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CONTENT

Virginija Bertašiūtė, Algė Daunoravičienė, Kristina Berškienė, Helmut Schwela THE CONCATENATIONS OF ELECTROCARDIOGRAPHIC PARAMETERS AT THE ANAEROBIC THRESHOLD.....	3
Karsten Froberg RELATIONS BETWEEN PHYSICAL ACTIVITY, FITNESS, MUSCLE STRENGTH AND HEALTH: FINDINGS FROM THE EUROPEAN YOUTH HEART STUDY (EYHS)	10
Almagul Ilyasova, Zhanymurat Erzhanov OPTIMIZATION OF PHYSICAL FITNESS DEVELOPMENT FOR PRIMARY SCHOOL LEARNERS IN PHYSICAL EDUCATION LESSONS	21
Romualdas Malinauskas, Zermena Vazne EMOTIONAL INTELLIGENCE AMONG LITHUANIAN AND LATVIAN STUDENT ATHLETES	29
Rasa Mickūnienė, Simona Pajaujienė, Rasa Jankauskienė THE RELATION BETWEEN THE SOCIOCULTURAL ATTITUDES TOWARDS APPEARANCE AND THE LIFESTYLE AND SELF-ESTEEM OF ADOLESCENTS	34
Brigita Miežienė, Liuda Sinkariova, Rasa Jankauskienė EXPLAINING THE RELATIONSHIP BETWEEN AUTONOMY SUPPORT AND MOTIVATIONAL PROCESS OF HEALTH BEHAVIOR IN PATIENTS WITH DIABETES FROM SELF-DETERMINATION THEORY PERSPECTIVE: LITERATURE REVIEW.....	40
Loreta Stasiulė, Sandrija Čapkauskienė KINETICS OF PULMONARY VENTILATION AND CARBON DIOXIDE OUTPUT DURING INTERMITTENT INCREASING CYCLING “ EXERCISE AFTER A PRIOR ANAEROBIC LOAD	48
Marius Zienius, Antanas Skarbalius, Aurelijus Kazys Zuoza, Kazimieras Pukėnas PECULIARITIES OF PRE-COMPETITIVE PSYCHOLOGICAL FACTORS, SPORT PERFORMANCE INDICATORS AND PHYSIOLOGICAL DEMANDS IN YOUTH GOLF	56
Marius Zienius, Antanas Skarbalius, Aurelijus Kazys Zuoza EFFECTS OF FOUR DAYS OF COMPETITION MODELLING FOLLOWED BY SIX DAYS OF TAPERING ON SPORT PERFORMANCE IN JUNIOR GOLFERS: A CASE STUDY.....	63
Ilona Judita Zuoženė, Gintarė Akelytė, Aurelijus Kazys Zuoza IS IT IMPORTANT TO TEACH LITHUANIAN CHILDREN SWIMMING? ANALYSIS OF DROWNING AND SCHOOLCHILDREN'S KNOWLEDGE OF SAFE CONDUCT AT THE WATER	71

Editorial Policy

BJSHS is an international quarterly peer-reviewed scientific journal that keeps sports and health professionals up to date with advances in the fields of sports science, health education and promotion and physical rehabilitation. The journal publishes research articles in the following areas: *Social Sciences* (Physical Education, Sports Coaching, Sports Pedagogy, Sports Psychology, Sports Sociology, Research Methods in Sports, Sports Management, Recreation and Tourism), *Biomedical and Health Sciences* (Coaching Science, Sports Physiology, Motor Control and Learning, Sports Biochemistry, Sports Medicine, Physiotherapy and Occupational Therapy, Physical Activity and Health, Sports Biomechanics, Adapted Physical Activity) and *Humanities* (Sports History, Sports Philosophy, Sports Law, Sports Terminology).

The issues contain editorials, reviews of recent advances, original scientific articles, case studies. In all cases, it is vital that the journal's integrity, independence and academic reputation is not compromised in any way.

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Professor of University of Southern Denmark granted a title of LSU Doctor **Honoris Causa**

University of Southern Denmark Professor **Karsten Froberg** was granted a title of Doctor Honoris Causa at the ceremonial meeting of the Senate of the Lithuanian Sports University (LSU) on April 7, 2014. The title was conferred for support in the development of the University sports science, significant international research in sports science in cooperation with LSU and merited educational activities.

“For many years we have been in close cooperation with the Lithuanian Sports University and have prepared a number of international projects and programmes. We have recently been working on the implementation of the “Nordplus” programme; we share our experience, good practice and the results achieved. It is a great honour to receive such an impressive evaluation and I accept it with great gratitude hoping to do a lot of significant work in the future”, said LSU Honorary Doctor Professor Karsten Froberg.

K. Froberg is an honored Danish scientist who has led the European Network of Sport Science, Education and Employment (ENSSEE) and significant international research projects in sports science. He has worked as a consultant for the Swedish Ministry of Education, Portugal Research Council and as the Swiss Sport Science Research Council advisor, as well as an external consultant for Italian, Swedish and Danish institutions of higher education. On his initiative a number of international graduate programmes have been developed.

THE CONCATENATIONS OF ELECTROCARDIOGRAPHIC PARAMETERS AT THE ANAEROBIC THRESHOLD

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ABSTRACT

Background. An anaerobic threshold has been an important index of performance for assessing cardiopulmonary and muscle integration during aerobic exercise. The analysis of electrocardiographic parameters concatenations can be used to describe the physiological changes in the whole body during physical load. Research aim was to evaluate the concatenations of electrocardiographic parameters in different physical ability men group at the aerobic threshold during bicycle ergometry.

Methods. The research contingent consisted of 90 healthy men who according to the power achieved at the anaerobic threshold were divided into 3 groups, and 17 men who had increased blood pressure and were assigned to a group of health problems. The following tests were used: anthropometric measurements, electrocardiography, bicycle ergometry, spiroergometry and mathematical statistics. During bicycle ergometry the pulmonary gas exchange rates were collected, which was used to establish the anaerobic threshold.

Results. This research has shown changes in the functional parameters of the cardiovascular system and inter-parametric concatenations of different fractal levels at the anaerobic threshold. This study established that the best results were obtained in the high aerobic power group.

Conclusions. This research established that the functional parameters of the cardiovascular system depended on the physical ability of subjects. At the anaerobic threshold in the high aerobic power group, the body metabolism and regulatory systems (JT/QRS) and heart and body (RR/QRS) interaction was weaker, and the heart metabolism and regulatory systems (RR/JT) interaction was stronger than in other research groups ($p < .05$).

Keywords: physical load, anaerobic threshold, concatenations of the electrocardiographic parameters.

INTRODUCTION

Properly selected physical activity supports the personal optimum physical capacity, guaranteeing people's participation in all spheres of life (Hobbs et al., 2013). Scientific research has shown that regular aerobic and adequately dosed physical load reduces the risk of developing cardiovascular diseases (Ross & Bradshaw, 2009; Schembre & Riebe, 2011), increases human body physical capabilities (Martinmäki, Häkkinen, Mikkola, & Rusko, 2008; Malinauskas, Dumčienė, Mamkus, & Venckūnas, 2014) and improves the quality of life (Dale et al., 2013). It is important to choose an optimal physical exercise by establishing anaerobic threshold

(AT), because above this level exhaustion and intramuscular pain are caused (Hofmann, Bunc, Leitner, Pokan, & Gaisl, 1994; Reilly & Ekblom, 2005). It is important for sportsmen to learn how to expand their AT in order to work longer and more efficiently (Jones & Carter, 2000; Reis et al., 2013). It is possible to have a higher threshold by repeating training near the AT, which will increase the body efficiency at burning oxygen and achieving the best sports results (Burnley & Jones, 2007; McKay, Paterson, & Kowalchuk, 2009). Usually AT is estimated by using either ventilatory measures (ventilatory threshold) or blood lactate

measures (lactate threshold) (Stedman, 2012). In our research we used ventilatory measurement.

Peculiarities and opportunities of human adaptation to physical load are relevant tasks of physiology, sports and clinical medicine (Vainoras, Šmidkaitė, Bikulčienė, & Gargasas, 2011). There are many research works which emphasize the unity of the body functions (Šmidkaitė, Navickas, Vainoras, Bikulčienė, & Poškaitis, 2009), synergic interaction (Bikulčienė, Venskaitytė, & Jaruševičius, 2014) and show informative advantages of complex, integral and integrated assessments (Žumbakytė-Šermukšnienė, Kajėnienė, Berškienė, Daunoravičienė, & Sederevičiūtė-Kandratavičienė, 2012). The further progress of medical diagnostic technologies is unthinkable without the development and usage of non-linear analysis methods based on chaos and complex systems theories (Berškienė, Navickas, & Vainoras, 2013). In sports medicine and clinical practice one of the most popular tests of the body adaptation to physical load is bicycle ergometry test.

An anaerobic threshold has been an important index of performance for assessing cardiopulmonary and muscle integration during aerobic exercise (Reis et al., 2013). The most common diagnostic tool which reflects a cardiac function is an electrocardiogram (ECG). It is a simple non-invasive method and the ECG parameters can be used to describe the physiological changes in the whole body (Vainoras et al., 2011). Such studies will allow evaluating the changes of the body complexity during various interventions, identifying differences of body reactions in groups of different physical ability, and selecting suitable physical workload.

The aim of the study was to evaluate the concatenations of durational electrocardiographic

parameters in different physical ability men's groups at the aerobic threshold during bicycle ergometry.

METHODS

Research subjects. The investigated contingent consisted of 90 men (20–66 years old) who volunteered to participate in this study (characteristics are presented in Table 1). The healthy men were divided into 3 groups according to the power level reached at the anaerobic threshold (in weak aerobic power group (WAPG) the average of anaerobic threshold was 183.33 ± 3.38 W ($n = 33$), in moderate aerobic power group (MAPG) the average of anaerobic threshold was 247.73 ± 3.50 W ($n = 30$) and in high aerobic power group (HAPG) the average of anaerobic threshold was 315.00 ± 6.67 W ($n = 10$) and 17 men (the average of anaerobic threshold – 236.76 ± 12.15 W; 47.82 ± 2.48 years of age; the body mass index – 27.41 ± 1.16 kg/m² of weight), who had increased blood pressure and were assigned to a group of persons with health problems. Initially, the data were collected from 102 men, but 12 cases were withdrawn from the final analysis due the data failure. The subjects were informed about the experimental procedures to which they would be submitted and signed the informed consent form before taking part in the study. The volunteers were free to withdraw from the study at any time without any consequences. The study was approved by the Regional Ethics committee.

The following methods were used in the research: anthropometric measurements, electrocardiography, blood pressure measurement, bicycle ergometry, spiroergometry and mathematical statistics. During bicycle ergometry the pulmonary

Table 1. Characteristics of the investigated contingent

The research group	Weak aerobic power group (n = 33)	Moderate aerobic power group (n = 30)	High aerobic power group (n = 10)	Health problem group (n = 17)	p < .05
The average of anaerobic threshold (w)	183.33 ± 3.38	247.73 ± 3.50	315.00 ± 6.67	236.76 ± 12.15	*, **, ***, ****, *****
Age (m)	45.93 ± 2.31	40.93 ± 1.70	36.70 ± 3.05	47.82 ± 2.48	*****
Body mass index (kg/m ²)	25.03 ± 0.42	24.46 ± 0.37	24.00 ± 0.67	27.41 ± 1.16	NS

Note. * – statistical difference between WAPG and MAPG, ** – statistical difference between WAPG and HAPG, *** – statistical difference between WAPG and HPG, **** – statistical difference between MAPG and HAPG, ***** – statistical difference between HAPG and HPG; NS – no significant difference.

gas exchange rates were collected, which was used to establish the anaerobic threshold.

Experimental protocol. All subjects completed a form about their health condition before participating in the research. Their anthropometric measurements (i. e. height, weight) were carried out. The subjects were familiarized with the experimental environment and the research personnel. After the initial measurements had been done, the participants without warm-up performed a computerized bicycle exercise stress test. A short-term provocative research protocol was used. The initial workload performed by all subjects was 50 W, and it was increased by 25 W every minute up to reaching sub-maximal power. The frequency of pedalling was 60 rotations/min. During the test the electrocardiographic and the pulmonary gas exchange parameters were synchronically and continuously registered during whole bicycle ergometry test. The ventilatory variables were obtained through a computer-aided spirometric measurement system. The device presents the power values (W), oxygen consumption (VO_2), carbon dioxide production (VCO_2), minute ventilation (VE) and heart rate (HR) applied at the exact time. The respiratory exchange ratio (RER) was also calculated and recorded in the research. The power applied to the cycle ergometer during exercise protocols was controlled by the system through an interface with the bicycle. The anaerobic threshold was established by the pulmonary gas exchange rate (O_2/CO_2), when the increased alveolar CO_2 output relative to O_2 uptake and registered respiratory exchange ratio (RER) were above 1.

The computerized electrocardiographic registration and the analysis system “Kaunas-Load”, developed at the Institute of Cardiology of Lithuanian University of Health Sciences, were used for evaluating the functional state of the cardiovascular system. ECG parameters were measured for each cardio cycle. The durational

ECG parameters assessed were: duration of RR interval (ms) (RR), duration of JT interval (ms) (JT) and duration of QRS interval (ms) (QRS). Selected ECG parameters represent different fractality levels of the body: RR and JT describe systemic, QRS – cardiac intrinsic regulatory processes. New nonlinear analysis methods, such as second order matrix analysis, were used for concatenations evaluation. Concatenations which represent interactions of components of various body systems and changes according to the integration evaluation model were assessed: discriminant between RR and JT parameters (RR/JT), discriminant between RR and QRS parameters (RR/QRS), discriminant between JT and QRS parameters (JT/QRS).

Data processing and statistical analysis. The data were analysed using SPSS 16.0 for Windows programme. The Mann – Whitney test was applied for comparison of two independent samples. The alpha level of $p < .05$ was required for statistical significance. Group data are presented as mean (m) \pm standard error of the mean (SEM). The parameters were rated by the maximum and minimum value.

RESULTS

ECG durational RR, JT and QRS parameters at the AT during bicycle ergometry are illustrated in Table 2. RR was statistically significantly shorter in the HAPG than in other groups at the AT, what reflects the better state of the body regulatory system in that group ($p < .05$). JT also was statistically significantly shorter in the HAPG than in other groups, which shows the better metabolism and supplying system’s state of the body at the AT in that group ($p < .05$). QRS was statistically significantly longer in the HAPG than in other groups at the AT, which demonstrates the better state of the regulatory system at the organs’ level in that group ($p < .05$).

Analysing concatenation of ECG parameters, it was established that the heart metabolism and

Table 2. ECG durational parameters at the anaerobic threshold during bicycle ergometry

Parameters	Weak aerobic power group	Moderate aerobic power group	High aerobic power group	Health problem group	$p < .05$
RR at AT, ms	423.84 \pm 10.01	386.25 \pm 5.88	359.99 \pm 7.86	399.12 \pm 10.82	*, **, ****, *****
JT at AT, ms	167.42 \pm 3.67	152.39 \pm 2.57	142.18 \pm 4.29	162.47 \pm 4.56	*, **, *****
QRS at AT, ms	86.38 \pm 0.92	88.73 \pm 1.12	90.20 \pm 3.03	88.09 \pm 1.46	NS

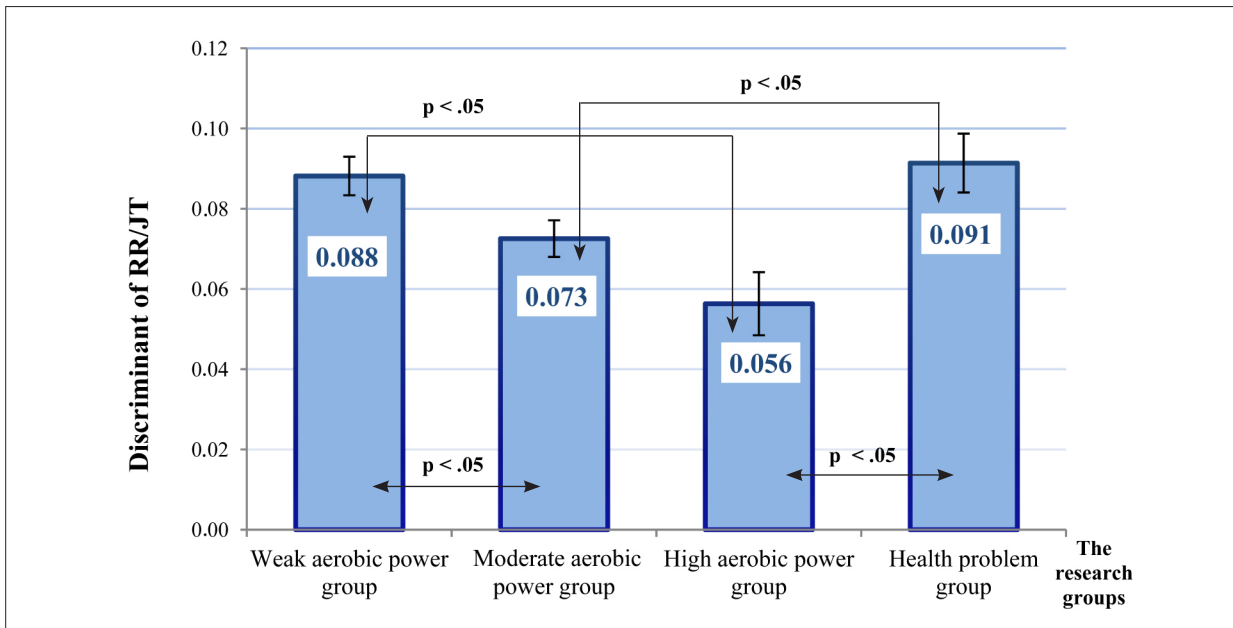
Note. * – statistical difference between WAPG and MAPG, ** – statistical difference between WAPG and HAPG, *** – statistical difference between WAPG and HPG, **** – statistical difference between MAPG and HAPG, ***** – statistical difference between HAPG and HPG; NS – no significant difference.

regulatory systems (RR/JT) interaction was stronger in HAPG than in other research groups ($p < .05$) (Figure 1). This shows strengthening of functional links between regulatory and supplying systems at the systemic level at the AT in the better physical ability group.

A concatenation between RR and QRS parameters reflects connection between the two levels of regulatory systems (body and organ

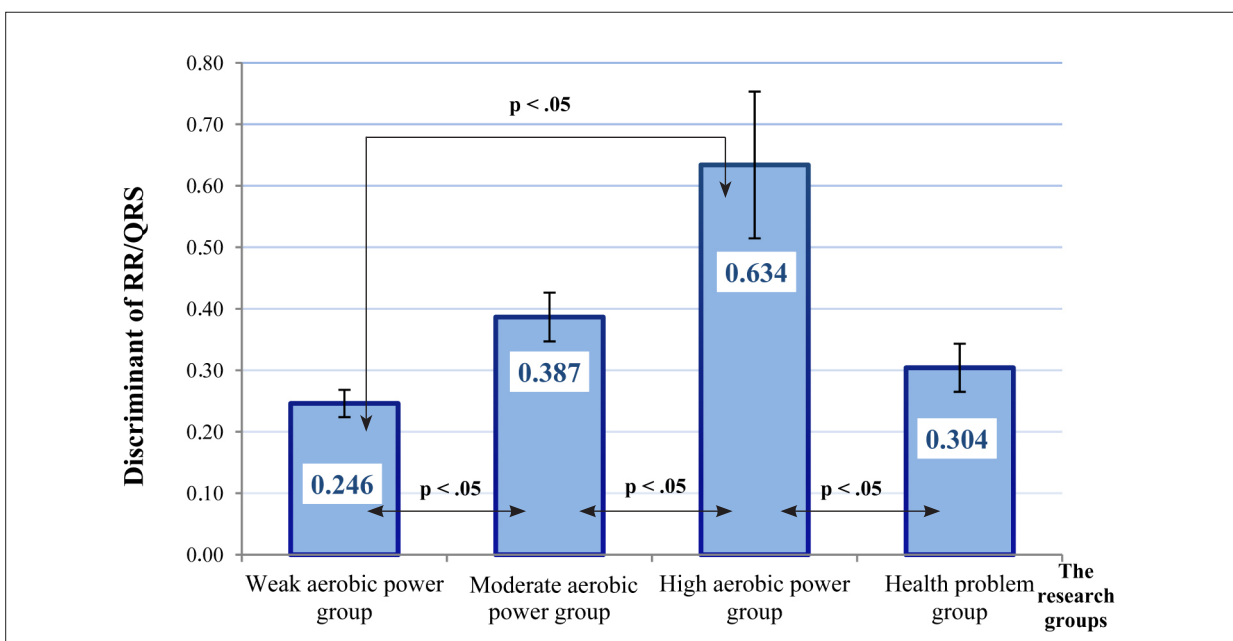
levels) (Figure 2). This index in HAPG was weaker than in other research groups ($p < .05$), so the better regulations between heart and body were in lower physical ability groups.

At AT JT/QRS in the high aerobic power group was weaker than in other research groups ($p < .05$) (Figure 3). Based on our research results it can be said that the body metabolism and regulatory



Note. $p < .05$ – statistical difference between groups.

Figure 1. Discriminant of concatenation between RR and JT parameters at the anaerobic threshold during bicycle ergometry



Note. $p < .05$ – statistical difference between groups.

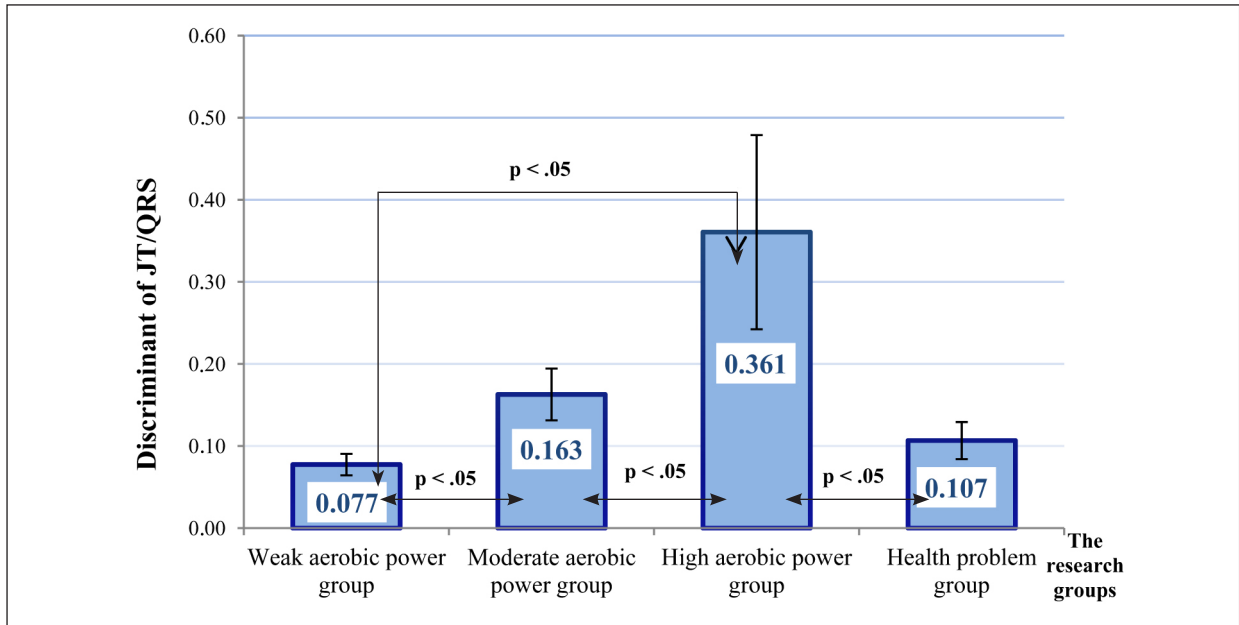
Figure 2. Discriminant of concatenation between RR and QRS parameters at the anaerobic threshold during bicycle ergometry

systems concatenations depended on physical ability and it decreased in HAPG.

