG-TERM PHYSICAL ACTIVITY AND VISUAL ATTENTION IN HEALTHY OLDER ADULTS

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Relevance of the research. Recent statistical data indicate that in Latvia inhabitants aged over 65 constitute almost 34% of the whole population (Central Statistics Bureau, 2019). With age being one of the main risk factors in developing dementia, this predicts an increase in neurocognitive disorders. The economic burden of such mental diseases as dementia has become a major health economic challenge in Europe, costing more than 200 billion euros per year (Olesen et al., 2012). Unhealthy diet, lack of physical activities and addictive health habits have been identified as the main life-style related health risk factors for dementia in Latvia according to the Ministry of Health of the Republic of Latvia (2014). Just as life-style habits increase the risk for dementia, they may also function as protective factors. Strong evidence has been on physical activity as protective towards pathological cognitive ageing, indicating physical activity interventions to be most beneficial when maintaining such cognitive processes as visual attention (e.g. Candela, Zucchetti, Magistro, Rabaglietti, 2015), however, more research is needed to identify the type, frequency, intensity and duration of the most beneficial activity (Stephen, Hongisto, Solomon, & Lönnroos, 2017).

The **object** of the research is the connection between long-term physical activity and attention and the **aim** is to determine the relationship between long-term physical activity and visual attention. We hypothesised that higher physical activity score would relate to better visual attention measures.

Research methods and organization. As many as 48 older adults aged from 65 (M = 72.2, SD = 5.22, 18% male) participated in the study. Visual attention was measured with *The Visual Matching task* (Woodcock, McGrew, & Mather, 2001)) and *The Map Test of Everyday Attention* (Robertson, Ward, Ridgeway, & Nimmo-Smith, 1996). Physical activity composite score was calculated from data acquired through *The Social Determinants of Health Behaviours* questionnaire (FINBALT, 2008).

Results and discussion. Contrary to our hypothesis, results indicated no relationship between visual attention measures; however, the data obtained only considered self-reported data on such physical activities as sports and exercise and did not include information regarding general or daily physical activity, e.g. at work or gardening, thus the method of investigating physical activity should be considered in further studies.

Conclusions. The results of the study did not indicate relationship between visual attention and long-term physical activity; however, this might indicate the need for more detailed and specific measures for long-term daily physical activities.

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IMPROVING THE SELF-REPORTED ASSESSMENT OF LIFE-SPAN PHYSICAL ACTIVITIES: A CASE OF LATVIA

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Relevance of the research. The increased economic burden of such mental diseases as dementia and depression has become a major health economic challenge in Europe, costing more than 200 billion euro per year (Olesen et al., 2012). Acknowledging the topicality and the rapid increase in older adults, in 2014 a study entitled Establishing the Net Attainable Benefits of Long-term Exercise (ENABLE-LV) was conducted in Latvia in collaboration with the University of Sussex. The aim of the study was to investigate the role of temporal aspects of physical activity, i.e. the span of time spent doing aerobic physical exercises and its relation to age related cognitive decline. The results from the study indicated better cognitive performance in seniors with longer physical activity experience in some domains; however, the study raised a significant question – if daily activities, such as housework and occupational activity, should not be considered, when investigating physical activity experience (Sneidere et al., 2017; Šneidere et al., 2019). According to the Compendium of Physical Activities (Ainsworth et al., 2011), such household activities as gardening takes roughly the same amount of METs as slow cycling, thus indicating the need for more detailed investigation on physical activities as such.

The **object** of the research is the total – purposeful and daily – life-span physical activity and the **aim** is to improve the self-reported assessment of physical activities by identifying the amount and intensity of daily physical activities in a Latvian sample of older adults.

Research methods and organization. Total physical activity measures are obtained using objective measure of aerobic capacity and results from fitness bracelets for short-term physical activities and the Total Life-Span Physical Activity Questionnaire (Ulmane, Šneidere, & Stepens, 2019). The questionnaire includes eight main activity domains: "work", "education", "sleep", "transportation", "self-care", "leisure time", "household activities" and "sports". The data are obtained in two steps. Firstly, a short questionnaire is given, where participants are asked to fill in general life-time activities. Secondly, a cognitive interview is conducted.

Results and discussion. Results from the pilot study indicated the need for more detailed measures of physical activity that would include not only purposeful exercise and sports, but would also take into consideration general physical activities, such as house chores and walking for transportation, thus first steps into adapting and validating the Total Life-Span Physical Activity Questionnaire are in progress.

Conclusions. The pilot study ENABLE-LV indicated a significant issue in retrospective physical activity investigation i.e. – need for a measure of a total life-time physical activity. The current study aimed to develop and validate methods for investigating physical activity retrospectively in more detail, thus obtaining information not only about the involvement in purposeful exercise, but also the type, length and period of life during which an activity has taken place.