A concatenation of ECG parameters represents supplying system function at various levels of fractality and its link with the respiratory function. The pulmonary gas exchange parameter values are given in Table 3. The best values were established in the high aerobic power group than in other groups at the AT.

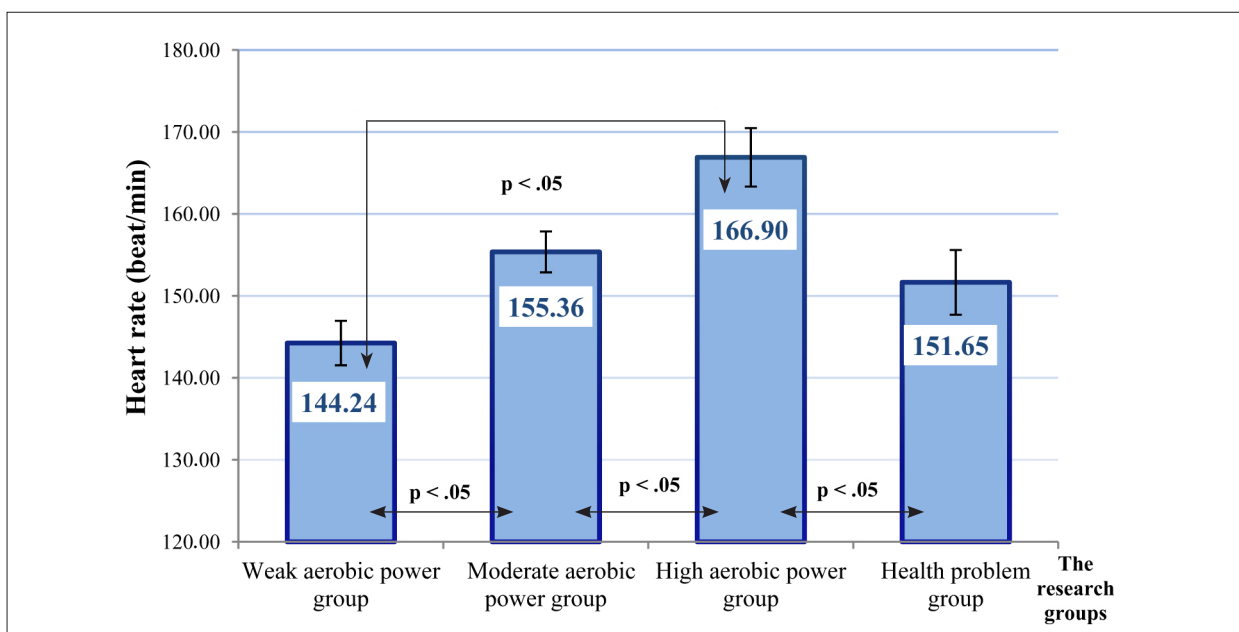
Heart rate values of different group participants during bicycle ergometry at the AT are illustrated in Figure 4.

We established that the cardiovascular system reaction at the anaerobic threshold depended on the men's physical ability – the heart beat was biggest in the high aerobic power group ($p < .05$).



Note. $p < 0.05$ – statistical difference between groups.

Figure 3. Discriminant of concatenation between JT and QRS parameters at the anaerobic threshold during bicycle ergometry



Note. $p < .05$ – statistical difference between groups.

Figure 4. Heart rate at the anaerobic threshold during bicycle ergometry

Table 3. Spirometric parameter values at the anaerobic threshold during bicycle ergometry

Parameters	Weak aerobic power group	Moderate aerobic power group	High aerobic power group	Health problem group	p < .05
0 ₂ Pulse AT, ml/beat	15.96 ± 0.36	20.67 ± 0.43	24.94 ± 0.79	20.05 ± 0.89	*, **, ****, *****
Max0 ₂ Pulse, ml/beat	18.57 ± 0.51	22.56 ± 0.47	26.66 ± 0.95	21.31 ± 0.87	*, **, ****, *****
VE at AT, l/min	61.16 ± 2.13	81.29 ± 2.53	104.06 ± 4.79	77.96 ± 4.39	*, **, ****, *****
MaxVE, l/min	99.35 ± 3.47	116.79 ± 4.28	119.99 ± 9.92	99.25 ± 4.98	*, **, *****

DISCUSSION

The purpose of this study was to evaluate the concatenations of durational electrocardiographic parameters in different physical ability men's groups at the aerobic threshold during bicycle ergometry. The bicycle ergometry test which was used in our investigation engaged a large muscle mass, so the functional capacity of the cardiovascular system plays an important role (Papievienė, Poderienė, Trinkūnas, Grūnovas, & Poderys, 2014). This research has shown changes in the functional parameters of a cardiovascular system, i. e. the electrocardiographic parameters, and the changes of inter-parametric concatenations (complexity) of the different fractal levels at the anaerobic threshold. We demonstrated that the best results were shown in the high aerobic power group.

Hofmann et al. (1994) did not observe significant differences between the threshold detected through the HR break point and blood lactate change point of sedentary women performing exercise with a non-continuous loading protocol. Bunc, Hofmann, Leitner, and Gaisl (1995) observed that AT obtained through HR did not demonstrate significant differences when compared to AT measured through the ventilatory method, lactate or from the electromyography of the vastus medialis of the thigh. Reis et al. (2013) established that the HR response is equally effective in detecting AT when compared to other methods employed in healthy elderly men. Their findings are relevant to the physical therapy and they support the possible use of HR as the capacity means to accurately detect AT and prescribe exercise at the safest and most appropriate individualized intensity to improve the functional capacity and the quality of life in aging. The results obtained during our study showed that HR was the highest in high aerobic power group at the anaerobic threshold during bicycle ergometry ($p < .05$).

We are aware that our study has limitations, particularly with regard to the small sample size and the constrained characteristics of our study population, which prevented the evaluation of factors such as age and level of fitness, each of which is known to influence the variables of interest. Also, we are aware that the choice of a rapid work rate incremental protocol may have influenced the results utilized, i. e. different results may be observed if a slower work rate increment protocol is used. We took precautions to limit errors in the calibration procedures, with all equipment being calibrated before each test and all tests being performed. Thus, our investigation should be considered as a pilot study conducted at extreme altitude, with the conclusions only being applicable to healthy untrained adults.

Our results suggest a possibility to determine AT during bicycle ergometry test using durational ECG parameters analysed and it is a less expensive method compared to those that use expired gas measurements, and may therefore be utilized in sports medicine and in extreme conditions such as high altitude.

This study of ECG parameters and their concatenations with the help of new mathematical methods of analysis opens the new opportunities for practical application of complex systems theory in order to reveal the changes at the AT.

Additionally, our results suggest that the use of these tools in other populations presenting cardiorespiratory and metabolic disease risk factors should be investigated in future studies.

CONCLUSIONS

In this research it was established that the functional parameters of the cardiovascular system depended on the physical ability of subjects – the heart beat at the anaerobic threshold was the highest in the high aerobic power group ($p < .05$).

At the anaerobic threshold in the high aerobic power group, the body metabolism and regulatory systems (JT/QRS) and heart and body (RR/QRS) interaction were weaker, and the heart metabolism and regulatory systems (RR/JT) interaction was stronger than in other research groups ($p < .05$).

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RELATIONS BETWEEN PHYSICAL ACTIVITY, FITNESS, MUSCLE STRENGTH AND HEALTH: FINDINGS FROM THE EUROPEAN YOUTH HEART STUDY (EYHS)

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ABSTRACT

The European Youth Heart Study (EYHS) is an on-going multi-centre, prospective, observational cohort study. High quality observational data from population-based samples followed over time provide a valuable source that can be used for examining hypotheses of associations of suspected risk factor exposures with health outcomes. Furthermore, given that the data are collected in well-defined population samples with high participation rates, it can be used for surveillance purposes. Surveillance involves a systematic collection of data from well-defined populations, and analysis and interpretation of such data. Timely collected- and high quality data from population-based samples is a crucial resource that can inform policy-makers and the public, and is vital for health care authorities for timely planning of prevention programs.

The EYHS has used standardized high quality methods to obtain CVD risk factor levels and their determinants among population-based samples of children and adolescents across Europe. It involves random population-based samples of children and adolescents recruited from distinct geographical regions in Europe, which are followed over time. Since the late 1990-ies the EYHS has collected detailed data on 6580 children, adolescents, and young adults with high response rates (overall response rate of 72%). These data have been widely used for describing population distribution of early determinants of cardiovascular risk factors and sources of their inequalities, and in identifying personal, genetic, and environmental determinants of current and young adulthood cardiovascular health outcomes.

This article summarizes major findings related to sedentary behaviour, physical activity and physical fitness. The findings include cross-sectional and prospective observational data from the EYHS.

Keywords: children, physical activity, sedentary behaviour, cardiovascular fitness.

INTRODUCTION

Cardiovascular diseases are the leading cause of death in Europe (Nichols, Townsend, Scarborough, & Rayner, 2013), and the societal and economic burden of these diseases continues to be enormous. While marked improvements in mortality from cardiovascular disease have occurred over the last three decades in most Northern- and Western European countries, many Central- and Eastern European countries show less progress in combating these diseases (Nichols et al., 2013). Both within and between country inequalities are likely to be dynamic and vary over time and monitoring environmental,

behavioural, and biological cardiovascular disease risk factor levels in children and adolescents is an important outset for addressing the future disease burden in Europe. Regional- and national inequalities are likely to be present and comprise a key future public health challenge in Europe.

Although the majority of cardiovascular diseases manifest in adulthood, their origins begin in utero or childhood. Autopsy investigations indicate that the earliest type of lesions (fatty streaks) can be identified in large arteries as early as during fetal life, and the majority of children are affected during the first decade. Growth and

maturation during childhood coincide with major changes in health behaviours and biological risk factor levels, and have important links to current and adult cardiovascular health (Ekelund et al., 2009; Laitinen et al., 2012). Well known biological risk factors include obesity, raised blood pressure, and impaired glucose homeostasis. While the influence of lifestyle behaviours such as smoking, physical activity, and diet on these biological risk factors in childhood have been studied in some detail, the magnitude of associations, detailed dose-response relationships and the influence of other factors such as chemicals with endocrine disrupting abilities, genetic variation, metabolites, and their interaction with lifestyle behaviours remain largely unknown. Furthermore, assessment of lifestyle exposures such as physical activity with better methods (e. g. using multi-sensor accelerometry) in large cohorts of children and adolescents followed into adulthood are required to improve our understanding of such factors influence on cardiovascular risk from childhood to adulthood. Collecting surveillance data on cardiovascular risk factors and further elucidating what determines cardiovascular health in childhood through adulthood are vital for prioritizing public health policy and action for primordial prevention of cardiovascular disease (defined as prevention of the development of risk factors in the first place) in Europe.

AIMS AND METHODS

The European Youth Heart Study (EYHS) is a multi-centre, prospective, observational cohort study of diverse population-based samples of children and adolescents from distinct geographical regions in Europe. The study was initiated in the late 1990-ies with the overall aim to identify the foundations of cardiovascular disease risk in the first decades of life.

Using standardized high quality methods to obtain CVD risk factor levels and their determinants among population-based samples of children and adolescents across Europe, the EYHS has collected detailed data on 6580 children, adolescents, and young adults with high response rates (overall response rate of 72%). At each study location, a proportional two-stage cluster sample of children and adolescents has been carried out (around 1000 children in each sample). The primary sampling unit was a complete list of schools in the area (e. g. the municipality). Each school was given a weighting

according to the number of children enrolled, and at each study location a minimum of 20 schools was be randomly selected using probability proportional to school size. The secondary sampling unit were children and adolescents enrolled in these schools.

The first centres involved were in Denmark, Portugal (Madeira), Norway and Estonia. Later Iceland and Spain joined the study. The assessments started in 1997 studying 9 and 15 year old children of both gender. A 6- and 12-year follow-up have been finished in Denmark and Madeira, 6-year follow-up in Norway and Iceland.

Sedentary and physical activity behaviours were objectively assessed with accelerometers. Blood samples were drawn for analysis of traditional CVD risk factors, genetic mapping and a possibility to analyse new biomarkers. Assessments also included measurements of dietary intake, physical fitness including cardio-respiratory fitness (CRF), muscular strength, skinfold measurements and a comprehensive questionnaire for both children and parents. New measures have been included, e. g. ultrasound of the carotid artery to measure arterial stiffness and intima-media thickness (in Denmark). Main outcomes and determinants are given in Table 1.

The data have been widely used for describing population distribution of early determinants of cardiovascular risk factors and sources of their inequalities, and in identifying personal, genetic, and environmental determinants of current and young adulthood cardiovascular health outcomes (Lawlor et al., 2005; Ekelund et al., 2006; Froberg & Andersen, 2005; Kelliny et al., 2009; Barker et al., 2011; Ekelund et al., 2009; Ong et al., 2009; den Hoed et al., 2010; Grøntved et al., 2013; Grøntved et al., 2014).

This article summarizes the major findings related to sedentary behaviour, physical activity and physical fitness. The findings include cross-sectional and prospective observational data from the EYHS.

SEDENTARY BEHAVIOUR

During the past decades the increase of sedentary behaviours, such as television watching and playing electronic games, may have contributed to increase the incidence of metabolic and CVD risk factors in children, including disturbed insulin and glucose metabolism, hypertension, general and abdominal obesity, and dyslipidaemia.

Table. Main cardiovascular outcomes and determinants that have been assessed in the EYHS

Cardiovascular health outcomes	Cardiovascular health determinants (cont)
Obesity Blood pressure Arterial stiffness Triglyceride HDL cholesterol Total cholesterol Glucose Insulin HbA1c	Muscle strength Cardiorespiratory fitness Leptin Adiponectin Family history of diseases Early life determinants Birth weight Maternal lifestyle during pregnancy Socio-demographic determinants Socioeconomic status of parents Geographical region
Cardiovascular health determinants	
Physical activity Smoking Diet Alcohol intake Metabolites in urine and blood Endocrine disrupting chemicals in urine and blood	Ethnicity Gender Living conditions Marital status
	Other health outcomes/determinants Well-being Depression Cognitive function

A cross-sectional analysis of data from the EYHS, revealed that, on average, European children spent 262 min/day in sedentary activity (van Sluijs, Page, Ommundsen, & Griffin, 2010) [van Sluijs, 2010 #2135]. Additionally, sedentary time increased substantially with increasing age, indicating that early intervention is needed to prevent this increase and the development of health problems associated with sedentary behaviour. Since sedentary activity is associated with a variety of behavioural and social factors, and associations are different for different countries, a single strategy aimed at reducing time spent in sedentary activity in youth is therefore unlikely to be effective across Europe as the target populations and behaviours of focus differ between countries (van Sluijs et al., 2010)[van Sluijs, 2010 #2135]. No associations with percent time sedentary were observed, suggesting that correlates associated with sedentary behaviour is likely to differ from those associated with physical activity (Nilsson et al., 2009). Besides environment factors, it has been hypothesized that sedentary behaviour may be related to lower birth weight. Data from the different centres of the EYHS showed that birth weight did not affect sedentary behaviour (Ridgway et al., 2011 c).

Major dimensions of sedentary behaviour are TV viewing and computer games. Children and adolescents that have more autonomy over their own behaviour are more likely to watch more than

2 h of TV after school and spend more than an hour per day playing computer game (Jago et al., 2008 a). This TV viewing behaviour was associated with adiposity (Ekelund et al., 2006). However, after adjustment for physical activity and other covariates, the association of TV viewing with clustered metabolic risk (the sum of four skin folds, hypertension (average of systolic blood pressure and diastolic blood pressure), hyperglycaemia (fasting plasma glucose), insulin resistance (fasting insulin), inverted fasting HDL cholesterol, and hypertriglyceridemia) was no longer significant. These results suggest that TV viewing and physical activity may be separate entities and differently associated with adiposity and metabolic risk. The association between TV viewing and clustered metabolic risk was mediated by adiposity, whereas physical activity was associated with individual and clustered metabolic-risk indicators independently of obesity. As illustrated in figure 1, time spent sedentary was significantly and positively associated with fasting insulin and HOMA-IR in healthy Portuguese children after adjusting for total or central fat mass as measured with DXA, and time spent in moderate- and vigorous-intensity physical activity (MVPA) and overall physical activity (Sardinha, Baptista, & Ekelund, 2008 a).

Adjusted geometric means of HOMA-IR stratified by quartiles of time spent sedentary (p for trend = .043) and time spent at MVPA

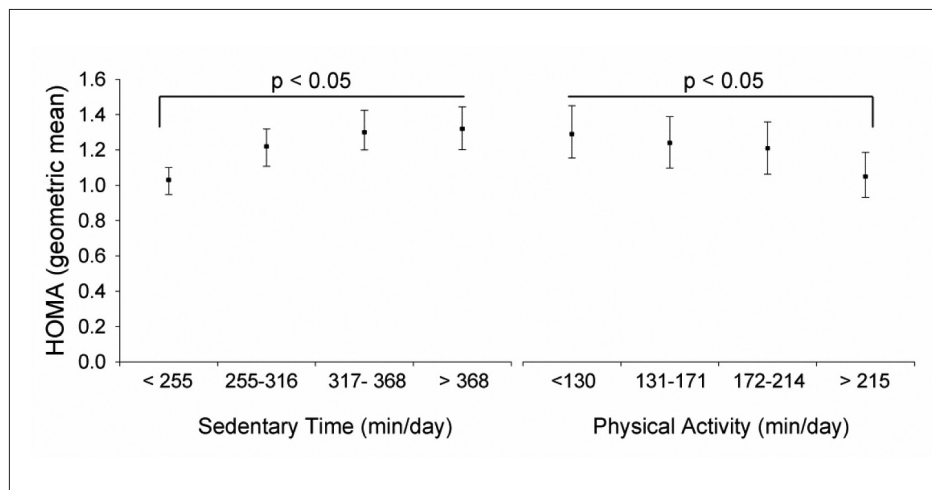


Figure 1. Adjusted geometric means of HOMA-IR stratified by quartiles of time spent sedentary (p for trend = .043) and time spent at MVPA (p for trend = .11) in 9- to 10-year-old Portuguese children ($n = 308$). Post hoc analyses revealed significant differences ($p < .05$) between the first and fourth quartile for time spent sedentary and at moderate and vigorous intensity. Data are adjusted for sex, sexual maturity, birth weight, and fat mass. Adapted from (Sardinha et al., 2008 a)

(p for trend = .11) in 9- to 10-year-old Portuguese children ($n = 308$). Post hoc analyses revealed significant differences ($p < .05$) between the first and fourth quartile for time spent sedentary and at moderate and vigorous intensity. Data are adjusted for sex, sexual maturity, birth weight, and fat mass. Adapted from (Sardinha et al., 2008 a).

A prospective cohort study among Danish men and women, followed for up to 12 years, revealed that TV viewing and total screen time in adolescence were positively associated with adiposity, triglycerides, and metabolic syndrome z-score in young adulthood. Individuals who increased their TV viewing, computer use, or total screen time with more than 2 hours/day from adolescence to young adulthood had 0.90, 0.95, and 1.40 kg/m² higher body mass index, respectively, in young adulthood compared with individuals who remained stable or decreased their viewing time. Insulin and metabolic syndrome z-scores were also higher among individuals who increased their TV viewing, computer use, or total screen time more than 2 hours/day compared with individuals who remained stable or decreased their viewing time (Grontved et al., 2013).

Taken together, cross-sectional and longitudinal findings suggest that screen-viewing behaviours of the entire family are likely to be important for changing youth screen-viewing. Preventive action against obesity and metabolic risk in children may need to target TV viewing and physical activity separately.

But new data show children can be sedentary and healthy in a cardiometabolic perspective. A paper from Ekelund et al. (2012) examining the independent and combined association between

objectively measured time in moderate-to vigorous-intensity physical activity (MVPA) and sedentary time with CVD risk factors in pooled data from 14 studies between 1998 and 2008 comprising 20871 children aged 4–18 years from the International Children's Accelerometry Database (including EYHS data) showed that time in MVPA was significantly associated with all CVD outcomes independent of sex, age monitor wear time, time spend sedentary and waist circumferences. Sedentary time was not associated with any outcome independent of time in MVPA; but in combined analyses, higher levels of MVPA were associated with better CVD risk factors across tertiles of sedentary time. The conclusion was that higher MVPA time by children and adolescents was associated with better CVD risk factors regardless of the amount of sedentary time.

Therefore, the development and implementation of multidimensional strategies focused on especially increasing overall involvement in different types of moderate-intensity activity are critically important in the primary prevention of metabolic disorders in children in order to improve young adulthood health in combination with reducing sedentary time.

PHYSICAL ACTIVITY

Lower birth weight has been associated with reduced physical performance, including muscle strength, muscle endurance and aerobic fitness in both childhood and adulthood and it has been suggested that this lower physical capacity may lead to reduced levels of physical activity. A survey using combined analysis of three European cohorts,

indicated there was no evidence for an association between birth weight and total physical activity or time spent in MVPA (Ridgway et al., 2011 c). Overall there was no evidence for an association between birth weight and sedentary time. Further, higher birth weight was found to be associated with higher fat mass index and greater waist circumference, adjusted for sex, age-group, sexual maturity, height, and socioeconomic status. Lower birth weight was associated with higher fasting insulin only after further adjustment for adolescent waist circumference and body height (Ridgway et al., 2011 b). However, there was no evidence that physical activity or aerobic fitness can moderate the associations among higher birth weight and increased fat mass and metabolic risk in youth.

Influences on young peoples' physical activity are multi-factorial. A variety of psychological, social and physical environmental correlates of physical activity for young people have been identified. Data from a cross-sectional study among Norwegian boys and girls shows that there are psycho-social and environmental correlates of location-specific physical activity. Dependent of location (a) school commuting, b) informal games play at school and c) organized sport, structured exercise and games play in leisure time), psycho-social and environmental correlates explained between 15 and 55% of the variance in physical activity. The impact of peer support, enjoyment and perceived competence in physical activity generalized across the three locations. Enjoyment of physical education classes, parental support and teacher support, in contrast, confined to particular location-specific forms of physical activity. Generally, behavioural beliefs and environmental factors represented marginal correlates of all location-specific forms of activity (Ommundsen, Klasson-Heggelbo, & Andersen, 2006). Frequency of outdoor play after school was found as a significant correlate for daily time in MVPA in 9-year-olds, while this correlate is attenuated in favour of participation in sport and exercise in clubs in 15-year-olds (Nilsson et al., 2009).

After adjustment for sex, study location, sexual maturity, birth weight, and parental BMI, time spent at MVPA and time (min/d) spent at vigorous physical activity were independently associated with body fatness. Sex, study location, sexual maturity, birth weight, and parental BMI explained 29% of the variation in body fatness. Children who accumulated less than 1 h of moderate physical

activity/d were significantly fatter than were those who accumulated more than 2 h/d. (Ekelund et al., 2004).

Clustering of CVD risk factors has recently proved a better measure of cardiovascular health in children than single risk factors. A cross-sectional study of children from Denmark, Estonia, and Portugal reported that odds ratios for having clustered risk for ascending quintiles of physical activity were 3.29 (95% CI 1.96–5.52), 3.13 (1.87–5.25), 2.51 (1.47–4.26), and 2.03 (1.18–3.50), respectively, compared with the most active quintile. Risk factors included in the composite risk factor score (mean of Z scores) were systolic blood pressure, triglyceride, total cholesterol/HDL ratio, insulin resistance, sum of four skinfolds, and aerobic fitness. The first to the third quintile of physical activity had a raised risk in all analyses. The mean time spent above 2000 counts per minute (cpm) in the fourth quintile was 116 min per day in 9-year-old and 88 min per day in 15-year-old children. It was found that, achieving 90 min of daily activity might be necessary for children to prevent insulin resistance, which seems to be the central feature for clustering of CVD risk factors (Andersen et al., 2006).

Figure 2 depicts the graded relationship between physical activity intensity quintiles and CVD Z-score.

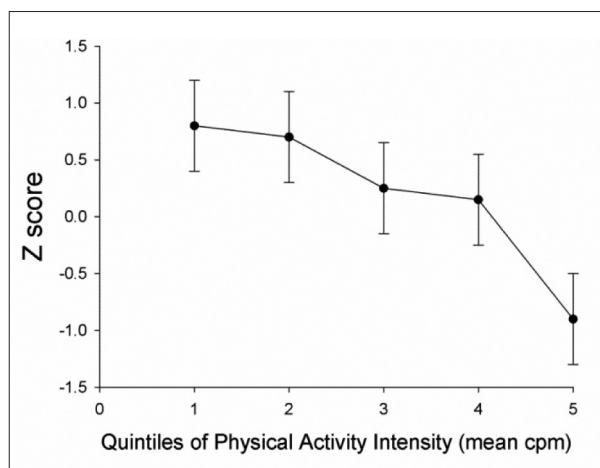


Figure 2. Mean Z score in the quintiles of average physical activity intensity. Vertical bars = 95% CI. Adapted from (Andersen et al., 2006: License permission 3153560906548; Content publisher: Elsevier; Content publication: The Lancet)

Further cross-sectional analysis showed that physical activity and CRF were separately and independently associated with individual and clustered metabolic risk factors in children (Ekelund et al., 2007). Total physical activity and

all other subcomponents of physical activity were significantly associated with clustered metabolic risk. After excluding waist circumference from the summary score and further adjustment for waist circumference as a confounding factor, the magnitude of the association between CRF and clustered metabolic risk was attenuated, whereas the association with total physical activity was unchanged. In a recently accepted paper (Ried-Larsen, Grontved, Froberg, Ehelund, & Andersen, 2013) we observed that maintaining the adolescence MVPA level or increases herein was associated with lower arterial stiffness compared to the ones who decline. This association was independent of a range of confounders (incl. Tv-viewing, parental education, family history of CVD, soft drink and vegetable consumption). Furthermore, adiposity did not mediate that, suggesting that MVPA could have a preventive effect on the general population, not only the overweight. Besides being associated with the prevention of clustering of CVD risk factors, physical activity is an important predictor of health bone. Several previous studies in children and adolescents have reported positive associations between physical activity and bone density and architecture in boys and in girls. A cross-sectional study including Portuguese children demonstrated that vigorous intensity emerged as the main physical activity predictor of femoral neck strength but did not explain gender differences. Recommending daily vigorous physical activity for at least ~25 minutes seems to improve (10–14%) femoral neck bone health in children (Sardinha et al., 2008 b).

Prospective observational analysis including 15-year old students from the Danish arm of the EYHS reported a physical activity declining from 45 minutes > 3000 counts per minute in 1997 to 35 minutes > 3000 counts per minute in 2003 (Jago et al., 2008 b). Longitudinal regression analyses showed that a change in minutes > 3000 counts per minute was negatively associated with fasting insulin levels and HOMA-IR in 2003. Results demonstrated that a 6-year decline in physical activity was associated with higher insulin and HOMA-IR levels, suggesting that preventing an age-related decline in physical activity may be an effective means of preventing youth insulin resistance.

In conclusion, birth weight may not be an important biological determinant of habitual physical activity in children and adolescents. The accumulated amount of time spent at MVPA is

related to body fatness in children; however, this relation is weak since the explained variance was less than 1%. These data suggests that physical activity levels should be higher than the current international guidelines of at least 1 hour per day of physical activity of at least moderate intensity to prevent clustering of CVD risk factors. Vascular and bone health are improved by MVPA and more intense physical activity levels, respectively. Decrease in MVPA tends to have deleterious effects on biomarkers that are related to cardiovascular health and diabetes. These results suggest that fitness and activity affect metabolic risk through different pathways.

PHYSICAL FITNESS

Health-related fitness cut-offs for children and adolescents allow the identification of target populations for health promotion policies and disease prevention at early ages. CRF is easy and relatively cheap to measure, and yet it is an accurate tool for screening children with clustering of CVD risk factors. Lower birth weight was associated with lower CRF, after adjusting for sex, age group, country, sexual maturity and socio-economic status, but introduction of fat free mass as a covariate in the model reduced the association between birth weight and CRF (Ridgway et al., 2011 a). Adegboye et al. (2011) defined optimal cut-points for low CRF and evaluated its accuracy to predict clustering of risk factors for CVD in children and adolescents from EYHS. In girls, the optimal cut-offs for identifying individuals at risk were: 37.4 mlO₂/min/kg (9-year-old) and 33.0 mlO₂/min/kg (15-year-old). In boys, the optimal cut-offs were 43.6 mlO₂/min/kg (9-year-old) and 46.0 mlO₂/min/kg (15-year-old). Specificity (range 79.3–86.4%) was markedly higher than sensitivity (range 29.7–55.6%) for all cut-offs. Positive predictive values ranged from 19% to 41% and negative predictive values ranged from 88% to 90%. The diagnostic accuracy for identifying children at risk, measured by the area under the curve, was significantly higher than what would be expected by chance for all cut-offs. We also observed that boys with a higher CRF (just above this cut point) had lower arterial fitness compared to the least fit boys (Ried-Larsen et al., 2013).

Results from 9- and 15-year-olds from Denmark reported that physical fitness was weakly related to single CVD risk factors except sum of skinfolds where the relationship was strong (Wedderkopp

et al., 2003). Low fitness increased the risk of having three or more CVD risk factors. An OR of 24.1 was found in the low fit group. Children and adolescents from Denmark, Portugal, Estonia, and Norway demonstrates a curvilinear relation between CRF and health parameters, including waist circumference, skinfolds, and blood pressure (Klasson-Heggebo et al., 2006). Additionally, Anderssen et al. (2007) reveal a strong association between CRF and the clustering of CVD risk factors, as described earlier by Wedderkopp, Froberg, Hansen, Riddoch and Andersen (2003). The OR for clustering in each quartile of fitness, using the quartile with the highest fitness as reference, were 13.0, 4.8, and 2.5, respectively, after adjusting for country, age, sex, socio-economic status, pubertal stage, family history of CVD and diabetes. In stratified analyses by age group, sex and country, similar strong patterns were observed. Later, it was reported that physical activity, CRF and fatness (skinfold and waist circumference) were all independently associated with clustered CVD risk (summed z-score of the CVD risk factors systolic blood pressure, triglyceride, total cholesterol:HDL ratio, HOMA score and aerobic fitness) in these children (Andersen et al., 2008). Results from a cohort study including 9- and 15-year-olds from all regions of Norway found that low muscle fitness is associated with clustered metabolic risk, independent of CRF, and after adjustment for age, sex, and pubertal stage. Independent of muscle fitness, an inverse association was found between CRF and clustered metabolic risk. Moreover, the OR for having clustered risk in the least fit quartile compared with the most fit quartile were 7.2 and 17.3 for muscle fitness and CRF, respectively. This study found that muscle fitness and CRF were independently associated with metabolic risk in youth (Steene-Johannessen, Andersen, Kolle, & Andersen, 2009).

Changes in CRF are a significant predictor of changes in body fat percentage from childhood to adolescence, even after controlling for confounding factors such as physical activity, sex, and maturity (Ornelas, Silva, Minderico, & Sardinka, 2011). A cohort study of Portuguese children show that while CRF significantly increased among boys and decreased in girls, the percentage of body fat decreased over time in boys and increased among girls. Alone, CRF explained 39, 26, and 25% of the total variance in waist circumference, fat mass, and trunk skinfold, respectively. Adjusting for

physical activity, sex, and maturation changes, CRF remained a significant predictor of these body composition variables.

Prospective observational analysis on the Danish cohorts showed that greater isometric strength of abdomen and back in youth is associated with lower levels of CVD risk factors in young adulthood independent of CRF, adiposity, socio-demographic and lifestyle factors (Figure 3). Each 1 SD difference in isometric muscle strength in youth was inversely associated with BMI, triglyceride, diastolic blood pressure, and a composite CVD risk factor score in young adulthood in multivariable adjusted analyses including CRF. Each 1 SD difference in isometric muscle strength in youth was significantly associated with 0.59 lower odds of general overweight/obesity in young adulthood and was marginally associated with incident raised of blood pressure, raised triglyceride and low HDL-C (Grøntved et al., 2013).

Lower isometric muscle strength and CRF in youth were also independently associated with adverse levels of fasting insulin, insulin sensitivity, and beta-cell function in young adulthood (Grøntved et al., 2013).

Improving CRF in children and adolescents has been studied especially in relation to school settings with limited effect for years. A simple way of getting a better CRF has been documented in Danish children in the EYHS. Active travel to school and to other activities provides an opportunity for daily physical activity and better CRF. Studying 919 nine and 15 year old children it was shown that the children and adolescents who cycled to school were significantly more fit than those who walked or travelled by motorized transport. They were nearly five times as likely (OR 4.8; 95% CI 2.8–8.4) to be in the top quartile of fitness (Cooper et al., 2006). In a 6 year follow up study of the 9 year old children at baseline, it was shown that higher CRF was significantly associated with cycling to school in children and adolescents of both sexes. Longitudinal regression models showed that a change in travel mode from non-cycling to cycling was a significant predictor of CRF at follow-up ($p < .001$) after adjustment for potential confounders. Participants who did not cycle to school at baseline, but who had changed to cycling at follow-up, were significantly fitter (0.33 W kg⁻¹) than those who did not cycle to school at either time point ($p = .001$), a difference of 9% was found (Cooper et al., 2008).

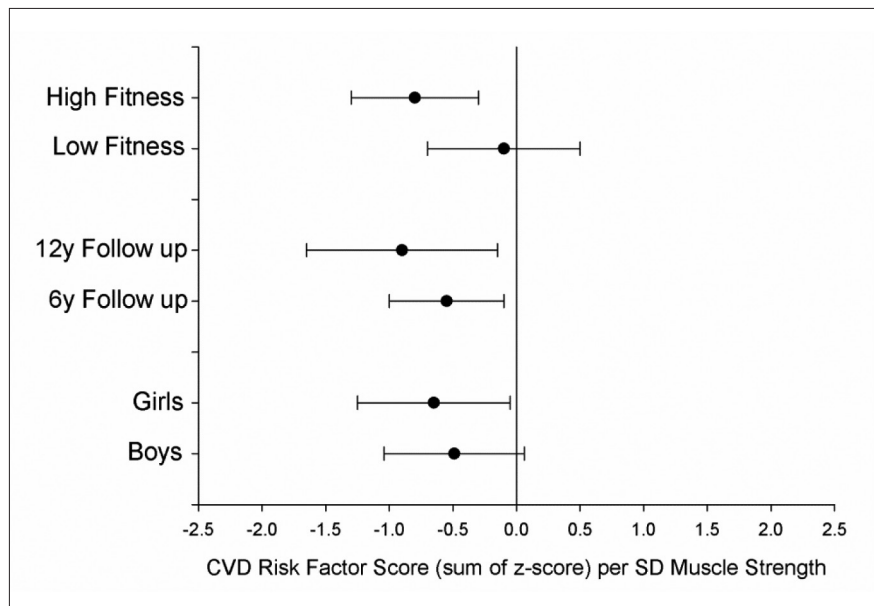


Figure 3. Isometric muscle strength in youth and composite cardiovascular risk factor score in young adulthood stratified by cardiorespiratory fitness (below and above the median, sex specific), follow-up time (6- or 12 years), and sex. Adapted from Grøntved et al. (2013)

In summary, low CRF is strongly associated with the clustering of CVD risk factors in children independent of country, age and sex. High levels of CRF are recognized to have wide ranging health benefits not only in terms of direct benefits observed in childhood, such as lower obesity risk and improved metabolic and vascular function, but also in terms of reduced disease risk in later life. The greatest benefit may be achieved when increasing CRF from low to moderate, mainly in those children and adolescents who are the least physically fit. Increasing CRF and muscle strength of abdomen and back should both be targets in youth prevention strategies to prevent insulin resistance and beta-cell dysfunction and improve CVD risk factors and body composition phenotypes in young adults. Commuting to school by cycling seems to be an easy and simple way of increasing CRF.

CONCLUSIONS

Key findings from both the cross-sectional and prospective observational data strongly suggest that sedentary behaviour, physical activity, cardio respiratory fitness, muscle fitness and muscle strength are relevant behaviours and attributes that influence several dimensions of health in children and adolescents, with latter influence on young adulthood.

Key findings so far from the EYHS can be seen below. Each of the exposures has some independent effects on different outcomes, and also combined effects that tend to have an increased magnitude,

with a major contribution for the challenge that our society is currently facing, the battle against the ominous enemy of chronic disease. Reduced sedentary behaviour, and increased physical activity, CRF, muscle fitness and muscle strength may represent the common soil for a lifelong healthy life starting as early as in childhood.

Sedentary behaviour

- Correlates associated with sedentary behaviour are likely to differ from those associated with physical activity (PA).
- TV viewing and PA may be differently associated with adiposity and metabolic risk.
- Objectively measured time spend sedentary is associated with insulin resistance independent of overall and central body fat in 9–10-year-old children.
- Youth screen-time behaviour is associated with cardiovascular risk in young adulthood.

Physical Activity

- Frequency of outdoor play after school is a significant correlate for daily time in MVPA.
- PA levels should be higher than the current international guidelines of at least 1 hour per day of PA of at least moderate intensity to prevent clustering of CVD factors.
- Physical activity is inversely associated with insulin resistance in glucose-tolerant children.
- PA and CRF are separately and independently associated with individual and clustered metabolic risk factors in children.

Physical Fitness

- Low CRF is strongly associated with the clustering of CVD risk factors in children and adolescents.
- Low muscle fitness is associated with clustered metabolic risk.
- Greater isometric strength of abdomen and back in youth is associated with lower levels of CVD risk factors and improved glucose metabolism and beta-cell function in young adulthood.
- Changes in CRF are a significant predictor of changes in body fat percentage from childhood to adolescence.
- Active commuting to school can significantly improve CRF.

Perspectives. A new EYHS project also including centres from Lithuania, Finland, Austria, Italy, Kosovo, and Hungary beside the old centres in Denmark, Norway, Ireland, Iceland and Portugal, will seek to identify childhood environmental, behavioural, biological, and genetic determinants of cardiovascular disease risk in childhood, adolescence and adulthood. It will provide new important surveillance data on behavioural, environmental, and biological risk factors for cardiovascular diseases among population-based samples of children and adolescents across all geographical regions of Europe.

The project will include population-based random samples of 9-year old children and 15-year old adolescents. From each country at least 1000 children and adolescents will be recruited, yielding a total sample size of at least 15000 children and adolescents. Furthermore, previous sampled participants from Denmark, Portugal, Norway, and Iceland have been followed up in adolescence or young adulthood (6- or 12-year follow-up), and will be followed up again with participants being 21–34-year of age (12- or 18-year follow-up).

The project – if supported through the Horizon 2020 program – will substantially expand the current knowledge of cardiovascular health status, and disparities herein, among diverse European children and adolescents and the extent that childhood and adolescent environment, lifestyle, biology, genetic make-up individually and jointly influence cardiovascular risk later in life.

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OPTIMIZATION OF PHYSICAL FITNESS DEVELOPMENT FOR PRIMARY SCHOOL LEARNERS IN PHYSICAL EDUCATION LESSONS

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ABSTRACT

Background. Nowadays, an urgent social problem in sovereign Kazakhstan, which defines the strategy of social development of our society, is upbringing a new person developed spiritually, morally and physically. Physical fitness of primary school learners as a sphere of scientific-pedagogical knowledge in Kazakhstan Republic has not been fully researched. It conditioned the problem of our investigation – to substantiate theoretically and work out the methodology of optimization of physical fitness development for primary school learners in PE lessons. Theoretical analysis of scientific works suggests that physical fitness of primary school learners as a sphere of scientific-pedagogical knowledge has not been fully investigated. Despite the diversity of issues and theoretical as well as practical pedagogical research, it should be noted that the problem of physical fitness of primary school learners using sport games in PE lessons is still open for theoretical consideration and experimental research.

Research aim was to define the most effective methodology of physical fitness of 8–9 year- old boys in PE lessons using elements of football in general education schools.

Methods. All in all there were 102 boys. They were divided into 4 groups – 3 experimental groups and 1 control group. During the experiment, 75% of time for teaching technical actions of football was devoted for group E1, for E2 – 50%, and for E3 – 25%; for physical fitness – 25, 50 and 75% respectively. During the experiment, with the help of methods given above, we covered the following aspects: physical development, general physical fitness, special fitness.

Results. Analyzing the increase in overall physical fitness for the whole period of the experiment, we observed a significant increase in all of the surveyed groups ($p < .05–.001$). All the tested groups were approximately of the same level.

Conclusions. The study showed that the best option for physical training for primary school children in physical education classes in comprehensive schools was to have 75% of the total lesson time to the development of physical fitness and 25% of the lesson time – to technical training (program C). Physical education classes with elements of football contribute to more intense dynamics of indicators of general and special training of 8–9-year-old boys. Analysis of the studied parameters of fitness and technique of playing football has shown that methods of education and physical qualities of technical preparation, which was given to the third experimental group, contributed to the development of better skills in football.

Keywords: physical education lessons, physical, technical fitness, football.

INTRODUCTION

Nowadays, an urgent social problem in sovereign Kazakhstan, which defines the strategy of social development of our society, is upbringing a new person developed spiritually, morally and physically. Physical education (PE) and sport as an important means of

upbringing children have a definite social function and become an element of lifestyle of Kazakh people, creating nice prerequisites for individual development (Кульнарарова, 2013). Increasing the importance of systematic PE lessons and sport is carried out by introducing them to all learners,

which is considered as a condition for preparation of sport reserve and solving other problems of physical development of the young generation (Yang, Telema, Laakgo, Keltikangas-Järvinen, & Pulli, 2007; Синявский, Власов, & Сергеев, 2009; Касымбекова, Кошаев, & Абишев, 2013).

Studying the issues of physical fitness of primary school learners showed that it needed special scientific-pedagogical consideration aimed at working out concrete offers, directed to practical provision of its tasks with physical fitness (Malina, Bouchard, & Bar-Or, 2004; Бервинова & Шарабакин, 2005).

Consideration of the problems of physical fitness for primary school learners in PE lessons involves studying:

- The basis of school PE (Минаев, 1989; Волков & Ромашев, 1998; Бервинова & Шарабакин, 2005).
- Organization and planning the physical development of pupils in PE lessons and in their leisure time (Гужаловский, 1987; Gudžinskienė, 2006; Юревич & Мусатаев, 2013).
- Development of skills of schoolchildren (Bar-Or, 1996; Turley, 1997; van Praag, 2000; Бальсевич, 2000).

Theoretical analysis of scientific works suggests that physical fitness of primary school learners as a sphere of scientific-pedagogical knowledge has not been fully investigated. Despite the diversity of issues and theoretical as well as practical pedagogical research, it should be noted that the problem of physical fitness of primary school learners using sport games in PE lessons is still open for theoretical consideration and experimental research.

The relevance of this problem, the lack of theoretical elaboration and demand for practice conditioned the problem of our investigation – the development of the theoretical basis and the methodology of optimization of physical fitness of primary school learners in PE lessons.

The aim of the work was to define the most effective methodology for physical fitness of 8–9-year-old boys in PE lessons using the elements of football in general education schools.

METHODS

Research methods included literature review, pedagogical experiment, testing and methods of mathematical statistics.

Research was carried out in 2011–2012 academic year. Pupils of the 2nd and 3rd grades of general education school “Prestige”, Almaty city took part in this investigation. All participants were divided into 4 groups. Three experimental groups (E1, E2, and E3) included 25 boys each, and the control group (C) – 27. All in all there were 102 boys. Physical development of participants who were in the control group was realized according to the program of school general education. For one year the boys in experimental groups E1, E2, E3 in PE lessons did special football exercises for their technical preparation, which was planned on the basis of a modified program of children and youth’s sport school (CYSS). Investigations were done in three stages (each of it in 3 months). The first stage of the experiment took place in September–November, the second stage – in December–February, and the third stage – in March–May. The first testing was done in November, the second one – in March, the third one – in June. Effectiveness of two factors was verified during the experiment:

- the ration of time given for physical and technical development;
- purposeful development of various physical skills.

During the experiment, group E1 had program A, i. e. 75% of lesson time (34 min) was allotted for teaching technical actions of football and 25% – for the development of physical skills (11 min). Group E2 had program B, where 50% of lesson time (23 min) was devoted to acquiring technical actions, and 50% of time (22 min) – for physical skills. Group E3 had program C with 75% of lesson time (34 min) for physical skills and 25% of lesson time (11 min) for teaching technical actions of the game.

During the experiment we measured:

- physical characteristics: body height, body mass, circumference of thorax, excursion of thorax;
- general physical fitness: strength of trunk, strength of arm, long jump, 30 m run, 300 m run, throw of stuffed ball in the sitting position, tapping test for 30 seconds;
- special fitness: hitting the ball for distance, test of agility (running in the gym with changes in r direction), shuttle run (3 x 10 m), hitting five balls to the football gate.

The results obtained were processed by methods of mathematical statistics. We calculated arithmetical mean (X) and standard error (SE), as well as changes in the percentage of the investigated

data. Comparing the results of definite groups and increase of index sizes for separate periods of research, verifying the hypothesis and equality of separate averages (X) we applied analysis of variance ANOVA (F – Fisher's criteria). Statistical significance of differences between indexes were evaluated by level $p < .05$ when $F = 2.76$.

RESULTS

Dynamics of indexes of physical development of the investigated 8–9-year-old pupils is presented in Table 1.

Body height. In the first study, the meaning of this index ranges from 129.5 to 133.3 cm. However, intergroup differences are statistically insignificant ($F = 2.03$; $p > .05$). Differences of boys' body height were significant in groups E1 and E3 ($F = 2.86$; $p < .05$). During the second stage of the experiment a further increase of body height on average was 1.03–1.45% ($p > .05$).

Analogous increase of body height of all investigated groups was found in the third group (2.15–2.67%).

Body mass. In the first study, the average values of this index ranged from 26.7 to 30.4 kg, but intergroup differences were not significant ($F = 1.05$; $p > .05$). The biggest difference of values was between groups E1 and E3 ($p > .05$). During the whole experiment, the sizes of this index increased almost the same in all groups; therefore, in the third investigation statistically significant intergroup differences were not observed ($p > .05$).

The circumference of the thorax. In the first survey, the value of this indicator ranged from 62.5 to 65.0 cm, but intergroup differences were not significant ($F = 1.54$; $p > .05$). The greatest differences were observed between groups E1 and E2 ($p < .05$). During the second phase of the experiment, the values of the chest circumference investigated increased by an average of 0.78–1.28% ($p > .05$), the third – 2.04–2.52 ($p > .05$).

Excursion of the thorax. Throughout the experiment, there was a significant increase in this index in all groups. The most significant increase was noted in groups E2 and E3.

Changes in general physical fitness are presented in Table 2.