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RELATIONSHIP BETWEEN PARENTS' AND CHILDREN'S PHYSICAL ACTIVITY, PHYSICAL CAPACITY AND THEIR IMPORTANCE IN THE CHILDREN'S FREQUENCY OF ILLNESSES

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Introduction. Physical activity (PA) has a profound impact on health and development in children. Parental behaviors represent an obvious important factor in child PA. In children, physical activity is favorably associated with cardiovascular risk factors (Lee et al., 2012), anthropometric indicators (particularly body composition, waist circumference and fat mass) and bone health (Hills, Andersen, & Byrne, 2011). Regular engagement in physical activity is also beneficial for young people's mental health and self-esteem, and has been suggested to support improved cognitive performance and scholastic achievement (Singh, Uijtdewilligen, Twisk, Van Mechelen, & Chinapaw, 2012), Despite these known benefits, data from several countries suggest that the majority of children are insufficiently active to confer health benefit (Janssen & LeBlanc, 2010). Our aim was to evaluate the relationship between parents' and children's physical activity, physical capacity and their importance in the children's frequency of illnesses.

Methods. The study involved 438 schoolchildren aged 7 to 10 years and 438 their parents from Kaunas region primary schools. Physical activity in primary school-age children was assessed by parents using a questionnaire (Bacardí-Gascón, Reveles-Rojas, Gail, Crawford, & Jiménez-Cruz, 2011). Parents had to answer seven questions about how much time their children spend on various activities (watching TV, going to school, spending time in the yard, in the park, playing games, etc.). Physical activity of parents of primary school children was assessed using the Godin Leisure-Time Exercise Questionnaire (GLTEQ). Information about how much the child missed school due to illness was received from health professionals. Open-ended questions were asked for the assessment of sociodemographic factors.

Results. We found no relationship between parent and child physical activity as well we did not find any association between physical activity and illness in children, but we found the significant relationship between children's physical activity and physical capacity and between children's physical capacity and illnesses. The results of our study can be explained by the fact that physical activity does not play a role in the illness rates of children aged 7–10. During this period, physical capacity develops intensively and genetic factors play a key role here. The results of our study showed that physically fit children are less likely to develop illness. However, parents' physical activity is irrelevant to this phenomenon.

Conclusions. Physically fit children are less likely to be ill. Physically active children have better physical performance than physically inactive children.

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RELATIONSHIP BETWEEN MUSCLE STRENGTH AND BODY BALANCE IN WOMEN WITH LOW BONE MASS: A PRELIMINARY STUDY

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Relevance of the research. Aging is characterized by declines in body balance and strength, both of which contribute to increased risk for fracture (Aartolahti et al., 2019; Ossowski et al., 2016). However, it is unclear if these factors coexist or are independent in women with low bone mass. Therefore, the aim of the study was to explore the relationship between the muscle strength of the upper & lower limbs and body balance in elderly women with osteoporosis and osteopenia.

Research methods and organization. The study included 52 women aged 61–79 years (M = 68 years) who were diagnosed as low bone mass defined by a T-score ≤ −1 (Nelson et al., 2002). In order to determine the level of functional strength, two attempts with Fullerton Physical Fitness Test (FPFT) for the elderly were used: 30-second Chair stand (SCS) for lower limb strength and Arm curl (SAC) for measuring upper limb strength (Rikli & Jones, 2013). Body balance assessment was conducted using 8-Foot Up-and-Go from FPFT and single leg balance test from Timed Balance Tests (TBT).

Results and discussion. The strength of the upper and lower extremities was positively correlated with the dynamic body balance in participants (p = .02, p < .001 respectively). However, no relationship was found between the strength of the upper and lower limbs with static balance in the group of women with osteoporosis and osteopenia (p = .59, p = .67 respectively). In order to fully explain the relationship between muscle strength and body balance in women with reduced bone mass, the study should be continued with the participation of a larger research group.

Conclusions. The obtained results suggest that the muscle strength of the lower extremities may have an impact on maintaining balance during movement in women with reduced bone mass, which may be important for preventing falls in the elderly.

The study was conducted within the framework of the EIP-AHA projects entitled "Frailty and Functional Decline: RISINC2013-FRAILTY"

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IMPACT OF A 6-MONTH AEROBIC EXERCISE PLUS CALORIC RESTRICTION INTERVENTION ON RESTING METABOLIC RATE, SUBSTRATE OXIDATION AND METABOLIC SYNDROME COMPONENTS IN OVERWEIGHT AND OBESE WOMEN

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Background. Despite the existence of several studies investigating the role of combined different diet regimes and different exercise programs on weight loss and related health benefits, the effect of 6-month program including 12.5% calorie restriction (CR) with weekly 150 minutes of moderate-intensity aerobic exercise remains unclear.

The aim of the study was to test the hypothesis that 6-month CR and aerobic exercise would increase RMR and fat oxidation, and improve metabolic parameters.

Methods. Overweigh and obese participants were randomized to either control (CG, $n = 13$) or experimental caloric restriction plus aerobic exercise group (EG, $n = 13$) for 6 months. Changes in resting metabolic rate (RMR), substrate oxidation, body mass index (BMI), waist circumference, blood pressure (BP), level of lipids and glucose were measured.

Results. RMR increased ($p < .05$) in EG, whereas no changes in substrate oxidation were observed. Combined caloric restriction and exercise intervention decreased ($p < .05$) BMI, waist circumference, systolic BP, triglycerides and glucose levels, and increased ($p < .05$) high-density lipoprotein cholesterol level.

Conclusions. Six-month combination of 12.5% calorie restriction and *150 weekly minutes* of moderate-intensity aerobic exercise is associated with effective and healthy weight loss strategy, which can prevent metabolic syndrome and improve resting metabolic rate.

Keywords: obesity, female, diet, aerobic training, health.

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