30 m run. The initial results of this index were almost equal in all groups ($p > .05$). In the second survey, group differences were not observed ($p > .05$). It should be noted that during the second stage of the research the value of this indicator improved to the greatest extent in the experimental groups (on average from 4.86 to 6.62%, $p < .01$), some lower growth was observed in the control group (3.32%, $p < .05$). In the third survey, results ranged on average from 5.6 to 5.5. The most results in E2 group, which spend more time for the development of physical skills, produced insignificant differences ($F = 0.48$; $p > .05$).

Long jump from the standing position. In the first survey, the results of this measure were almost identical to intergroup differences which were statistically insignificant ($F = 1.48$; $p > .05$). The greatest differences were observed between the

Table 1. Changes in the physical development of the tested groups ($X \pm SE$)

Index	Stages	Groups			
		E ₁	E ₂	E ₃	C
Body height (cm)	1	133.3 ± 1.00	131.7 ± 1.32	129.5 ± 0.93	131.9 ± 1.37
	2	135.7 ± 1.04	134.4 ± 1.43	131.9 ± 0.99	134.3 ± 1.43
	3	139.6 ± 1.11	137.8 ± 1.55	136.4 ± 1.09	138.6 ± 1.67
Body mass (kg)	1	30.4 ± 1.00	28.3 ± 0.81	26.7 ± 0.92	28.9 ± 0.70
	2	31.5 ± 1.06	29.3 ± 0.82	29.9 ± 0.92	29.7 ± 0.71
	3	33.8 ± 1.11	31.2 ± 0.89	32.2 ± 0.99	31.8 ± 0.73
Circumference of the thorax (cm)	1	65.0 ± 1.00	62.5 ± 0.63	63.7 ± 0.86	63.8 ± 0.66
	2	66.2 ± 0.98	63.4 ± 0.59	64.6 ± 0.89	64.3 ± 0.68
	3	68.6 ± 1.04	65.8 ± 0.62	66.8 ± 1.05	66.0 ± 0.69
Excursion of the thorax (cm)	1	3.6 ± 0.22	3.1 ± 0.24	3.7 ± 0.24	4.6 ± 0.22
	2	3.8 ± 0.21	3.6 ± 0.20	4.2 ± 0.23	4.8 ± 0.23
	3	4.9 ± 0.20	5.3 ± 0.18	5.6 ± 0.21	6.2 ± 0.31

groups E2 and E3 ($F = 1.8$; $p > .05$) and the smallest between groups E1 and E3 ($F = 0.05$; $p > .05$). During the second phase of the experiment, results of the long jump increased by 10.4–15.1 cm on average. In the third survey, results of this indicator ranged from 156.0 to 159.2 cm, but intergroup differences were not statistically significant ($F = 0.24$; $p > .05$). The greatest differences were observed between E1 and E2 we all as E2 and E3 groups (accordingly: $F = 1.69$; $p > .05$; $F = 1.7$; $p > .05$), and the smallest – between E1 and E3 groups ($F = 1.11$; $p > .05$). The most significant increase was observed in the results of E3 group.

Throwing the medicine ball while sitting.

Initial values of this index ranged from 194.7 to 236.6cm, and intergroup differences were statistically significant ($F = 3.58$; $p < .05$). The greatest differences were observed between the E2 and C groups ($F = 2.83$; $p < .05$). In the second survey, intergroup differences of this indicator were also statistically significant ($F = 3.18$; $p < .05$). In the third survey, results this index ranged from 256.8 cm in C group to 307.6 cm in E1 group, intergroup difference was statistically significant ($F = 4.24$; $p > .01$). The greatest difference was between E1 and C groups ($F = 2.9$; $p > .05$), and the smallest – between E1 and E2 groups, E3 and C groups (accordingly $F = 1.13$; $F = 1.11$; $p > .05$).

The rise in the saddle. Initial results of this indicator ranged from 4 to 10 times, intergroup differences statistically significant ($F = 7.7$; $p < .001$). The greatest difference was between groups E2 and C ($F = 4.7$; $p < .01$) and the smallest difference – between E1 and E3 groups ($F = 1.65$; $p > .05$). In the third survey, the indicator values ranged from 11 in group C to 17 times in group E3 ($F = 13.1$; $p < .001$). The greatest difference in indicators was between groups E3 and C ($p < .05$)

300 m run. In the first survey, results of this indicator in the experimental groups ranged from 79.1 to 73.9 s, however, intergroup differences were insignificant ($F = 2.05$; $p > .05$).

In the second phase of the research, performance in races for 300 meters improved on average by 4.01–8.56%. In the third survey we observed opposite results, so intergroup differences were again statistically insignificant ($F = 2.35$; $p < .05$), the exception is a significant difference between groups E1 and C ($F = 3.10$; $p < .05$). The most significant improvement was seen in the group E3 – 8.9 s.

Tapping Test. Initial values of this indicator ranged from 48 to 54 movements, intergroup differences were statistically significant ($F = 5.28$; $p < .01$). The biggest difference was seen between groups E2 and C ($F = 3.53$; $p < .05$), and the smallest – between groups E1 and E2 ($F = 1.12$; $p > .05$). In the third investigation, tapping test results ranged from 58 to 67 movements, intergroup differences were again statistically significant ($F = 6.78$; $p < .01$). The most significantly these indexes were in groups E2 and E3.

Trunk force. The initial results of this indicator fluctuated from 38.4 kg in group C to 52.7 kg in group E2, intergroup differences were statistically significant ($F = 6.15$; $p < .001$). During the following investigations intergroup differences of results were statistically significant ($p < .001$).

In the second stage, this index increased most in group E₃. In groups E1 and E2 backbone force increased insignificantly ($p > .05$), in E₃ group it increased by 14.6% ($p < .05$). In the latest investigation, results of this indicator fluctuated from 47.4 to 60.2 kg, and intergroup differences were statistically significant ($F = 9.72$; $p < .001$).

Arm force. In the first investigation the results of this index fluctuated from 11.9 to 12.9 kg, however intergroup differences remained insignificant ($F = 0.45$; $p > .05$). In the subsequent stages of research there was practically an identical increase in this index in all groups with some advantage of group E3, where we noticed a significant increase of results ($p < .05$) in all stages.

In the third investigation intergroup differences of results of arm force were statistically significant ($F = 3.07$; $p < .05$). Most differences were observed between groups C and E3 ($F = 3.19$; $p < .05$), and the least – between groups E1 and C ($F = 0.45$; $p > .05$).

The changes of indexes of special physical fitness are presented in Table 3.

Shuttle run. At the beginning of experiment results of this index fluctuate from 10.9 to 9.7 s. During the second stage, in all groups the results of this index were stable ($p > .05$). In the last investigation, results of shuttle run fluctuated from 9.3 to 8.4 s. Most differences were observed between groups E2 and C ($F = 4.37$; $p < .01$), and the least – between groups E1 and E3 ($F = 1.66$; $p > .05$).

Test of agility. In the first investigation, results of this index fluctuated from 31.9 to 29.4 s.

Table 2. Changes of indexes of general physical fitness ($X \pm SE$)

Indexes	Stages	Groups			
		E ₁	E ₂	E ₃	C
30 m run (s)	1	6.1 ± 0.09	6.1 ± 0.10	6.3 ± 0.11	6.1 ± 0.14
	2	5.7 ± 0.07	5.6 ± 0.7	5.7 ± 0.07	5.8 ± 0.12
	3	5.6 ± 0.08	5.5 ± 0.06	5.5 ± 0.05	5.6 ± 0.11
Long jump from the standing position (cm)	1	130.4 ± 3.62	140.3 ± 4.30	130.1 ± 3.28	133.3 ± 4.06
	2	145.5 ± 2.66	153.9 ± 4.09	140.5 ± 2.72	142.0 ± 4.17
	3	156.8 ± 2.73	159.2 ± 3.84	156.0 ± 3.46	156.8 ± 3.51
Throwing the medicine ball (cm)	1	233.0 ± 10.56	236.6 ± 8.36	210.7 ± 7.46	194.7 ± 13.16
	2	254.3 ± 9.98	255.4 ± 8.34	227.3 ± 6.97	214.1 ± 11.92
	3	307.6 ± 12.11	288.6 ± 9.73	272.5 ± 8.65	256.8 ± 10.38
The rise in the saddle (quantity)	1	8 ± 0.63	11 ± 0.84	9 ± 1.05	4 ± 0.86
	2	13 ± 0.55	14 ± 0.63	14 ± 0.79	7 ± 0.89
	3	15 ± 0.39	16 ± 0.72	17 ± 0.75	11 ± 0.90
300 m run (s)	1	74.5 ± 1.29	73.9 ± 1.24	79.1 ± 2.07	75.4 ± 1.30
	2	68.1 ± 1.08	68.9 ± 1.11	74.1 ± 1.72	72.4 ± 1.25
	3	65.8 ± 1.27	67.3 ± 1.18	70.2 ± 1.79	70.2 ± 1.65
Tapping Test (number of times in 10 s)	1	53 ± 2.66	54 ± 2.58	50 ± 1.67	48 ± 2.19
	2	60 ± 1.60	62 ± 1.63	58 ± 1.09	52 ± 1.26
	3	66 ± 1.48	67 ± 0.91	63 ± 0.98	58 ± 1.32
Trunk strength (kg)	1	46.6 ± 2.37	52.7 ± 1.53	46.9 ± 1.81	38.4 ± 2.80
	2	54.1 ± 1.41	56.7 ± 1.43	54.9 ± 1.49	41.5 ± 2.79
	3	56.8 ± 1.45	58.7 ± 1.45	60.2 ± 1.36	47.4 ± 2.71
Arm strength (kg)	1	12.9 ± 0.74	11.9 ± 0.70	12.9 ± 0.69	12.6 ± 0.69
	2	17.8 ± 0.66	16.3 ± 0.67	17.0 ± 0.71	16.4 ± 0.49
	3	20.3 ± 0.59	18.9 ± 0.54	21.8 ± 0.89	20.8 ± 0.63

However, intergroup differences were statistically insignificant ($F = 1.14$; $p > .05$). In the third investigation, results of complex agility fluctuated from 26.4 to 22.4 s, intergroup differences were statistically significant ($F = 4.92$; $p < .01$). The improvement of result of this test was most considerable for representatives of group E3 (by 28.4%). Most differences were observed in groups E1 and C ($F = 3.92$; $p < .05$) and smallest – between groups E1 and E3 ($F = 2.0$; $p > .05$).

Hitting of ball for distance. At the beginning of the research, results of this index increased from 8.2 to 10.3 m, however intergroup differences were statistically insignificant ($F = 0.94$; $p > .05$). In the second investigation, intergroup differences in this index fluctuated statistically significantly ($p < .001$). In the third investigation, results of this index fluctuated from 17.5 to 21.4 m, intergroup differences were statistically significant ($F = 3.84$; $p < .05$). During the third stage of the research the value of this index increased in groups E1–E3 and C, respectively by 78.6; 72.4; 85.3 and 37.3%. The greatest difference of indexes could be seen between groups E1 and C ($F = 1.39$; $p < .05$), the smallest – between groups E2 and E2 ($F = 1.2$; $p > .05$).

Hitting five balls to the football gate. At the beginning of research, results of this index fluctuated from 16.6 to 12.9 s. The greatest difference was between groups E1 and C ($F = 4.54$; $p < .01$), the smallest – between groups E1 and E2 ($F = 1.39$; $p > .05$). In the second survey, intergroup index differences were statistically significant. The subjects of experimental groups got the highest indexes. In the third survey, the results of this index fluctuated from 12.3 to 10.3 s, intergroup differences were statistically significant ($F = 5.77$; $p < .01$). The highest difference was between groups E3 and C ($F = 3.75$; $p < .05$), the smallest was between groups E1 and E2 ($F = 1.16$; $p > .05$).

During the experiment, at the physical education lessons, in the time allotted for technical preparation, boys were trained by following techniques of football game: dribble, taking the ball, stop the ball, hitting the ball with the foot and head, deceptive motion. The received data testified that learning limited had a positive impact on pupils' technical preparation indexes, that was confirmed by the recorded data on the implementation of correct hits, stops and ball transmission.

Table 3. The results of specially prepared index ($X \pm Sx$)

Data	Stages	Groups			
		E ₁	E ₂	E ₃	C
Shuttle run (s)	1	10.1 ± 0.17	9.7 ± 0.21	10.2 ± 0.24	10.9 ± 0.17
	2	9.8 ± 0.17	9.3 ± 0.16	9.6 ± 0.14	10.5 ± 0.17
	3	8.7 ± 0.13	8.4 ± 0.14	8.8 ± 0.14	9.3 ± 0.13
Test of agility (s)	1	30.6 ± 1.02	29.4 ± 0.77	31.7 ± 0.95	31.9 ± 1.07
	2	25.2 ± 0.61	24.9 ± 0.70	27.2 ± 0.45	29.3 ± 1.02
	3	22.4 ± 1.03	23.3 ± 0.16	22.7 ± 0.59	26.4 ± 1.14
Hitting of ball for distance (m)	1	10.3 ± 0.96	9.8 ± 1.12	8.2 ± 0.96	9.1 ± 0.71
	2	18.4 ± 0.79	16.9 ± 0.84	15.2 ± 1.13	12.5 ± 0.71
	3	21.4 ± 0.74	21.3 ± 1.01	19.3 ± 0.99	17.5 ± 0.95
Hitting five balls to the football gate (s)	1	12.9 ± 0.41	1.7 ± 0.37	14.2 ± 0.51	16.6 ± 0.76
	2	11.6 ± 0.33	11.8 ± 0.28	11.5 ± 0.35	14.9 ± 0.75
	3	10.9 ± 0.32	10.8 ± 0.14	10.3 ± 0.29	12.3 ± 0.45

DISCUSSION

Analyzing the dynamics of the physical development of children of primary school age, during the experimental work we did not see much difference between the experimental and control groups. Studies indicate that children develop without abnormalities. This is one of the main requirements for physical exercise (Baxter-Jones, 2001). Meanwhile, comparing the average physical development of the first and third surveys, we observed a slightly larger increase of indexes in the experimental groups, and especially in the second and the third. This can be explained by the fact that the means and methods used with large amounts of physical training in teaching boys of experimental groups had a positive impact on their physical development, in contrast to the control group. The analysis showed that data on physical development did not fully disclose the physical condition of the child. The main signs of physical fitness of children still were well-developed strength, speed, endurance, joint mobility, coordination and agility (Bar-Or, 1996; Armstrong & Welsman, 2000; Telema, Yang, Hirvansalo, & Raitkari, 2006; Rowland, 2007)

Analysis of the dynamics of general physical fitness results shows that in all groups surveyed there was a noticeable increase in the values of their parameters. This indicates a favorable age of 8–9 years for the development of basic motor skills: speed, strength, endurance. On this issue similar opinion is shared by many other authors. (Волков & Ромашев, 1998; Rowland, 2005;

Dencer, Thorsson, & Karlson, 2009; Синявский et al., 2009).

These data of basic physical fitness of the first stage of the study indicate the different relationship between the indexes of the groups. For example, in the run for 30 meters, the long jump, hand grip strength, no real differences were seen ($p > .05$). However, it should be noted that the growth of these indexes was somewhat higher in the experimental groups. Indicators of the tapping test, abdominal muscles, postural forces were interrelated statistically significantly ($p < .01$) throughout the first phase. Here we should note the similarity of this opinion with the opinion of well-known scientists Гужаловский (1987), van Praag (2000), Stepinski, Zwirko, Frolkiewicz and Debieka, (2003), Malina et al. (2004).

According to the analysis of the first phase results it should be noted that in general there was some advantage of groups E1 and E3. This can be explained by the fact that a large part of the lesson was assigned to the development of physical skills. Meanwhile, in group E1 greater emphasis was on teaching the techniques of football, and the control group was engaged in a school program.

During the experiment, a similar pattern was observed during the second phase of the experiment. Increase in overall physical training was more intense in groups E2 and E3.

This is especially shown by indicators of throwing the soft ball, running for 300 meters, the long jump where already significant differences

were found between the averages of the tested groups. In general, the second stage of the study showed the advantages of experimental groups over the control group. Thus, all this shows the usefulness of the techniques used in the experimental groups during the study period.

During the third phase of the study parameters of physical training in all tested groups increased significantly. However, it should be noted that the greatest index gains were achieved group E3 in the third stage. It can be explained by the fact that they were given more time (75%) of the lesson on the development of physical skills.

Analyzing the performance of special training throughout the experiment in the tested groups we see the following pattern: in terms of skill set, operational thinking, the impact on range, experimental groups were leading. This can be explained by the fact that these results depend not only on the level of the manifestation of power-speed, but also on the quality of the technique of movement. The same opinion is held by the researchers Dencer et al. (2006), Chvicalovskij, Wulf, de Medeiros, Kalfer and Tani (2008), Jaščaninienė, Kemerytė-Riaubienė, Kepežėnas and Katinas (2011).

Under the influence of purposeful physical training in the secondary school boys learned the basic techniques of football. The experimental data showed that for the qualitative development of the techniques of football in the first place good physical preparation is required. This is evident in the third experimental group, where the first stage of the experimental education of physical skills received 75% of the lesson time.

All studies of physical development, general and specialized training of primary school children show availability of application of the integrated program with elements of football (the experimental groups) in the classroom with the 8–9 year- old boys without harm to their health.

Data from studies indicate that training with elements of football create more favorable conditions for the manifestation of its features for more children in football. This coincides with the opinion of Адамбеков and Боранбаев (1999).

The data on the technical training, after each stage and at the end of the experiment show that pupils of the experimental groups mastered the techniques of football. This is evidenced by the fact that 13 boys from the experimental groups were

taken to the football school (one of the first group, 4 – from the second, 8 – from the third)

Our data suggest that the initial training was appropriate to establish a foundation for general physical fitness. It would be possible to achieve better results and special technical preparation, as confirmed by the data obtained in the third experimental group.

CONCLUSIONS

1. Analyzing the increase in overall physical fitness for the whole period of the experiment, we see a significant increase in all of the surveyed groups ($p < .05-.001$). All tested groups were approximately of the same level. Indicators of general physical fitness could be divided into two groups:

- the first group included indicators which showed superiority of the experimental groups: 30 m run, 300 m run, long jump, taping test ($p < .05-.01$);
- the second group included indicators that showed approximate equality between all groups: throwing a soft ball while sitting, strength of spine muscles, training of the abdominal muscles, force of the hand ($p < .01-.01$).

2. The study showed that the best option for physical training of primary school children in physical education classes at comprehensive schools should be considered when 75% of the total lesson time was given to physical fitness and 25% of the time the lesson was given technical training (program C).

3. Physical education classes with elements of football contribute to more intense dynamics of indicators of general and special training of 8–9-year-old boys.

4. Analysis of the studied parameters of fitness and techniques of playing football has shown that methods of education and physical qualities of technical preparation that were given to the third experimental group contributed to the formation of more successful elements of football.

General increase of indicators of technical preparation of the 8–9-year-old boys, evaluated by the expert commission was as follows: in group E1 – 38.8%, in group E2 – 41.2%, in group C – 26.6%.

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EMOTIONAL INTELLIGENCE AMONG LITHUANIAN AND LATVIAN STUDENT ATHLETES

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ABSTRACT

Background. This article deals with the issue of the manifestation of emotional intelligence in Lithuanian and Latvian student athletes. Emotional intelligence has been suggested as providing a new perspective on how emotional competencies necessary for performance in today's workplace among would-be physical educators might be more effective and better understood. Hence, the following *research question* is raised: does the emotional intelligence of Lithuanian student athletes differ from that of Latvian student athletes? We hypothesized that the emotional intelligence of Lithuanian student athletes differs from that of Latvian student athletes. *Research aim* was to reveal the manifestation of emotional intelligence in Lithuanian and Latvian student athletes.

Methods. The independent random sample consisted of 227 student athletes from the Latvian Academy of Sports Education and 214 student athletes from the Lithuanian Sports University. Schutte Self-Report Inventory (SSRI) was employed. This instrument divides emotional intelligence into four separate components, namely: ability to use personal positive emotional experience (optimism), ability to assess and express emotions (appraisal), ability to understand and analyse emotions (social skills) and ability to manage emotions (utilization).

Results. The analysis of the ability to use personal positive emotional experience resulted in the following averages: 51.48 ± 5.24 in case of the Lithuanian student athletes and 52.78 ± 6.33 in case of the Latvian student athletes. The application of the Student's t-test revealed a statistically significant difference in the ability of the Lithuanian student athletes to use own positive emotional experience and that of the Latvian student athletes: $t(439) = 2.32$; $p < .005$.

Conclusions. The comparison of the components of emotional intelligence of Lithuanian and Latvian student athletes revealed that Latvian student athletes have better ability to use own positive emotional experience (optimism) ($p < .05$). No other statistically significant difference between Lithuanian and Latvian student athletes in terms of the components of emotional intelligence was observed.

Keywords: emotional intelligence, emotions, student athletes.

INTRODUCTION

The significance of emotional intelligence for educators is a subject of continuous scientific discussions. The emergence of the emotional intelligence term received a great deal of attention from the scientists and inspired a number of articles. It is a proven fact that the "emotionally gifted" people have inner advantage both in terms of personal and professional life, and therefore they are happier and more successful. It was even suggested that it is the emotional intelligence

rather than IQ or cognitive abilities that matters more when predicting and assessing academic and professional achievement (Goleman, 1995). We believe that it is crucially important to observe and analyse the segment of would-be teachers because the currently available educational programs that are designed to develop the emotional intelligence of the students of Education Studies are insufficient.

Mayer and Salovey (1993) developed an ability model of emotional intelligence which emphasized

the importance of the components of emotional intelligence. This model defines emotional intelligence as abilities (Matthews, Zeidner, & Roberts, 2003). The model reveals that emotional intelligence as construct is lot like traditional intelligence because the abilities associated with emotional intelligence also alter with age (Mayer, Salovey, & Caruso, 2000). Although Salovey and Mayer (1990) initially described emotional intelligence as a single personality trait, eventually they claimed that emotional intelligence should be perceived as the totality of a person's abilities (Mayer et al., 2000). Mayer et al. (2000) interpret emotional intelligence as the abilities which help to express and manage emotions during social interactions. The Mayer-Salovey-Caruso model (2000) is multifold because emotional intelligence is perceived as the totality of components and abilities. The perception, assessment and expression of emotions are described as processes whereas the control of emotions is the most important of the processes (Mayer et al., 2000).

The earlier research carried out by Malinauskas and Malinauskienė (2004) suggests that the continuous professional development of would-be sports educators (in our case Lithuanian and Latvian student athletes) is becoming an increasingly more significant factor determining successful development of the entire educational system, whereas emotional intelligence now plays a critically important role in the professional life of would-be sports educators. The earlier research reveals that the would-be sports educators who are female are more empathic than their male counterparts (Malinauskas & Malinauskienė, 2004). However, this problematic area has not been sufficiently researched on the intercultural level and the emotional intelligence manifested by Lithuanian and Latvian student athletes has not been thoroughly revealed because the research was limited to observation of Lithuanian and Latvian school students during their physical education classes (Akelaitis & Malinauskas, 2013).

Hence, the following *research question* is raised: does the emotional intelligence of Lithuanian student athletes differ from that of Latvian student athletes?

Scientific novelty: the present research will provide the first thorough analysis of the components of the emotional intelligence of Lithuanian and Latvian student athletes.

The object of the research is the emotional intelligence of Lithuanian and Latvian student athletes.

The aim of the research is to reveal the manifestation of emotional intelligence in Lithuanian and Latvian student athletes.

Hypothesis of the research: we hypothesize that the emotional intelligence of Lithuanian student athletes differs from that of Latvian student athletes.

METHODS

Instruments: data collection and analysis. Schutte Self-Report Inventory (SSRI) was employed. This instrument is extremely beneficial in the way that it divides emotional intelligence into four separate components (Palmer, 2003), namely: ability to use personal positive emotional experience (optimism), ability to assess and express emotions (appraisal), ability to understand and analyse emotions (social skills) and ability to manage emotions (utilization). The questionnaire was designed to facilitate the measurement of the respondents' ability to identify, understand, utilize and independently manage emotions in both themselves and others (Schutte et al., 1998; Schutte & Malouff, 1999).

The internal consistency of the questionnaire employed in the research was measured with Cronbach's alpha. The value of the Cronbach's alpha coefficient for the research sample was .76. The statistical hypotheses were tested with Student's t-test because the data followed normal distribution. The Lithuanian version of the *SSRI* shows internal consistency value .79 and a test-retest reliability coefficient of .84 for the overall questionnaire (Malinauskas & Šniras, 2010). The Latvian version of the *SSRI* shows internal consistency value .78 (Akelaitis & Malinauskas, 2013).

Sample and procedure. The research was carried out during the 2013/2014 academic year. The independent random sample consisted of 227 student athletes from the Latvian Academy of Sports Education and 214 student athletes from the Lithuanian Sports University. The respondents were distributed from the 1st to the 4th academic year and all were studying in the bachelor degree program of physical education. The gender distribution in the research sample was as follows: 299 respondents were male and 142 respondents were female.

A two-level sampling strategy was applied. First of all, the groups of students were selected from random tables, and then all the students from the selected groups were researched. The research covered all the students from the 1st to the 4th academic year who were enrolled in the study programs titled Sport Coaching and Physical Education. The survey was conducted in compliance with the ethical principles and applicable legislation, i. e. each respondent was explained the goal of the study and was ensured that the questionnaires were anonymous. The survey was conducted during the internship practice of Education Studies. The duration of the survey was 20 minutes.

RESULTS

The gender issue was not taken into consideration in the present research because the

major goal was to reveal intercultural differences between the Lithuanian and Latvian student athletes in terms of emotional intelligence. The research started from the analysis of the ability of the Lithuanian and Latvian student athletes to use personal positive emotional experience (optimism). The analysis of the ability to use personal positive emotional experience resulted in the following mean scores: 51.48 ± 5.24 for Lithuanian student athletes and 52.78 ± 6.33 for Latvian student athletes (Figure 1).

The application of the Student's t test revealed a statistically significant difference in the ability of the Lithuanian student athletes to use their own positive emotional experience and that of the Latvian student athletes: $t(439) = 2.32$; $p < .05$.

Having recalculated the indicator averages into points, it was determined that, with an exception of the ability of Lithuanian and Latvian student athletes to understand and analyse emotions

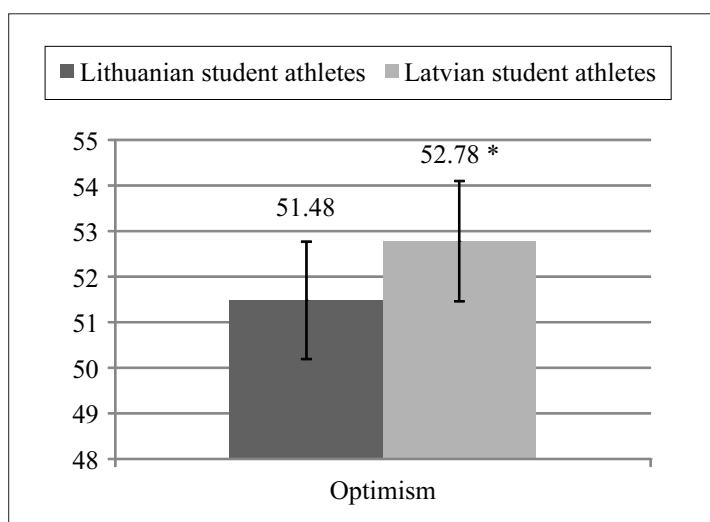


Figure 1. Mean scores of the ability of the Lithuanian and Latvian student athletes to use personal positive emotional experience (optimism)

Note. * – $p < .05$ – there is a statistically significant difference between the results of Lithuanian and Latvian student athletes.

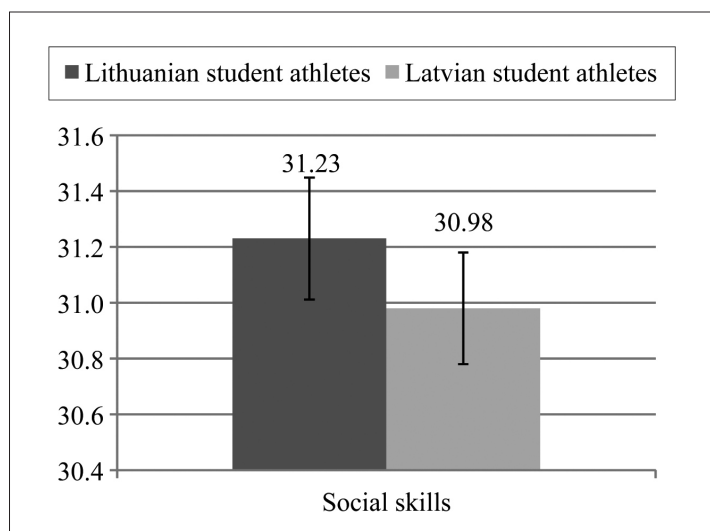


Figure 2. Mean scores of the ability of the Lithuanian and Latvian student athletes to understand and analyse emotions (social skills)

Note. $p > .05$.

Table. The statistical indicators of the abilities of emotional intelligence among Lithuanian and Latvian student athletes (M ± SD)

Abilities of emotional intelligence	Lithuanian student athletes (n = 214)	Latvian student athletes (n = 227)	t; p
Ability to assess and express emotions (appraisal)	21.81 ± 2.85	21.55 ± 3.31	-0.87 p > .05
Ability to manage emotions (utilization)	16.14 ± 2.70	16.42 ± 3.19	1.00
			p > .05

Note. M = mean; SD = standard deviation.

(social skills), there was no statistically significant difference between the Lithuanian and the Latvian student athletes ($t(439) = -0.61$; $p > .05$; Figure 2).

The research also addressed the ability of Lithuanian and Latvian student athletes to assess and express emotions (appraisal of emotions). It was determined that the Lithuanian and Latvian student athletes were similar in terms of the ability to assess and express their emotions (Table).

The research results revealed that there were no significant differences between the Lithuanian and Latvian student athletes in terms of their ability to assess and express emotions (utilization) ($t(439) = -0.87$; $p > .05$). The data set out in Table shows that the Lithuanian and Latvian student athletes are not different in terms of the ability to manage their emotions ($t(439) = 1.00$; $p > .05$).

DISCUSSION

The carried out research helped assess the intensity of the components of emotional intelligence in the Lithuanian and Latvian student athletes. The reliability of the data of this research can be validated both by the results announced by Gaitniece-Putāne (2008) and by the results obtained from our Latvian sample because Gaitniece-Putāne (2008) obtained similar results when researching her Latvian respondents of the same age.

The results of this research also do not contradict with the results obtained in the earlier research involving Lithuanian and Latvian school students because the higher education students were different only in terms of a single component of emotional intelligence, whereas the school students did not differ at all. The results of this research also compliment other studies claiming that intercultural differences in the Eastern European countries in terms of abilities (components) of emotional intelligence are insignificant (Bakacsi, Takacs, Karacsonvi, & Imrek, 2002) because all these countries belong to a single cluster.

However, all previous researchers of emotional intelligence worked with managers rather than student athletes. The results of the present study revealed that intercultural differences did influence one of the abilities of emotional intelligence, i. e. the ability to use personal positive emotional experience (optimism). The fact that the Latvian student athletes demonstrated better ability to use personal positive emotional experience (optimism) may be explained by the Winter Olympic Games prior to which the present research was conducted and during which Latvian athletes achieved better results. Moreover, more Latvian student athletes participated in the Winter Olympic Games in Sochi.

Our study was focused on the student athletes, i. e. would-be sports educators, whereas Murphy (2006) researched the students majoring in social science, management and technical subjects. We found out that the Latvian student athletes demonstrated better ability to use personal positive emotional experience (optimism), whereas Murphy (2006) did not look for intercultural differences but determined that the female respondents had better ability to understand and analyse emotions than the male respondents in that particular research. Since we did not compare our research results in terms of gender, we believe that such analysis could be carried out in future studies.

Summing up, it may be stated that the research methods employed in the study carried out with the Lithuanian and Latvian student athletes could also be efficiently used to research the students from the same countries who are enrolled in different study programs. It would be useful to continue the study in this particular field by focusing on the differences of emotional intelligence in terms of different gender and different age (different year of study). The study could be further developed by looking for differences between Lithuanian and Latvian student athletes and graduate student athletes working as physical education and sports specialists in terms of their emotional intelligence.

CONCLUSION

The comparison of the components of emotional intelligence of Lithuanian and Latvian student athletes revealed that Latvian student athletes had

better ability to use personal positive emotional experience (optimism) ($p < .05$). No other significant difference between Lithuanian and Latvian student athletes in terms of the components of emotional intelligence was observed.

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THE RELATION BETWEEN THE SOCIOCULTURAL ATTITUDES TOWARDS APPEARANCE AND THE LIFESTYLE AND SELF-ESTEEM OF ADOLESCENTS

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ABSTRACT

Background. The adolescents seeking to conform to the ideal appearance associate the reduction of weight with smoking and alcohol consumption (Haley, Hedberg, & Leman, 2010) or go on a diet instead of increasing their physical activity (Liechty, 2010). The adolescents dissatisfied with their body have lower self-esteem (Neumark-Sztainer et al., 2006). In this study we assumed that the sociocultural attitudes towards appearance would be associated with adolescents' harmful lifestyle and lower self-esteem. Research aim was to disclose the relation between the sociocultural attitudes towards appearance of adolescents and their lifestyle and self-esteem.

Methods. The research was carried out in Kaunas schools ($n = 16$) using the method of written survey. In total, 805 adolescents were surveyed, 329 (41.1%) out of them were boys. The mean age (SD) of the respondents was 17.23 (0.6) years. *Instruments:* Sociocultural Attitudes Towards Appearance Questionnaire-3 SATAQ-3-L (Thompson, van den Berg, Roehrig, Guarda, & Heinberg, 2004), Rosenberg Self-Esteem Questionnaire (Rosenberg, 1989). Physical activity (PA) was determined using the questions from the international study Health Behaviour in School-Aged Children. The frequency of dieting and having harmful habits were determined by individual questions.

Results. The weight of the majority of adolescents (75.5%) was normal. The numbers of adolescents were as follows: those who smoked (39.8%), consumed alcohol (80.5%), were on diet (36.8%), and had low levels of physical activity (74.4%). The adolescents who smoked, consumed alcohol and were on diet had significantly higher scores in all SATAQ subscales. Physically active adolescents were more striving to meet the Internalization of athletic body image. In the groups of boys and girls, BMI was related to more frequent sociocultural pressures ($p < .01$) and more frequent dieting ($p < .01$). In the group of boys, the frequency of smoking was related to lower self-esteem ($p < .05$). In the group of girls, sociocultural pressures were related to lower self-esteem ($p < .05$).

Conclusion. The sociocultural attitudes towards appearance of adolescents are related to more harmful lifestyle and lower self-esteem. Therefore, health literacy of the adolescents has to be increased by teaching proper attitudes towards their bodies, appropriate diet, and exercising.

Keywords: sociocultural attitudes towards appearance, body image, lifestyle, physical activity, self-esteem.

INTRODUCTION

With the prevalence of cult of the body in the Western society, more and more adolescents feel pressure to conform to social expectations. The majority of studies state that girls experience more pressure to conform to the socially idolized appearance; however, many studies confirm that the sociocultural environment also has an effect on boys (Bearman et al., 2006). The adolescents striving to conform to the ideal

appearance associate the reduction of weight with smoking and alcohol consumption (Haley et al., 2010) or go on a diet instead of increasing their physical activity (Liechty, 2010). The adolescents dissatisfied with their body have lower self-esteem (Neumark-Sztainer et al., 2006).

Young people often start using addictive substances to fit in with their friends who behave this way and due to the inability to resist negative

influence of others (Jaruševičienė, Valius, Veryga, & Žemaitis, 2009). According to the data of the international study Health Behaviour in School-Aged Children (HBSC) aged 11–15, in the survey of 2010, 21.2% of the boys and 15.0% of the girls admitted they were smoking. In the study, the adolescents smoking every day, at least once per week and less than once per week are attributed to smokers. Among the children aged 11–15 who participated in the HBSC study in 2010, approximately every tenth respondent admitted they were consuming alcoholic beverages on a regular basis (12.9% of the boys and 8.1% of the girls). This is a considerably higher age than ten or more years ago (Currie et al., 2012).

According to the data of the studies, the peers may have an effect on the development of attitude towards the body, especially in the adolescence. It was noticed that the mockery of peers was related to dissatisfaction with the body and dieting (Shroff & Thompson, 2006). Although both the boys and the girls mock each other, the boys tend to criticise the weight and shape of girls more than the girls do. When the body weight of the girls increases during puberty, they take on the means of weight loss because they feel increasing sociocultural pressures. Meanwhile the boys aspire for a muscular and strong body and take measures to gain body weight (Bearman, Martinez, Stice, & Presnell, 2006).

During adolescence, physical activity is an important factor of good health. However, dissatisfaction with the body may prevent from engaging in physical activity. In Lithuania, in 1994–2010, on the average, every second boy (45.2%) and only every fifth girl (20.2%) could have been considered having a sufficient level of physical activity. Regardless of such low indicators of physical activity of school-aged children, the proportion of physically active boys has been gradually decreasing since 1998, and the proportion of physically active girls has also decreased in 2010 (Zaborskis & Raskilas, 2011).

The insults of peers, hurting remarks and bullying affect self-esteem of the adolescents (Zaborskis & Vareikienė, 2008), which may later have negative repercussions on their mental and physical health. There is a lack of studies analysing the relation between the social and cultural environment and the peculiarities of adolescents' lifestyle and self-esteem in the country. These studies are useful for the practitioners engaged in health promotion in the schools of the country.

Research aim was to disclose the relation between the sociocultural attitudes towards appearance of adolescents and their lifestyle and self-esteem. We hypothesize that the sociocultural attitudes towards appearance would be associated with adolescents' harmful lifestyle and lower self-esteem.

METHODS

The research was carried out in 2009 in Kaunas secondary schools ($n = 10$) and gymnasiums ($n = 6$) using the method of written survey. In total, 805 adolescents were surveyed, 329 (41.1%) out of them were boys and 476 (59.1%) were girls. The age of the respondents was between 16 and 19, the mean age (SD) was 17.23 (0.6) years.

Out of the general list of schools of Kaunas city, which included 39 secondary schools and 9 gymnasiums in 2009, every third school was selected using systematic random sampling. In every selected school, two-three classes of eleventh-year students were surveyed. The permit of the Department of Education of Kaunas City Municipality Administration was obtained for the research. The heads of the schools had given vernal consent to carry out the research in their schools. The research was based on the principles of goodwill and anonymity. The students who did not want to participate in the research could refuse to do so. The questionnaires were filled in during lessons at the presence of the researcher. It took approximately 30 minutes to fill in the questionnaire, but the students could take the whole lesson to do it. In total, 856 adolescents were questioned, but after analysing the responses, it was found that 51 questionnaires were spoiled and/or filled in carelessly and therefore, the data of 805 adolescents was used for the research.

A questionnaire comprising several blocks of questions was used for the survey. The Sociocultural Attitudes Towards Appearance Questionnaire-3 (SATAQ-3-L) was used (Thompson et al., 2004). The questionnaire comprised four subscales: The Subscale of General-Internalization (e. g. "I would like my body to look like the one of the people who are in movies"), The Subscale of Athletic-Internalization (e. g. "I wish I looked as athletic as sports stars"), The Pressures Subscale (e. g. "I've felt pressure from TV or magazines to change my appearance"), The Subscale of Information (e. g. "TV programs are an important source of information about fashion and "being attractive").

The responses to the questions were arranged on the Likert scale from “completely disagree” (1 point) to “completely agree” (5 points). The mean score was calculated on each subscale. A higher score indicated a higher expression of the variable. The General-Internalization, Athletic-Internalization, Pressures and Information subscales showed good internal consistency reliability (Cronbach’s alpha = .70, Cronbach’s alpha = .68, Cronbach’s alpha = .77 and Cronbach’s alpha = .68, respectively).

Self-esteem was determined using the Rosenberg’s Self-Esteem Scale (Rosenberg, 1989), which is comprised of a scale of 10 statements with 4 versions of responses from “completely agree” (4) to “completely disagree” (1). A higher score represented higher self-esteem. The respondents who scored from 0 to 28 were attributed to the group of low self-esteem. The Lithuanian version of the questionnaire is used in the Health Behaviour in School-Aged Children study coordinated by WHO (Currie, Samdal, Boyce, & Smith, 2002). Cronbach’s alpha = 0.75.

Physical activity (PA) was determined using the questions from international study Health Behaviour in School-Aged Children coordinated by WHO: “Over the past 7 days, how many days were you physically active for a total of at least 60 minutes per day?” and “In an ordinary week, how many days on average are you physically active for a total of at least 60 minutes?” with versions of responses on the scale from “none” to “seven days per week”. Physical activity was considered sufficient if the respondents were active for at least one hour for five or more days per week (Petronytė & Zaborskis, 2009).

The frequency of dieting was determined by the question “Have you ever tried to lose weight by fasting/going on extremely strict diets?” with variants of responses from “never” (1) to “very often” (5). The respondents who scored 1–3 points were attributed to the group of adolescents who did not diet and the ones who scored 4–5 points were attributed to the group of adolescents who dieted.

Harmful habits were determined by questions about smoking, alcohol and drug use and its frequency from the international study Health Behaviour in School-Aged Children coordinated by WHO (Zaborskis & Vareikienė, 2008), for instance, “Have you consumed alcoholic beverages in the last 3 months?” with the variants of responses from “never” to “every day”. The respondents who admitted having consumed any of the following

alcoholic beverages were attributed to the group of adolescents who consumed alcohol: beer, wine, vodka and other beverages several times per week or more often. We determined the habit of smoking by the question: “How many cigarettes do you smoke in a day?” with ten versions of responses from “I do not smoke” to “3–4 packs a day”. The respondents who smoked every day, several times per week or less were attributed to the group of smokers.

Body mass index (BMI) was calculated based on the height and weight specified by the respondents. The respondents were divided into three groups based on the recommendations of WHO (Flegal, Graubard, Williamson, & Gail, 2005). The respondents with BMI below 18.5 kg/m² were considered to be underweight and the ones with BMI equal to or exceeding 25 kg/m² were considered to be overweight.

Statistical data analysis was carried out using a software package *SPSS 20.0 for Windows*. To identify the differences between values in two independent groups, Mann-Whitney U Test was used. To determine the correlation between the variables, Spearman’s rank correlation coefficient was used. The statistical relation between qualitative features was evaluated by χ^2 (chi-square) criterion. To analyse the dependence of dependent variables on independent variables logistic regression was performed and the confidence interval (CI) was calculated. The results were considered to be significant if 1 was not in the confidence interval. The differences of results were considered to be statistically significant, if the value of error probability was $p < .05$ with the confidence of 95%.

RESULTS

The body mass of the majority of adolescents (75.5%) was normal. 136 adolescents (17.5%) were underweight and 54 adolescents (7%) had too high BMI (equal to or exceeding 25 kg/m²). BMI of 81% of the boys was normal, 11.1% were overweight and only 7.9% of the boys had too low BMI. 71.7% of the girls had normal weight, 24.1% were underweight and only 4.1% of the girls had too high BMI.

Comparing the intensity of expression of harmful habits (smoking, alcohol consumption, dieting) and insufficient level of physical activity in the groups of boys and girls (Table 1), we found that dieting and insufficient level of physical activity were more prevalent among girls.

In the research, we analysed how the sociocultural attitudes towards appearance were expressed in the groups of harmful habits and physical activity (Table 2). Mann-Whitney U test demonstrated that the adolescents who smoked and consumed alcohol more often felt sociocultural pressures. The adolescents consuming alcohol expressed higher general internalization of sociocultural attitudes, sociocultural pressures and they were more susceptible to information than the adolescents who refrained from alcohol. In these subscales, dieting adolescents also had significantly higher general internalization of sociocultural attitudes. However, the adolescents with sufficient level of physical activity had considerably higher internalization of athletic body image.

Research variables	Total n (%)	Boys n (%)	Girls n (%)	Significance
Smokes	320 (39.8)	141 (44.3)	177 (55.7)	$\chi^2 = 2.253; df = 1; p = .133$
Consumes alcohol	647 (80.5)	267 (41.5)	377 (58.5)	$\chi^2 = 0.288; df = 1; p = .591$
Diets	294 (36.8)	55 (18.8)	237 (81.2)	$\chi^2 = 92.337; df = 1; p = .001$
PA (insufficient, if up to 5 d./week)	563 (74.4)	215 (38.4)	345 (61.6)	$\chi^2 = 6.308; df = 1; p = .012$

Table 1. The expression of harmful habits and insufficient level of physical activity in the total sample and in the groups of boys and girls, %

Note. PA – physical activity.

Table 2. The expression of the sociocultural attitudes towards appearance in the groups of harmful habits and physical activity

Research variables	General-Internalization	Athletic-Internalization	Pressures	Information
	M		M	M
Smokes	2.69	2.82	2.37	2.73
Does not smoke	2.67	2.79	2.24	2.67
	$U = 71409; p = .810$	$U = 69469; p = .422$	$U = 68282; p = .047$	$U = 71213; p = .294$
Consumes alcohol	2.71	2.82	2.32	2.73
Does not consume alcohol	2.51	2.74	2.19	2.58
	$U = 40617; p = .02$	$U = 44796; p = .287$	$U = 44402; p = .05$	$U = 43342; p = .028$
Diets	3.10	3.00	2.67	2.94
Does not diet	2.43	2.68	2.06	2.55
	$U = 40898; p = .001$	$U = 54850; p = .001$	$U = 41183; p = .001$	$U = 49660; p = .001$
Insufficient level of PA	2.73	2.74	2.34	2.72
Sufficient level of PA	2.51	2.97	2.15	2.63
	$U = 42962; p = .004$	$U = 42666; p = .002$	$U = 44382; p = .004$	$U = 48518; p = .14$

Note. PA – physical activity.

Table 3. Correlation (Spearman's coefficients) among sociocultural attitudes towards appearance, harmful habits, physical activity and self-esteem in the groups of boys and girls

Research variables	1	2	3	4	5	6	7	8	9	10
1. BMI	1	0.13**	.15**	.18**	.06	.09	.04	.40**	-.02	-.02
2 General-Internalization	.04	1	.54**	.58**	.52**	.09	-.01	.37**	-.03	-.03
3. Athletic-Internalization	-.02	.57**	1	.46**	.47**	.06	.002	.29**	.03	.05
4. Pressures	.20**	.53**	.39**	1	.47**	.10*	.03	.37**	-.08	-.10*
5. Information	.02	.56**	.44**	.41**	1	.07	.01	.29**	.06	-.04
6. Frequency of alcohol consumption	.11	.02	-.06	.04	.02	1	.28**	.18**	-.08	-.11*
7. Frequency of smoking	.06	.07	.06	.15**	.06	.35**	1	.04	-.01	-.08
8. Dieting	.32**	.18**	.11	.22	.10	.001	.11*	1	.03	-.11*
9. PA	.04	.01	.13*	.002	.02	-.04	-.05	-.05	1	.07
1. Self-esteem	.04	-.004	.09	-.04	-.04	-.02	-.11*	-.07	.08	1

Note. PA – physical activity, BMI – body mass index. The data of the girls is presented over the diagonal and the data of the boys – below the diagonal. * – $p < .05$, ** – $p < .01$.

The correlation analysis in the group of boys revealed (Table 3) that BMI was related to more frequent sociocultural pressures and dieting. The general internalization of sociocultural attitudes was related to all subscales of sociocultural attitudes towards appearance well as dieting. The internalization of athletic body image was related to the sociocultural pressures, information, and more frequent smoking. The frequency of alcohol consumption increased the frequency of smoking. The frequency of smoking was related to dieting and lower self-esteem.

Having performed linear correlation in the group of girls, we found (Table 3) that BMI was related to the general internalization of sociocultural attitudes, internalization of athletic body image, sociocultural pressures, and more frequent dieting. General internalization of sociocultural attitudes was related to all subscales of sociocultural attitudes towards appearance as well as dieting. The internalization of athletic body image was related to more frequent sociocultural pressures, information, and physical activity. The sociocultural pressures were related to the information, more frequent consumption of alcohol, dieting, and lower self-esteem. The information was related to more frequent dieting. Alcohol consumption was related to more frequent smoking, dieting, and lower self-esteem. Dieting had negative correlation with self-esteem. As dieting gets more frequent, self-esteem gets poorer.

In order to determine what complex of factors explained the frequency of smoking, alcohol consumption, physical activity, and dieting, we performed logistic regression. The frequency of smoking was statistically significantly prognosticated by BMI $GS = 1.08$; $CI = [1.02-1.15]$. For this model, $\chi^2 = 22.46$; $df = 8$; $p = .004$ (*Nagerkelke* $R^2 = .018$). Sociocultural attitudes towards appearance statistically significantly prognosticated the consumption of alcohol $GS = 1.38$; $CI = [1.04-1.85]$. For the model, $\chi^2 = 10.08$; $df = 8$; $p = .26$ (*Nagerkelke* $R^2 = .02$). Physical activity was statistically significantly prognosticated by self-esteem $GS = 1.09$; $CI = [1.04-1.13]$. For the model, $\chi^2 = 2.42$; $df = 8$; $p = .97$ (*Nagerkelke* $R^2 = .05$). Dieting was also statistically significantly prognosticated by BMI $GS = 1.39$; $CI = [1.28-1.52]$. And sociocultural attitudes towards appearance tripled the frequency of dieting $GS = 3.19$; $CI = [2.36-4.32]$. For this model, $\chi^2 = 8.76$; $df = 8$; $p = .36$ (*Nagerkelke* $R^2 = .39$).

DISCUSSION

The research attempted to disclose the relation between the sociocultural attitudes towards appearance of adolescents and their lifestyle and self-esteem. The research revealed that smoking and alcohol consumption of the adolescents was related to more frequent sociocultural pressures. Alcohol consumption was related to more frequent general internalization of sociocultural attitudes and the information. The authors claim that young people often start using addictive substances to fit in with their friends who behave this way and due to the inability to resist negative influence of others (Jaruševičienė et al., 2009). Other authors believe that the adolescents striving to conform to the ideal appearance may associate the reduction of weight with smoking and alcohol consumption (Haley et al., 2010).

In the research, dieting adolescents aspired to conform to the sociocultural attitudes towards appearance. In the group of girls, significant correlation between dieting and all four scales of sociocultural attitudes towards appearance was found. In the group of boys, dieting only correlated with the general internalization of sociocultural attitudes. The obtained results indicate that the girls seeking recognition among the peers and striving to conform to the ideal body created by society exhaust themselves by dieting and incorrect exercise (Jankauskienė, Pajaujienė, & Mickūnienė, 2010; Pajaujienė, Jankauskienė, & Mickūnienė, 2010).

The adolescents with insufficient level of physical activity more often are prone to general internalization of sociocultural attitudes and more often feel pressure about it. In our research, internalization of athletic body image was related to higher physical activity. Other studies also revealed that the dissatisfaction of the adolescents with their bodies was not related to exercising to control weight (Liechty, 2010), which allows concluding that the adolescents who are dissatisfied with their bodies more often go on a diet than increase their physical activity.

We expected that lower self-esteem of the adolescents would be related to higher sociocultural attitudes towards appearance. In the group of girls, significant correlation between self-esteem and sociocultural pressures was found. In the group of boys, we did not find significant correlation between self-esteem and all four scales of the sociocultural attitudes towards appearance. The obtained results were confirmed by other authors (Pokrajac-Bulian, Ambrosi-Randic, & Kukic, 2008).

The limitation of the research is that it is momentary. Such studies have both pros and cons. It allows evaluating the prevalence of risk factors, but does not allow determining the causality. Further research observing the change of the relation of sociocultural attitudes towards appearance and lifestyle and self-esteem of the adolescents over time would be beneficial.

CONCLUSIONS

The sociocultural attitudes towards appearance of adolescents are related to more harmful lifestyle and lower self-esteem. Therefore, health literacy of the adolescents has to be increased by teaching proper attitudes towards their bodies, appropriate diet, and exercising.

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EXPLAINING THE RELATIONSHIP BETWEEN AUTONOMY SUPPORT AND MOTIVATIONAL PROCESS OF HEALTH BEHAVIOR IN PATIENTS WITH DIABETES FROM SELF-DETERMINATION THEORY PERSPECTIVE: LITERATURE REVIEW

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ABSTRACT

Background. The aim of this study is to provide an overview of the research examining the relationships between contextual factor – autonomy support – and motivational process to control diabetes using self-determination theory as a guiding framework.

Methods. Overview of published literature of applying SDT examining motivation and behavior in patients with diabetes was performed. *Sage*, *Medline* and *Google Scholar* data basis were searched using “autonomy support and diabetes” and “self-determination and diabetes” words combinations. Literature review included cross-sectional, longitudinal research and experimental studies.

Results. Research shows that autonomy support directly affects autonomous motivation, competence and patient satisfaction. Through the mediators in the behavior motivation model - autonomy and competence – autonomy support is associated with diabetes related behavior, physiological and psychological outcomes.

Conclusions. It may be concluded that interrelationship between contextual social (relationship with health care specialists), inner psychological (motivation) and physiological (glycemic index) factors is crucial considering the content of educational programs of diabetes care. So, minimization of long-term diabetes complications, enhanced psychological health and quality of life could be expected if health professionals provide autonomy support for their diabetes patients.

Keywords: autonomous motivation, perceived competence, health-behavior.

INTRODUCTION

Health related behavior is the issue of concern for individuals who struggle to manage their diabetes, scientists, health care professionals and educators as more than a half of diabetes patients have treatment non-compliance problems (Rubin & Peyrot, 2001). This may lead to disturbed glycemic control which in turn is the strongest risk factor for developing microvascular complications, diabetic retinopathy, nephropathy and neuropathy, which, if undetected or left untreated, can lower the quality of life (Girach,

Manner, & Porta, 2006). Research shows that behavioral variables as healthy eating, medication adherence and physical activity are very important for diabetes related health outcomes such as lipid ratio, hemoglobin A1C, body mass index, self-reported general health for diabetes patients (King et al., 2010). Prescription of behavior in case of diabetes usually includes blood glucose testing, insulin taking, diet with minimum sugar and fat as well as regular physical exercise. Moreover, these goals set by professionals might not be entirely

internalized by their patients. Also it should be considered that treatment compliance is not consistent across behaviors, normally prescribed in case of diabetes (Coyle, Francis, & Chapman, 2013). For example, type 1 and type 2 diabetes patients have better compliance to medication and insulin administration, they also tend to attend clinic appointments regularly, however, patients suffer lack of compliance for healthy diet and exercise behavior (Soryte & Bulotaite, 2013).

Understanding the context explaining why some patients do engage in health related behavior, necessary to manage their condition, while others do not, is important for designing educational interventions which would target true causal mechanisms of behavior change and enhance health (Texeira et al., 2006; Butterworth, 2008). More specific question is what active components of educational intervention can be adapted in primary care. Literature review indicated that neither socio-demographic characteristics nor aspects of personality predicted treatment adherence, except the relatively uncommon states such as mental illness and temporary periods of stressful life events (e. g. recent divorce, loss of job (Schechter & Walker, 2002). So, other factors which would help identify target intervention groups and goals to be achieved should be examined.

After reviewing intervention programs for diabetes patients, authors concluded that in order to achieve better health-related outcomes, more than knowledge is needed (Norris, Engelgau, & Narayan, 2001). Since most of health-related behaviors such as physical activity, healthy diet and, in case of patients, medication use, are not enjoyable and self-motivated, so the quality of motivation seems to be the key element in behavior change efforts (Butterworth, 2008). Consequently, in case there is low motivation, enhancement it from outside becomes crucial. Research shows that communication with health care practitioners is related to better self-management behavior (Heisler, Bouknight, Hayward, Smith, & Kerr, 2002) and it could be expected that the patient-practitioner relationship is the valuable source of motivation enhancement for behavior change as practitioners have both expertise and authority in the field (Ryan, Patrick, Deci, & Williams, 2008). Evidence suggests that Self-determination theory (SDT) is a viable conceptual framework to study antecedents and outcomes of motivation for health-related behaviors (Ng et al., 2012) as the theory includes perceived support as patient-practitioner

relationship outcome which is an important contextual factor of health behavior.

Self-determination theory. Self-determination theory (SDT) is widely used as a framework in various fields to understand behavior. It is applied in education (Jõesaar, Hein, & Hagger, 2012), organization (Fernet, Austin, Trépanier, & Dussault, 2013), sport and exercise (Texeira, Carça, Markland, Silva, & Ryan, 2012) and health care (Chan, Lonsdale, Ho, Yung, & Chan, 2009; Kusrkar, Croiset, Kruitwagen, & Cate, 2011).

SDT posits that all humans have an innate tendency towards growth and well-being regardless of race, gender, culture (Deci & Ryan, 2000) and health/disease status (Fortier, Sweet, Tulloch, Pipe, & Reid, 2012). SDT provides framework presenting not only motivation itself, but also process of motivation explaining health-related behavior. Theory distinguishes three main types of motivation and five types of behavior regulation which lay in the continuum from the least to the most self-determined. The least favorable for health is *amotivation*. Amotivated patients do not even bother to initiate health behavior. So, behavior regulation does not exist. They may think, for example, that it just a waste of time and not a valuable thing. So, in case of amotivation, there is no behavior regulation at all. Further, *controlled motivation* implies two types of behavior regulation. One of the controlled forms of motivation is *external regulation*, when behavior is performed under environmental pressures such as rewards, “musts” and “shoulds” or guilt for not doing. Patients follow their treatment recommendations because doctor, parents or spouse (significant others) would be angry or disappointed if they did not. Health care practitioners often trigger this type of behavior regulation by initiating patients’ behavior change on the grounds of their authority. The other form of controlled motivation is *introjection* when a person behaves seeking acceptance, praise, or trying to avoid rejection, shame or guilt. This kind of behavior regulation covers more self-determined factors than in the case of external regulation, but is still initiated by environmental pressures. Both types of controlled behavior regulation are not related to long-term maintenance of health-related behavior (Ryan et al., 2008). Inwardly triggered or supported *autonomous motivation* implies self-initiated behavior. One of the three types of autonomous behavior regulation is *identified regulation*. The behavior is important to patients and integrated into their value system.

They may be involved in health behavior because they personally appreciate and understand the importance of behavior to remain healthy for a long time. Identified behavior regulation is enhanced by practitioners when they provide adequate treatment-related information, encourage genuine interest and personal meaning but do not control and do not make pressure to behave in a certain way. Further in the continuum lies *integrated regulation*. In this case, persons not only appreciate health-related behavior, but such behavior is consistent with their other values and lifestyle. Health practitioners encourage the integration supporting the patients when they face barriers in changing behavior, providing patterns of behavior and helping to make the informed choice (Ryan et al., 2008). Finally, intrinsic behavior regulation assumes free active engagement in behavior, which not necessarily has to be rewarded. The main condition intrinsically driven behavior be maintained is the satisfaction of basic human needs: autonomy, competence and relatedness (Deci & Ryan, 2000). When social environment supports these needs, the behavior is initiated voluntarily and consistently maintained (Julien, Sénécal, & Guay, 2009).

On the other hand, SDT posits that motivation is a process where behavior regulation could change in the controlled – autonomous motivation continuum (Ryan & Deci, 2000). The most important factors contributing to the behavior regulation change is an expertise and autonomy support provided by health care practitioners (Ryan et al., 2008), which are probably ignored by a team of health professionals. Some patients are self-determined and adherent to treatment regimen, still most patients require assistance with motivation from their practitioners (Butterworth, 2008). Autonomy support is an important contextual patient-practitioner relationship factor, which, if is patient-centered, supports main human needs: autonomy, competence and relatedness, and enhance autonomous motivation for health related behavior (Williams, Frankel, Campbell, & Deci, 2000). The main goal of autonomy support is to encourage sincere interest for behavior and provide meaning to that behavior (Teixeira, Silva, Mata, Palmeira, & Markland, 2012). Autonomy support helps patient to make an informed choice (Williams, McGregor, Zeldman, Freedman, & Deci, 2004).

Therefore, reasons for treatment non-compliance are complex and among other motivational factors involve the social aspect – the patient and the health care practitioner interaction.

So, the **aim** of this study is to provide an overview of the research examining the relationship between contextual factor – autonomy support – and motivational process to control diabetes using self-determination theory as a guiding framework.

METHODS

In the present article an overview of published literature of applying SDT examining motivation and behavior in patients with diabetes was performed. *Sage*, *Medline* and *Google Scholar* data basis were searched using “autonomy support and diabetes” and “self-determination and diabetes” word combinations. Literature review included survey research and experimental studies. Among them were cross-sectional and longitudinal studies.

RESULTS

Research on SDT in diabetes shows that autonomy support is a prominent contextual variable in the chain of motivation – behavior – outcomes. Correlational analysis usually reveals an association of autonomy support with the main health behavior outcome in diabetes – glycemic index HbA1c (Williams, Freedman, Deci, 1998; Williams, King, Nelson, Glasgow, 2005; Williams, Lynch, Glasgow, 2007). However, direct relationship using higher level of statistical analysis, as a rule, failed to be confirmed (Williams et al., 1998). According to theory, autonomy support is not supposed to predict either behavior or behavioral outcomes directly, rather through mediator variables – autonomy and competence (Ryan et al., 2008). For example, an early study by Williams and colleagues (1998) confirmed that autonomy support did significantly predict reductions in HbA1c in patients with both types of diabetes using hierarchical multiple regression analysis, when only gender and diabetes-relevant clinical variables were included as control variables. Important finding was that both type 1 and type 2 diabetes patients, who experienced their practitioners as more supportive showed lower HbA1c index. Although when autonomy and competence were included in the equation, autonomy support and HbA1c relationship became insignificant. Meanwhile autonomy support enhanced autonomous motivation for diabetes management, which in turn increased perceived competence, and competence was related to reductions in HbA1c (Figure) (Williams et al., 1998).

Every overviewed study, except one (Julien et al., 2009), are in line with the theory and confirm the role of autonomy support as a proximate predictor of autonomous motivation for diabetes management. In regression analysis, perceived autonomy support increased autonomous motivation for diet behavior and the latter accounted for significant change in perceived competence (Figure) (Williams et al., 1998). Results of another study of Williams, Zeldman, Freedman and Deci (2004) indicated that perceived autonomy support from practitioners elevates autonomous motivation for diabetes related health behavior (diet, exercise, glucose testing) from baseline to 6 months. Deeper analysis of indirect relationships in this study revealed that the indirect relationship between perceived autonomy support and change in HbA1c (over a year) was significant, indicating that perceived autonomy support relates to change in HbA1c indirectly through changes in autonomous motivation and perceived competence. These relationships are indicated after the preliminary analysis showed that change in relative HbA1c over the year could not be predicted from the (a) demographic variables, (b) disease variables, and (c) treatment variables (Williams et al., 2004). One of the latest Williams, Patrick, and Niemiec's (2009) studies confirmed

the positive relation of perceived autonomy support to autonomous motivation for medication use, which was further related to perceived competence for diabetes management. Perceived competence then associated with better perceived quality of life and medication adherence and the latter negatively affected non-HDL cholesterol (Figure) in structural equation model examining relations within SDT model of health behavior. Other research indicates the impact of autonomy support on both physical and psychological health. For example, Williams et al. (2005) using SEM analysis established direct relationships of autonomy support to perceived competence and patient satisfaction in type 2 diabetes patients. Indirect negative relationships were found between autonomy support and HbA1c through perceived competence and between autonomy support and depressive symptoms through patient satisfaction (Figure). So, patients who perceive more autonomy support from practitioners develop higher sense of competence which in turn enhances their engagement in treatment and improves mood.

Autonomy support is an important contextual variable in diabetes populations of different age. Moreover, research shows that for adolescent diabetes control autonomy support from multiple

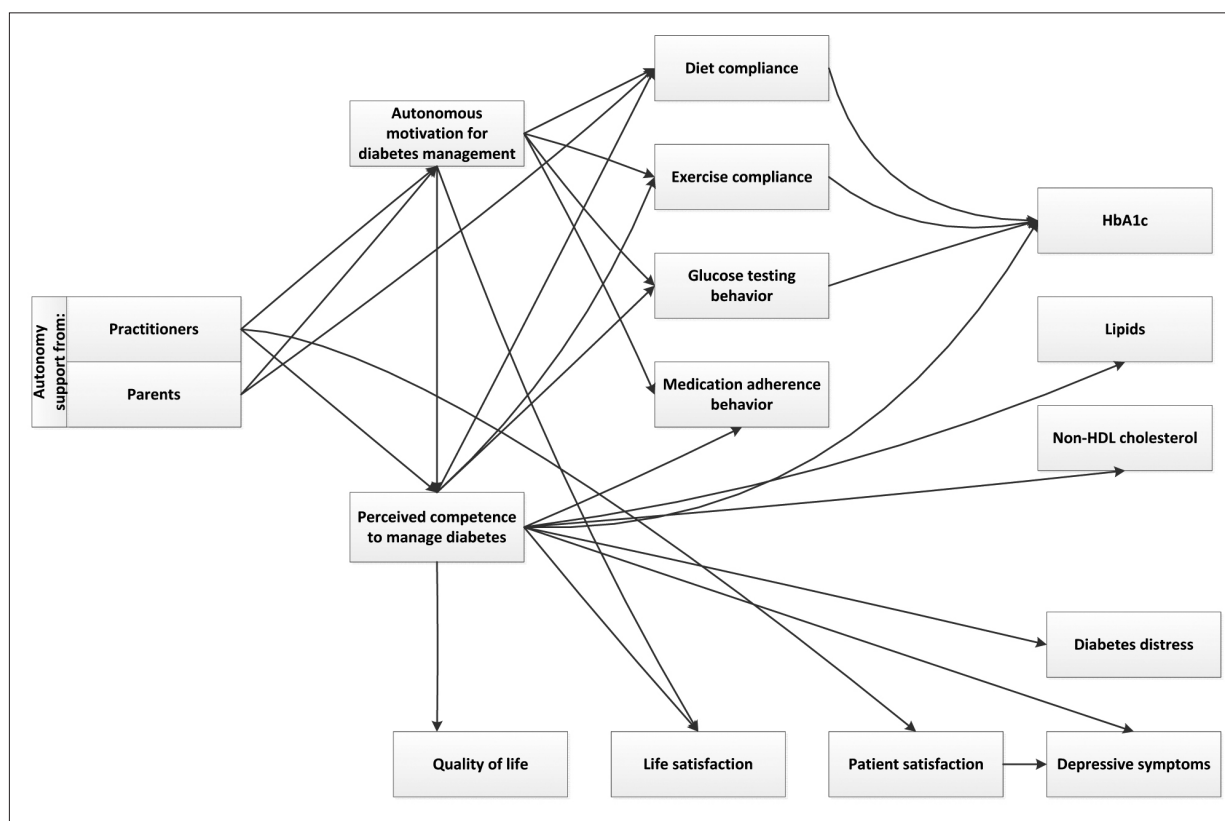


Figure. Model of the relationship between autonomy support and motivational process of health behavior in patients with diabetes from self-determination theory perspective

sources is crucial. In their study with a sample of adolescents with type 1 diabetes Austin, Senecal, Guay and Nouwen (2011) added evidence that autonomy support from both parents and practitioners enhanced adolescent autonomy for diet related behavior (Figure). Autonomy support from practitioners directly affected perceived competence and autonomous motivation, which in turn were related to dietary self-care in structural equation model. Also the more practitioners provide adolescents with choice and information, the more competent they feel about their dietary behavior. Autonomy support from parents was associated with autonomy and also directly related to dietary self-care (Figure). This direct relationship indicates that motivational factors do not fully account for the relationship between parental autonomy support and dietary self-care. The authors propose that autonomy support from parents – diet compliance direct relationship occurs because parents play an active role in meal planning.

However surprisingly in the cross-lagged longitudinal study, autonomy support at baseline was related to neither motivational factors as autonomous motivation, controlled motivation or amotivation nor diet behavior, after one year in type 2 diabetes adults, despite the fact that correlational analysis confirmed these relationships in the expected directions. Though in this study, active planning was reciprocally related to autonomous motivation, in turn, autonomous motivation at baseline was related to diet behavior in one year (Julien et al., 2009). This possibly indicates that including active planning, which already assumes self-determined actions, could diminish the effects of autonomy support on autonomous motivation in the motivation – behavior process model.

Some interventional studies tried to enhance perceived autonomy support and measure its impact on health behavior, health behavior mediators and outcomes in patients with diabetes. The results of these studies suggest that intervention focused on enhancing autonomy support should be planned carefully because not every technique proposed for autonomy support really works. For example, Williams et al. (2004) study shows that neither activation (when patients were helped to read their medical record and encouraged to ask questions and talk about their treatment with their physicians during a 20-minute session before their regularly scheduled visit) nor education (when American Diabetes Association videotape

on diabetes care was played for 20 minutes) as intervention significantly changed perception of autonomy from practitioners. While, as it is mentioned above, perceptions of autonomy for diabetes management behavior and competence were promoted by perceived autonomy support and were the mediators between autonomy support and glycemic control (diet, exercise, glucose testing) (Figure) in structural equation model.

Meanwhile, interactive technologies widely used in health education also could serve as autonomy support providers. A randomized controlled trial involved adults with type 2 diabetes patients. Participants before scheduled visit completed a computerized touch screen assessment and action planning procedure. The program assessed and provided tailored feedback for self-management behaviors, choice of specific activities in the goal area, identified barriers and selected strategies to overcome the barriers. The patient got an individualized action plan, highlighting issues to discuss with the practitioner. Six months later, these procedures were repeated. This patient-centered intervention program which was directed to support patients' autonomy using information technologies demonstrated that higher perception of autonomy support enhanced perceived competence after six months, which in turn was associated with positive change in lipids, reduced diabetes distress and depressive symptoms at twelve months in SEM analysis (Figure) (Williams et al., 2007). Authors speculate that interactive programs which are used to assess patients' concerns and preferences and set further treatment goals, based on patients' choice, are not perceived by patients as controlling.

Summarizing previous studies it might be assumed that practitioners who take into consideration patients with diabetes perspectives, provide choice, justify the need for health-related behavior, discuss alternative treatment options, support patients' self-initiation, minimize use of controlling language and help patients build diabetes self-management skills may support patients' autonomy and competence. In accordance with SDT model applied for patients with diabetes, autonomy support instead of affecting directly the behavior or its outcome, affects patient's autonomy and competence and these factors trigger other changes in the motivation – behavior – outcome chain: treatment adherence, glycemic index and psychological health, which is also a very important health outcome.

CONCLUSIONS

Understanding diabetes management has changed a great deal in recent years. The important emphasis has been placed on the increased patient-centered or collaborative approaches to care and education instead of disease-centered approach. The patient-centered approach is based on a philosophy of empowerment (Mitchell Funnell, Tang, & Anderson, 2007). So it is essential that health care specialists pay greater attention to relationships with their patients. The self-determination model in diabetes represents a theoretical approach of understanding and predicting diabetes related health behavior and its outcomes. Autonomy support is included in it as important contextual factor. In accordance with SDT, it is crucial to support patients in a nonjudgmental manner, enhance patients' initial attempts to initiate or maintain the behavior in order to help them become more autonomous as patient-centered approach of care acknowledges the patients' experience, priorities and fears (Aujoulat, d'Hoore, & Deccache, 2007). Studies demonstrate that when health care practitioners are more patient-centered, patients tend to display more treatment compliance in contrast when health care practitioners are more physician-centered (Williams et al., 2000). This is in line with the results of this review which adds evidence that patient-practitioner relationship is a very important trigger for health behavior or its change. It was mostly confirmed in the SDT model applied for diabetes that contextual factor – autonomy support from practitioners – enhances autonomous motivation and competence (the latter directly or through autonomous motivation), which, in turn, are the mediators of diabetes related health behavior (glycemic control), its change and/or outcomes. However, research beyond the SDT also indicates that the patient's subjective assessment of the practitioner-patient relationship is associated with the HbA1c values, independently of type of diabetes (Rose, Fliege, Hildebrandt, Schirop, & Klapp, 2002). Similar findings were among patients with coronary artery disease. Autonomy support from practitioners predicted autonomous motivation, which in turn predicted improved diet and more exercise in these patients (Williams et al., 2005). Perceived autonomy support also increased autonomous motivation to methadone treatment adherence (Zeldman, Ryan, & Fiscella, 2004). Other research in patients with depression states that even though patients tend to participate

in treatment more when they perceive autonomy support from practitioners, anyway autonomous motivation seems to be the key determinant to predict health-related behavior (Zuroff et al., 2007). Some evidence from current review even suggests that autonomy support fails to predict autonomous motivation when supposedly a more prominent active planning factor is included. Active planning enhances autonomous motivation and vice versa (Julien et al., 2009).

It should be noted that research mostly investigates the quality of motivation for diabetes management behavior in general or medication adherence and diet in particular. There is some lack of information in reviewed literature regarding motivation for physical activity. Taking in mind that diabetes related behavior compliance is not consistent across behaviors (Coyle et al., 2013; Soryte & Bulotaite, 2013) firstly, it is really important to differentiate motivation quality for each type of diabetes related health behavior. Secondly, research shows that physical activity in patients with diabetes is usually lower than recommended (Plotnikoff, 2006), although both aerobic and resistance training is beneficial in improving glucose homeostasis, psychological state, reduced rates of death from any cause and from diabetes in particular (Warburton, Whitney, Nicol, & Bredin 2006), too little importance is placed on exercise motivation research in the framework of SDT in this clinical group.

Theoretical approach and empirical evidence from different research areas suggest that autonomy support is a modifiable factor; it could be taught and learned (Su & Reeve, 2011). However there is a gap in endeavor to enhance autonomous motivation during educational programs based on SDT. These results implicate further experimental research trying to find the key techniques which would be capable to induce perceived autonomy support. Recently, research found that combining SDT framework and motivational interviewing practice could complement each other in promoting behavior change (Markland, Ryan, Tobin, & Rollnick, 2005). Motivational interviewing seems to be the solution of patient education and counseling problem. Experimental study shows that patients who receive motivational interviewing were significantly more autonomously motivated to control their diabetes than patients who did not receive MI (Rubak, Sandbæk, Lauritzen, Borch-Johnsen, & Christensen, 2009). This further leads to practical implication and helps to explain

human motivation for health behavior within the framework of SDT. Identification of significant relations of autonomy support also provides basis for enhancing health care in patients with diabetes. In turn, minimization of long-term diabetes complications, enhanced psychological health and quality of life could be expected if health professionals provide autonomy support.

In summary, it may be concluded that interrelationship between contextual social, inner psychological and physiological factors is crucial

to consider the content of educational programs of diabetes care. Educating practitioners to be more autonomy supportive would lead to more autonomously motivated patients and, consequently, better glycemic control. Looking more globally, results also imply that a multidisciplinary team of professionals (endocrinologists, general practitioners, nurses, dieticians, physiotherapists, health psychologist), trained to work with patients with diabetes, is required to develop, implement and supervise those educational programs.

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KINETICS OF PULMONARY VENTILATION AND CARBON DIOXIDE OUTPUT DURING INTERMITTENT INCREASING CYCLING EXERCISE AFTER A PRIOR ANAEROBIC LOAD

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ABSTRACT

Background. Research aim was to establish the influence of a prior anaerobic load on the kinetics of ventilation (V_E) and carbon dioxide output (VCO_2) during on- and off-transition phases of intermittent increasing cycling exercise.

Methods. The seven healthy, physically active females volunteered to estimate the influence of a prior anaerobic load on the kinetics of respiratory parameters. During the first visit VO_{2max} was evaluated using the increasing cycling exercise test. During the second testing the participants performed intermittent cycling exercise (ICE). During the other visit they performed supramaximal 30 s anaerobic exercise and after 15 min of the rest – ICE. In order to estimate the kinetics of respiratory parameters were analysed by adopting mono-exponential function.

Results. Mean blood lactate concentration was increased during ICE performed after prior anaerobic load in the presence of a residual metabolic acidosis. The asymptote and amplitude of monoexponential function reflecting VCO_2 kinetics during on- and off-transitions were not changed after prior anaerobic load. The time constant of this function was significantly longer ($p < .01$) both during on- and off-transitions at work rate below lactate threshold (LT), whereas this parameter at higher work intensities remained unchanged. The parameters of V_E monoexponential function during on- and off-transitions were not changed after prior anaerobic load.

Conclusion. Despite similar physiological mechanism responsible for V_E and CO_2 regulation during exercise the prior anaerobic load had different influence on the ventilation and VCO_2 kinetics during exercise below lactate threshold causing slowing of VCO_2 without changes of V_E kinetics.

Keywords: exercise intensity, lactate threshold, pulmonary ventilation, CO_2 output, acidosis.

INTRODUCTION

In the transition from rest to muscular work or during recovery, during variations in exercise intensity the rate of metabolism changes rapidly. Kinetics of pulmonary oxygen uptake (VO_2) and other related parameters (heart rate (HR), carbon dioxide output (VCO_2), pulmonary ventilation (V_E)) during transitional phases between rest and exercise are associated with humans aerobic capacity, reflects its acute adaptation abilities (Whipp & Ozyener, 1998; Jones & Carter, 2000). It is known that V_E kinetics at the start of moderate intensity exercise is characterised by two-phase

response: after initial fast increase this parameter slowly approaches steady state at 3–4 min of exercise. During recovery V_E also demonstrates fast decrease followed by slow decreasing to the rest level (Linnarsson, 1974; Whipp & Mahler, 1980). During exercise of heavy intensity V_E continues slowly increasing during the whole exercise (Wasserman, Whipp, Casaburi, & Oren, 1980; Martin, Whipp, Casaburi, & Oren, 1981).

VCO_2 changes as monoexponential function at the onset of moderate intensity (Di Prampero, 1981; Hughson & Morrissey, 1982). Similarly to

$\dot{V}O_2$, $\dot{V}CO_2$ also demonstrates so called component “cardiodynamic” associated with fast changes of pulmonary circulation (Whipp & Mahler, 1980).

The kinetics of $\dot{V}CO_2$ and \dot{V}_E is strongly interrelated and is regulated by similar physiological mechanisms (Jones & Heigenhauser, 1996). Whipp (1994) showed that \dot{V}_E is governed by the signals related to increased plasma K^+ concentration, PCO_2 , pH or PO_2 because the \dot{V}_E kinetics is strongly associated with that of $\dot{V}CO_2$ and \dot{V}_E changes slower than $\dot{V}O_2$. Pulmonary CO_2 output is additionally increased when the exercise intensity is associated with metabolic (lactic acid) acidosis. It has been found that an acute, endogenous metabolic acidemia speeds \dot{V}_E kinetics in moderate exercise (Ward & Whipp, 2010). On the other hand, despite the numerous research data exact mechanisms about how ventilation is regulated during exercise, what the link between CO_2 kinetics and ventilation is, remain disputable (Forster, Haouzi, & Dempsey, 2012). More research is needed for investigating relationships between alterations in acid-base state and the ventilatory responses (Lindinger & Heigenhauser, 2012).

To get more insight in the relative role of mechanisms regulating different pulmonary and oxygen uptake parameters the experimental model where one exercise boot is preceded by the other one (prior load) is often applied. There are numerous data about the influence of the intensity or mode of prior load on the kinetics of $\dot{V}O_2$ parameters during on-transition, steady state and off-transition phases of constant load exercise (Gerbino, Ward, & Whipp, 1996; MacDonald, Pedersen, & Hughson, 1997; Koppo & Bouckaert, 2000, 2001, 2002; Scheuermann, Hoelting, Noble, & Barstow, 2001; Fukuba, Hayashi, Koga, & Yoshida, 2002; Fukuba et al., 2007; Burnley, Jones, Carter, & Doust, 2000; Burnley, Doust, Carter, & Jones, 2001; Burnley, Doust, Ball, & Jones, 2002; Burnley et al., 2006; Koppo et al., 2003; Tordi, Perrey, Harvey, & Hughson, 2003; Endo et al., 2004; Moysi, Garcia-Romero, Alvero-Cruz, & Vicente-Rodriguez, 2005; Gurd et al., 2006; Jones, Berger, Wilkerson, & Roberts, 2006; Marles, Mucci, & Legrand, 2006; Marles, Perrey, Legrand, & Blondel, 2007).

Research aim was to establish the influence of a prior anaerobic load on the kinetics of \dot{V}_E and $\dot{V}CO_2$ during on- and off-transition phases of intermittent increasing cycling exercise.

METHODS

Participants. Seven healthy, non-smoking, physically active females volunteered to participate in the studies. Their physical and aerobic capacity characteristics are presented in Table 1. Informed consent was signed by each of the subjects after the experimental protocols and possible risks associated with participation in the studies had been explained, as approved by the Local Research Ethics Committee (in accordance with the Declaration of Helsinki). All participants reported to the laboratory rested (having performed no strenuous activity in the preceding 24 h), well hydrated and having abstained from food and caffeine for at least 3 h before testing. Tests were conducted in a well-ventilated laboratory at the same time of day for each participant, at a comfortable temperature (18–21°C).

Table 1. Physical and aerobic capacity characteristics of subjects

Sample size (n)	7
Age (years)	22.1 (1.5)
Height (m)	1.69 (0.66)
Weight (kg)	56.7 (4.9)
$\dot{V}O_{2max}$ ($l \cdot min^{-1}$)	2.3 (0.3)
$\dot{V}O_{2max}$ ($ml \cdot min^{-1} \cdot kg^{-1}$)	41.5 (5.2)

Note. Values are presented as means (SD). $\dot{V}O_{2max}$ – maximal oxygen uptake.

Pulmonary gas exchange data collection.

Pulmonary gas exchange data ($\dot{V}CO_2$ and \dot{V}_E) were collected continuously using the automated breath-by-breath systems “Oxycon Mobile” (Jaeger, Germany). Prior to each exercise test, the gas analyser was calibrated with certificated calibration gas. The all recorded data was analysed by five seconds mean intervals using “LAB Manager” and “Microsoft Excel” programs.

Measurement of blood lactate concentration.

The fingertip blood samples were collected into a capillary tube and subsequently analysed for blood lactate concentration as described previously (Kulis, Laurinavichyus, Firantas, & Kurtinaitienė, 1988). Lactate concentration in the blood was established by means of Eksan-G analyser using a membrane with enzyme lactaoxidase. Prior to each testing the analyser was calibrated by the standard 5 mM lactate solutions supplied by manufacturers.

Continuous increasing cycling exercise (CCE). The CCE was performed on the

mechanically braked cycle ergometer (Monark 834E, Monark-Crescent AB, Sweden). First all the subjects exercised for 3 min with the intensity of 17 W. Thereafter the intensity was set to 70 W and increased every minute by 10 W. The pedalling rate was 50 rpm. The test was terminated when the subject was not able to keep the required pedalling rate. Throughout the CCE pulmonary VO_2 was measured breath-by-breath using the automated system “Oxycon Mobile” (Jaeger, Germany). The $\text{VO}_{2\text{max}}$ determined as the highest mean value recorded in any 30 s period before the participant’s volitional termination of the test.

Intermittent increasing cycling exercise (ICE). The ICE was performed on the mechanically braked cycle ergometer (Monark 834E, Monark-Crescent AB, Sweden). The tests consisted of repeated work 3 min and passive rest 3 min intervals. No special warm-up was performed. The work rate of first work period was set to 17 W. Thereafter the intensity was set to 70 W and increased by 25 W during each consecutive work period. Before test and during the last 30 s of each work period a fingertip blood sample was collected into a capillary tube and subsequently analysed for blood lactate concentration. The test was continued until the participants’ blood lactate concentration raised over 4 mM level.

The Wingate anaerobic test (MAL). As a prior anaerobic load the supramaximal 30 s Wingate test was performed on Monark 834E cycle ergometer. The test was preceded by warm-up consisting of 5 min cycling (25–50 W) interrupted by short lasting bursts of high intensity. After this warm-up, the subjects took 1 min of rest for blood sampling and then performed 30 s all-out cycling followed

by 1 min cool-down cycling with no resistance. The bicycle ergometer mechanical resistance was set at 7.5% of body mass.

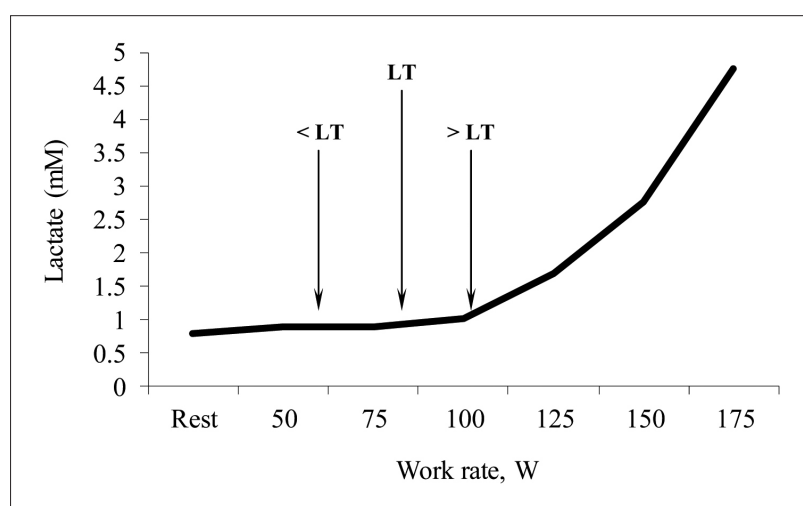
The lactate threshold (LT) and relative work intensity estimation. The LT was determined from visual inspection of individual plots of blood lactate concentration vs. work rate (Figure 1). The LT was considered as the work rate from [La] under rest level start raising slowly over 1–1.5 mM. The following relative intensities were chosen for the subsequent analysis: 25 W below lactate threshold (< LT); lactate threshold (LT); 25 W above lactate threshold (> LT) (Figure 1).

The analyses of respiratory parameters kinetics. In order to estimate the kinetics of respiratory parameters (VCO_2 and V_E) during on-transition and recovery periods were analysed by adopting mono-exponential function: $y(t) = y(b) \pm A \times (1 - e^{-t/\tau})$ where $y(b)$ is the baseline value (VCO_2 or V_E) through the last 30 s of work or rest; A is the amplitude and τ is the time constant of the response. During on-transition the first 20 s were always removed from the analysis (Whipp, Ward, & Lamarra, 1982).

Experimental protocol. In order to estimate the influence of a prior anaerobic load on the kinetics of respiratory parameters (VCO_2 and V_E) each participant was tested three times on separated days. During the first visit $\text{VO}_{2\text{max}}$ was evaluated using the CCE test ($10 \text{ W} \cdot \text{min}^{-1}$). During the second testing the participants performed ICE protocol. During the other visit they performed supramaximal 30 s anaerobic exercise (MAL) and after 15 min of the rest – ICE protocol.

Statistical analysis. All the values are reported as the means and standard deviations

Figure 1. Lactate threshold (LT) and relative work intensity estimation



Note. < LT represents 25 W below lactate threshold; > LT – 25 W above lactate threshold.

(SD). Examination of normality distribution was performed using Kolmogorov-Smirnov test. Comparisons of parameters between testing conditions and among different intensities were conducted using Wilcoxon matched pairs test or two-way repeated measures analyses of variance (ANOVA). If significant effects were found, post hoc testing was performed applying paired t- tests with a Bonferroni correction for multiple comparisons or Tukey's test. The limit of significance was set at $p < .05$.

RESULTS

To compare the parameters between testing conditions (without and after prior anaerobic load) data were normalized to each individual's lactate threshold (LT). Figure 2 shows mean blood lactate concentration on different testing conditions

indicating the presence of a residual metabolic acidosis during ICE performed after prior anaerobic load.

The asymptote, amplitude and time constant of VCO_2 and V_E kinetics during on- and off-transitions are given in Tables 2–3.

The asymptote and amplitude of mono-exponential function reflecting VCO_2 kinetics during on- and off-transitions were not changed after prior anaerobic load. The time constant of this function was significantly longer ($p < .01$) both during on- and off-transitions at work rate below LT, whereas this parameter at higher work intensities remained unchanged. The two-way ANOVA revealed that both during on- and off-transitions all the mentioned above parameters of VCO_2 kinetics increased significantly ($p < .001$) with intensity under both testing conditions (Table 2).

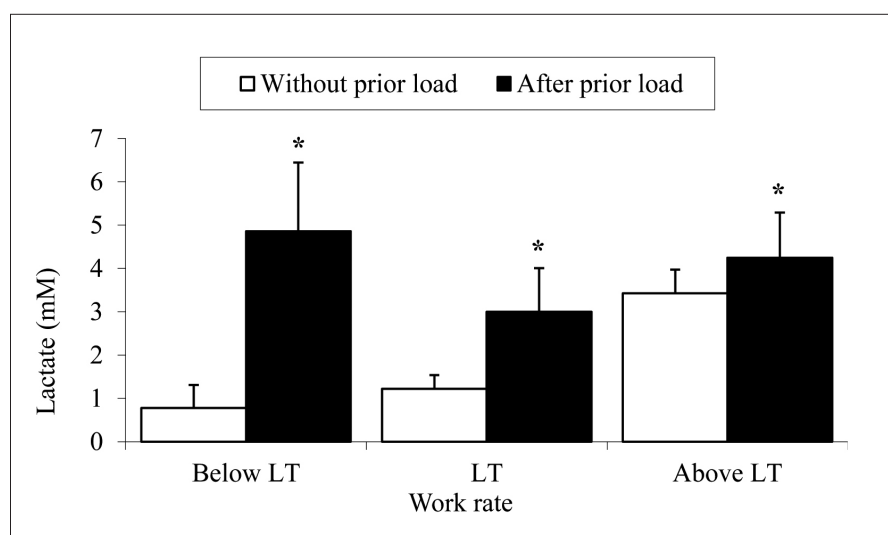


Figure 2. Mean blood lactate concentration [La] during intermittent increasing cycling exercise on different testing conditions

Note. The standard deviations presented by the bars. * – Denote significant ($p < .05$) difference between testing conditions. LT is work rate at lactate threshold.

Table 2. Parameters of VCO_2 kinetics during on- and off-transition periods of intermittent increasing exercise without and after prior anaerobic load

Parameters	Work rate	On-transition		Off-transition	
		Without prior anaerobic load	After prior anaerobic load	Without prior anaerobic load	After prior anaerobic load
Asymptote ($ml \cdot min^{-1}$)	< LT	850.5 (263.4)	787.6 (224.2)	244.6 (67.8)	249.9 (43.9)
	LT	1308.7 (290.1)	1246.1 (267.5)	302.3 (84.0)	306.5 (63.9)
	> LT	1827.3 (294.7)	1763.9 (321.9)	413.7 (57.8)	435.5 (86.4)
Amplitude, ($ml \cdot min^{-1}$)	< LT	640.4 (240.9)	505.5 (207.7)	607.3 (214.8)	536.1 (201.1)
	LT	1034.9 (236.2)	1012.4 (247.4)	1011.1 (249.2)	915.1 (232.9)
	> LT	1492.9 (257.5)	1403.0 (277.8)	1405.6 (273.0)	1322.9 (281.9)
Time constant (s)	< LT	29.0 (4.4)	39.8 (6.1) *	42.0 (4.7)	50.1 (5.9) *
	LT	36.4 (4.4)	37.2 (4.5)	58.4 (5.7)	54.9 (10.5)
	> LT	41.4 (5.2)	41.9 (5.5)	63.7 (7.6)	58.6 (4.1)

Note. The standard deviations (SD) are presented in brackets. * – Denote significant ($p < .05$) difference between testing conditions. LT is work rate at lactate threshold; < LT is work rate below lactate threshold and > LT is work rate above lactate threshold.

Table 3. Parameters of V_E changes during on- and off-transition periods of intermittent increasing exercise without and after prior anaerobic load

Parameters	Work rate	On-kinetics		Off-kinetics	
		Without prior anaerobic load	After prior anaerobic load	Without prior anaerobic load	After prior anaerobic load
Asymptote ($\text{ml}\cdot\text{min}^{-1}$)	< LT	26.1 (6.4)	28.5 (4.8)	10.6 (2.2)	12.5 (2.2)
	LT	37.1 (6.7)	38.7 (6.4)	12.9 (2.9)	14.1 (1.9)
	> LT	51.3 (8.2)	52.7 (6.8)	17.7 (2.3)	19.3 (3.7)
Amplitude, ($\text{ml}\cdot\text{min}^{-1}$)	< LT	16.6 (5.7)	14.4 (4.9)	15.6 (4.9)	16.0 (5.1)
	LT	25.7 (5.7)	27.2 (6.8)	24.2 (6.1)	24.3 (5.0)
	> LT	37.0 (8.4)	36.5 (6.4)	33.4 (8.6)	33.3 (6.9)
Time constant (s)	< LT	30.2 (5.8)	35.9 (8.5)	46.1 (4.1)	53.9 (9.6)
	LT	36.0 (3.7)	38.9 (6.1)	65.1 (6.9)	63.2 (13.0)
	> LT	42.1 (2.8)	44.6 (5.5)	69.1 (8.3)	64.7 (7.4)

Note. The standard deviations (SD) are presented in brackets. * – Denote significant ($p < .05$) difference between two testing conditions. LT is work rate at lactate threshold; <LT is work rate below lactate threshold and > LT is work rate above lactate threshold.

The parameters of V_E monoexponential function during on- and off-transitions were not changed after prior anaerobic load. The two-way ANOVA revealed that both during on- and off-transitions all the mentioned above parameters of V_E kinetics increased significantly ($p < 0.001$) with intensity under both testing conditions (Table 3).

DISCUSSION

The VCO_2 time constant was significantly longer both during on- and off-transitions at work rate below LT, whereas this parameter at higher work intensities remained unchanged. On the contrary, the parameters of V_E monoexponential function during on- and off-transitions were not changed after prior anaerobic load.

The latter finding contradicts the data presented by Ward and Whipp (2010) that metabolic acidaemia speeds V_E kinetics in moderate exercise, consistent with carotid chemoreception contributing to the *tightness* of arterial pH- CO_2 regulation and the magnitude of the transient arterial hypoxaemia.

The increased blood lactate concentration at any intensity of intermittent increasing cycling after prior anaerobic load shows that exercise was performed under conditions of metabolic acidosis. Despite the 15 min of rest which separated prior anaerobic load and following intermittent exercise it was rather high (7.83 (1.36) $\text{mmol}\cdot\text{l}^{-1}$). Other authors have also shown that remarkable metabolic acidosis is observed in working muscles during intensive exercise which is persistent during following exercise and causes vasodilation and

increase of oxygen supply to (Tordi et al., 2003). For instance it was established using very similar to ours' protocol that concentration of hydrogen in muscles was increased (Spriet, Lindinger, McKelvie, Heigenhauser, & Jones, 1989), and [La] was 5,6 $\text{mmol}\cdot\text{l}^{-1}$ (Burnley et al., 2002).

In our study only VCO_2 kinetics was slowed at the intensity lower than LT both during on- and off-transitions to exercise. It may be caused by increased rate of CO_2 production due to need to neutralize the increased amount of H^+ due to acidosis. The preceding load of heavy intensity is known to influence metabolism during subsequent exercise of heavy intensity (Germino et al., 1996; Krstrup, Gonzalez-Alonso, Quistorff, & Bangsbo, 2001). The intensified aerobic metabolism during second exercise leads to decreased anaerobic ATP resynthesis (Krstrup et al., 2001). Because of greater metabolic contribution of fatty acids and as consequence decreased respiratory exchange ratio (Green, Houston, Thomson, & Reid, 1979) VCO_2 may be lower during the whole duration of second exercise. During exercise CO_2 reserves are increased leading to ionic and osmotic changes that have effect on amount of bicarbonates and intracellular CO_2 (Jones & Heigenhauser, 1996). The ability of the organism to accumulate CO_2 improves ability to adapt to exercise (Cherniack & Longobardo, 1970). At the onset of light exercise CO_2 accumulates in muscles and venous. At heavy intensities when the [La] increases and concentration of K^+ decreases (Kowalchuk, Heigenhauser, Lindinger, Sutton, & Jones, 1988), the increase of CO_2 in muscles is impossible that's

why the CO₂ pressure always remarkably increases. This accelerates CO₂ diffusion from the muscles but real CO₂ release is dependent on the circulation CO₂ dissociation curve (Jones & Heigenhauser, 1996). Differences of CO₂ reserves between first and second loads are contributing to changed VCO₂ adaptation (Hughson & Inman, 1985).

As has been established by Whipp (1994 a) V_E is governed by signals that depend on increased concentration of K⁺ ions in plasma as well as impact of PCO₂, pH and PO₂ to chemoreceptors. It is believed that increase of V_E during exercise is proportional to the rate of metabolism. It remains unclear whether the rate of metabolism is dependent on VO₂ or VCO₂. When the reserves of the gases (especially CO₂) are changed V_E is changing not due to VCO₂ in working muscles but because of activated CO₂ exchange in lungs. For that reason pH of arterial blood is regulated by PaCO₂ when the intensity is moderate and concentration of bicarbonates remains unchanged (Whipp & Ward, 1998). Because kinetics of V_E is associated with that of VCO₂ at the onset of exercise V_E dynamics is lower than that of VO₂.

The rate of CO₂ exchange in the lungs is increased when the intensity is associated with metabolic acidosis. In such conditions because of HCO₃⁻ and H⁺ coupling extra CO₂ is produced. During exercise of increasing intensity it causes VCO₂ acceleration in comparison with VO₂ (Whipp & Ward, 1998). It has been reported that significant relationship between V_E and PaCO₂ exists during early phase of recovery (Afroundeh et al., 2013). In our case we observed some uncoupling between VCO₂ and V_E at the light intensity after prior anaerobic load. We can speculate that CO₂ were too low to cause significant changes V_E, despite the kinetics of VCO₂ was slowed.

CONCLUSIONS

After prior anaerobic load the rate of carbon dioxide output kinetics during on- and off-transition of exercise are decreased significantly when the work intensity is below lactate threshold. The kinetics of pulmonary ventilation remains unchanged under such conditions.

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PECULIARITIES OF PRE-COMPETITIVE PSYCHOLOGICAL FACTORS, SPORT PERFORMANCE INDICATORS AND PHYSIOLOGICAL DEMANDS IN YOUTH GOLF

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ABSTRACT

Background. Sport performance indicators, physiological demands and psychological hallmarks are the key factors in the development of golf performance. However, no research was found in youth golf. We hypothesized that the peculiarities of pre-competitive psychological factors, sport performance indicators, physiological demands in youth golf are not adequate compared with adult golf.

Methods. Ten male golfers participated in this study. The aim of the research was to assess and evaluate the peculiarities of pre-competitive psychological factors, sport performance indicators, physiological demands in youth golf. Sport performance indicators in golf were recorded using a personal sport performance statistical protocol. Locomotion and physiological demands were recorded using the FRWD W⁴⁰⁰ Series (Finland) device. Competitive state anxiety was assessed with the Competitive State Anxiety Inventory-2 (CSAI-2). The CSAI-2 assesses two components of state anxiety, cognitive and somatic anxiety, as well as a related construct, self-confidence.

Results. The subjects' long-game skills were at a higher level than their short-game skills. Pre-competitive cognitive and somatic anxiety was low, but self-confidence was high. Training effect on young golfers' aerobic fitness was low (1.28 – recovery zone).

Conclusions. Opposite to elite golfers, the long-game skills of youth golfers are more developed than their short-game skills. Playing golf does not have a positive training effect on young golfers' aerobic fitness. High level of self-confidence in youth golfers, which is adequate to elite golfers, could be determined by the similar level of mastership among competitive participants.

Keywords: cognitive and somatic anxiety, self-confidence, long-game skills, short-game skills, aerobic fitness.

INTRODUCTION

The sport performance indicators (Hellström, 2009 a), physiological demands (Smith, 2010) and psychological hallmarks (Hellström, 2009 b) of elite golfers are the key factors when golfers and their coaches compose annual training programmes. Each of these factors are equally important because golf is a game in which a small advantage in one area can mean the difference between finishing the first or finishing the 20th (Draovitch & Simpson, 2007). Hence, youth golfers need to develop all three factors in order to improve or optimize sport performance in golf (Draovitch & Simpson, 2007; Hellström, 2009 a; Hellström, 2009 b; Smith, 2010).

The player with the lowest total number of strokes is the winner of the competition and it is usually determined by better short-game skills (chipping, pitching, bunkers shots and putting) (Hellström, 2009 a). The best players on the Professional Golfers' Association (PGA) Tour are more accurate in the short-game than the rest of the players (Pelz, 1999; Dorsel & Rotunda, 2001). Accurately performed chipping, pitching or a bunker shot will have a significant effect on the number of one-putts (Pelz, 1999, 2000). The ability to hit the ball a long way (driving distance) and to be accurate from tee to fairway (driving accuracy) affects the final score too; from the

long-game skills, the green in regulation (GIR; see the definitions in Table 1) shows the strongest correlation with the scoring average (Hellström, 2009 a). However, in general, the indicators describing the short-game skills (scrambling and putts per GIR; see the definitions in Table 1) have the strongest correlations with the scoring average (Hellström, 2009 a).

Physiological demands show the physical state of golfers during the play on the golf course and the described peculiarities of the play (Draovitch & Simpson, 2007; Smith, 2010). For better performance it is necessary that the physiological state of the golfer would remain as close to the starting point as possible without any undue fatigue (Smith, 2010). Golf players who are physically fit can stay focused throughout the game; higher fitness levels also reduce recovery time (Draovitch & Simpson, 2007). Lower heart rate (HR) before the execution of the shot is one of the factors allowing players to achieve a better outcome (Boutcher & Zinsser, 1990; Cotterill & Collins, 2005; Smith, 2010; Neumann & Thomas, 2011; van der Lei & Tenenbaum, 2012). Golfers must integrate the physiological aspects of performance into their development plan in order to reach optimal movement capabilities (Smith, 2010).

Elite golfers are so good in technique and physical fitness that psychology usually becomes the leading factor determining a better performance among elite golfers (Hellström, 2009b). The attitude, confidence, ability to handle pressure, desire, concentration and motivation are important psychological qualities necessary to successfully participate in tournaments for elite golfers (Douglas & Fox, 2002). Meanwhile, the main cause of poor performance is the loss of confidence (Douglas & Fox, 2002). Moreover, skilled players indicated that the peak performance was related to being focused, feeling of performing effortlessly, automatically, being physically relaxed and mentally calm, feeling in control, having no fear, having high confidence, and experiencing fun and enjoyment (Cohn, 1991). Beauchamp (1999) noted that confidence, imagery and task focus were the most significant psychological skills for the peak putting performance among elite golfers. Differences in personality may explain why mood and emotions have no strong relationships to golf scores and it seems to be individual (Hellström, 2009 b). According to Martens, Vealey, and Burton (1990), less skilled sportspeople report the

higher overall levels of anxiety compared with elite competitors because they are less capable of self-regulating thoughts and are more likely to experience worry and self-doubt. Therefore, each player must have coping strategies when the stress arise during the play and these coping skills must be improved consistently (Hellström, 2009 b).

Review articles show that sport performance indicators (Hellström, 2009 a), physiological demands (Smith, 2010) and psychological hallmarks (Hellström, 2009 b) are usually analysed in adult golf. However, until now no peculiarities of these mentioned aspects are known in order to give the suitable training program for youth golfers in the long-term target development. We hypothesized that the peculiarities of pre-competitive psychological factors, sport performance indicators, physiological demands in youth golf were not adequate as compared with adult golf. **The aim of the research** was to assess and evaluate the peculiarities of pre-competitive psychological factors, sport performance indicators and physiological demands in youth golf.

METHODS

Participants. Ten male golfers (age 16.7 ± 1.95 years, height 180.2 ± 7.63 m, body mass 69.1 ± 7.77 kg, handicap index 8.14 ± 3.52) participated in this study. The participants belonged to the Lithuanian national youth golf team. The experimental procedures were performed in accordance with the Declaration of Helsinki. The participants and their parents gave their written informed consent. The Ethics Committee of Kaunas Regional Biomedical Research approved this study.

Instrumentation. Sport performance indicators in golf (Table 1) were recorded using a sport performance personal statistical protocol (Schempp & Mattsson, 2005). Locomotion and physiological demands (Table 1) were recorded using the FRWD W⁴⁰⁰ Series (Finland) device, which allowed us to determine locomotion and physiological indicators according to the age, height, body mass and basal heart rate indicators of the participants (Perez-Turpin, Cortell-Tormo, Suarez-Llorca, Andreu-Cabrera, Llana-Belloch, & Perez-Soriano, 2009). Competitive state anxiety (Table 1) was assessed with the Competitive State Anxiety Inventory-2 (CSAI-2; Martens, Burton, Vealey, Bump, & Smith, 1990), which is a self-report psychometric

inventory of state anxiety consisting of 27 items. The CSAI-2 assesses two components of state anxiety, cognitive and somatic anxiety, and a related construct, self-confidence, with 9 items representing each subscale. The CSAI-2 has good reliability and validity and has been widely used in the research on anxiety in sport (Martens et al., 1990). Each CSAI-2 subscale is rated on a scale from 1 = “not at all” to 4 = “very much so”, relating to the extremes of intensity. Thus, each subscale has a range from 9 to 36. Higher scores of cognitive and somatic anxiety indicate higher levels of anxiety, whereas higher scores of the self-confidence sub-scale correspond to higher levels of self-confidence.

Research design. The study was conducted over five days (August 10–14) at the Capitals Golf Club, Lithuania (par 71; yellow tees 5750 m), a course that has moderate elevation changes.

The participants were divided into five pairs of two players. Each pair played only one golf round (18 holes) in the golf course starting at 12:00 and each pair played this round in separate days in the same conditions of play: yellow tees, with a caddy (a person who carries a player’s bag and clubs); sunshine and light breeze, and the average temperature was 20° C.

Fifteen minutes prior to the golf round, the participants completed the psychometric measure of competitive state anxiety (CSAI-2). Later, the global positioning system device (FRWD W⁴⁰⁰ Series) was attached to the upper right arm of the subjects to record locomotion indicators. After 1–2 minutes, a signal from the device indicated

its connection with the satellite. The pulsometer (FRWD W⁴⁰⁰ Series) was also attached to the chest of the subjects. The recording of locomotion and physiological indicators was started by the subject pressing a button on the device when teeing up at the 1st hole and continued until the play finished with the final putt at the 18th hole when the device was turned off. During the play, the players recorded sport performance indicators; personal statistical protocols of sport performance were recorded after each player completed a hole (18 times). It should be noted that the procedure of completing CSAI-2, recording sport performance protocol and using the FRWD W⁴⁰⁰ Series (Finland) device was usual for the golfers because they previously applied it in the training and competition environment.

Statistical analysis. The descriptive statistics of data were presented as the mean and standard deviation (SD). The relationship between the sport performance indicators (driving accuracy, green in regulation, scrambling, putts per green in regulation, putts per round) and the score (strokes per round) was estimated using Pearson’s correlation coefficient. The relationship between the pre-competitive psychological factors (cognitive and somatic anxiety, self-confidence) and the sport performance indicators (score, driving accuracy, green in regulation, scrambling, putts per green in regulation, putts per round) was estimated applying Spearman’s correlation coefficient. The level of significance was set a priori at $p < 0.05$ for all analyses. The statistical analysis was carried out using SPSS 21.0 package for Windows.

Table 1. Sport Performance Indicators, Locomotion and Physiological Demands, Pre-Competitive Psychological Factors

Sport performance indicators	Driving accuracy (DA) (%); green in regulation (GIR) (%); scrambling (%); putts per GIR; putts per round; score (holes 1–9; 10–18; 1–18) (strokes).
Locomotion demands	Duration of play (min); distance covered (m); distance covered in excess of course distance (m and %).
Physiological demands	Heart rate (HR) (beats·min ⁻¹); maximal heart rate (HRmax) (beats·min ⁻¹); total energy expenditure (kcal); energy expenditure per minute (kcal·min ⁻¹); maximal energy expenditure per minute (kcal·min ⁻¹); maximal excess post-exercise oxygen consumption (EPOCmax) (mL·kg ⁻¹); maximal oxygen uptake (VO ₂ max) (mL·kg ⁻¹ ·min ⁻¹); maximal ventilatory response (L·min ⁻¹); maximal respiration rate (breaths·min ⁻¹); training effect (TE) (scale, 1–5).
Psychological factors	Cognitive and somatic anxiety; self-confidence.

Notes. Driving accuracy (DA), the percentage of times a player hits the fairway with the tee shot on par 4 and par 5 holes (regardless of club). Green in regulation (GIR), the percentage of times a player hits the green in regulation (greens hit in regulation/holes played); a green is considered hit in regulation if any portion of the ball touches the putting surface and the number of strokes taken is two or less than par. Scrambling, the percentage of times a player misses the GIR, but still makes par or better. Putts per GIR, the average number of putts per GIR. Par, a hole is classified by its par, meaning the number of strokes a skilled golfer should require to complete play of the hole; a hole is either par 3, 4 or 5. Training effect (TE), this indicates how a work-out improves aerobic (endurance) fitness; TE has five levels (1–1.9 – easy recovery; 2.0–2.9 maintaining fitness; 3.0–3.9 improving fitness; 4.0–4.9 highly improving; 5.0 – overreaching).

RESULTS

The subjects' long-game skills (DA, GIR) were at a higher level than their short-game skills (scrambling; putts per GIR; putts per round) (Table 2). The scoring average was 82.4 ± 5.93 strokes (front nine holes – 41.8 ± 2.74 strokes; back nine holes – 40.6 ± 3.5 strokes). From sport performance indicators, GIR had the strongest relationship to the score (strokes per round) ($r = -.716$; $p < .05$).

The subjects played 3 hours and 45 minutes on average, covering slightly more than 9 km; that is,

they exceeded the course distance off the yellow tees by 58% (Table 3).

The results confirmed that the physiological demands arising from golf were not considered intense (Table 4).

Pre-competitive cognitive and somatic anxiety was low, but self-confidence was high (Table 5). Self-confidence had the strongest relationships to the DA percentage ($r = .669$; $p < 0.05$) and the score (strokes per round) ($r = -.539$). While, cognitive anxiety had the strongest relationship to putts per GIR ($r = .346$). Somatic anxiety had the strongest relationship to scrambling ($r = -.319$).

DA (%)	GIR (%)	Scrambling (%)	Putts per GIR	Putts per round
59.23 ± 10.29	47.22 ± 11.19	27.86 ± 16.44	2.09 ± 0.18	34.6 ± 2.59

Table 2. Sport Performance Indicators of Youth Golfers

Playing duration (min)	Covered distance (m)	Distance covered in excess of course distance	
		m	%
224.6 ± 9.7	9098.2 ± 171.47	3348.2 ± 171.47	58.23 ± 2.98

Table 3. Locomotion Demands of Youth Golfers

HR (beats·min ⁻¹)	HRmax (beats·min ⁻¹)	Total energy expenditure (kcal)	Energy expenditure per minute (kcal·min ⁻¹)	Max. energy expenditure per minute (kcal·min ⁻¹)
108.6 ± 5.89	147.3 ± 5.23	1084.1 ± 134.37	4.82 ± 0.53	12.9 ± 1.1
EPOCmax (mL·kg ⁻¹)	VO ₂ max (mL·kg ⁻¹ ·min ⁻¹)	Max. ventilatory response (L·min ⁻¹)	Max. respiration rate (breaths·min ⁻¹)	Training effect (scale, 1–5)
6 ± 1.83	37.7 ± 3.62	73.8 ± 10.41	44.9 ± 5.2	1.28 ± 0.15

Table 4. Physiological Demands of Youth Golfers

Cognitive anxiety (scores)	Somatic anxiety (scores)	Self-confidence (scores)
16.1 ± 2.38	13.9 ± 2.13	29 ± 2.54

Table 5. Pre-Competitive Cognitive and Somatic Anxiety, Self-Confidence of Youth Golfers

DISCUSSION

The subjects' sport performance indicators were very different compared with those of professional golf players in the season of 2013. The clearest difference relates to short-game skills where the Professional Golfers' Association (PGA) Tour players recorded 29.19 putts per round, 1.78

putts per GIR and 57.79% for scrambling (<http://www.pgatour.com>). The subjects performed 5.41 putts per round on average and 0.31 putts per GIR more than the PGA Tour players. Furthermore, the scrambling percentage of the subjects was on average 30% less than that for the PGA Tour players. Scrambling is currently the best general measure for the short game skills, which involves

the players' abilities around the green and on the putting green (Hellström, 2009 a). Meanwhile, the difference between the long-game skills of the subjects and professional golf players was less. The green in regulation percentage of the subjects was 47.22% on average, somewhat lower than the 64.99% for the professional players (<http://www.pgatour.com>). GIR is currently the best measure for the long-game skills (Hellström, 2009 a). The percentage for the driving accuracy of the subjects was 59.23% on average, which was slightly lower compared with the performance of the best players in the world (61.29%) (<http://www.pgatour.com>). In summary, it is clear that the subjects' long-game skills (DA, GIR) were at a higher level than their short-game skills (scrambling; putts per GIR; putts per round). The researchers (Pelz, 1999, 2000; Dorsel & Rotunda, 2001; Hellström, 2009 a) noted that better short-game skills were directly related to better outcome; the best players in the world distinguish themselves from the rest of the players by the short-game skills. Hence, in the future, it is necessary for junior golfers to improve their short-game skills because the indicators describing these skills have the strongest correlations with the scoring average (Hellström, 2009 a). In our case, the subjects' GIR percentage was found as the most important for a better score (strokes per round) ($r = -.716$; $p < .05$). The researchers found that scrambling ($r = -.67$; $p < .05$) (Finley & Halsey, 2004) and putts per GIR ($r = .63$; $p < .05$) (Quinn, 2006) had the strongest correlations with the scoring average in elite golf, but GIR also was an indicator strongly related to the low scoring average (Finley & Halsey, 2004; Quinn, 2006).

The locomotion and physiological demands of subjects were in line with the findings of other studies. A single round of golf can last from 2.5 to 6 h (Smith, 2010); the distance covered is generally less than 10 km (Kobriger, Smith, Hollman, & Smith, 2006; Zunzer, von Duvillard, Tschakert, Mangus, & Hofmann, 2013). The HR response range is reported as 100–120 beats·min⁻¹ (McKay, Selig, Carlson, & Morris, 1997; Burkett & von Heijne-Fisher, 1998; Stauch, Lui, Giesler, & Lehmann, 1999); the range for total energy expenditure is 960–1954 kcal and that for energy expenditure is 6.0–11.8 kcal·min⁻¹ (Smith, 2010). Our additional findings suggest that playing golf did not have a positive training effect on the subjects' aerobic fitness (1.28 – recovery zone). Hence, playing golf, unfortunately, is not the best means for getting in

a better shape to play a better golf. Draovitch and Simpson (2007) noted that golf players were likely to suffer from a performance decrement unless they had a moderately high level of aerobic fitness. It's highly important that the golfer's aerobic state was optimal during the shot preparation and execution, which enables the players to achieve a better outcome (Boutcher & Zinsser, 1990; Cotterill & Collins, 2005; Smith, 2010; Neumann & Thomas, 2011; van der Lei & Tenenbaum, 2012). Considering the player's optimization from a multidisciplinary perspective, the role of physiology should be seen as equally important as other contributing factors (Smith, 2010). Therefore, young golfers should be advised to include aerobic training sessions in their training programmes with the aim of improving sport performance.

The subjects' pre-competitive cognitive and somatic anxiety was low. Meanwhile, high level of self-confidence was among all players. High self-confidence is one of the most significant psychological factors in golf which allows the players to compete successfully (Cohn, 1991; Beauchamp 1999; Douglas & Fox, 2002; Hellström, 2009 b). Being mentally calm is also a very significant factor for a better performance (Cohn, 1991; Hellström, 2009 b). The research results are relatively in line with McKay (1998) who noted that pre-competitive cognitive anxiety (scores – 17.1 and 15.1) of elite and amateur golfers was higher than somatic anxiety (scores – 13.9 and 13.5); while self-confidence was moderately high (scores – 25.9 and 22.8). Furthermore, McKay (1998) determined that the cognitive (scores – 13.7 and 12.9) and somatic (scores – 11.2 and 10.7) anxiety of elite and amateur golfers before the practice round was significantly lower ($p < .05$), while their self-confidence (scores – 28.1 and 26.4) was significantly higher ($p < .05$) than that before the competition. Weinberg & Genuchi (1980) revealed that golfers with lower pre-competitive anxiety performed better than those with higher anxiety levels. The subjects' self-confidence was higher compared with that of elite and amateur golfers (McKay, 1998) and it is a feature which probably allows the subjects to compete more successfully (Cohn, 1991; Beauchamp, 1999; Douglas & Fox, 2002; Hellström, 2009 b). However, pre-competitive cognitive anxiety of subjects should be lower (McKay, 1998), being mentally calm influences a better execution (Cohn, 1991; Hellström, 2009 b). Furthermore, the subjects' self-confidence levels

had the strongest influence on the DA percentage ($r = .669$; $p < .05$) and the score (strokes per round) ($r = -.539$). McKay (1998) observed that the self-confidence levels of amateur players also had influence on the score (strokes per round) ($r = -.37$). Meanwhile, the subjects' cognitive anxiety levels had the strongest influence on the number of putts per GIR ($r = .346$).

CONCLUSIONS

The long-game skills of youth golfers are more developed than their short-game skills, which is opposite to elite golfers. Secondly,

the moderate-high levels of aerobic fitness are essential for the golfers to compete successfully; however, there is evidence that playing golf does not have a positive training effect on the young golfers' aerobic fitness. The findings suggest that the high level of self-confidence in youth golfers, which is adequate to that of elite golfers, could be determined by the similar level of mastery among competitive participants. The research results allow practitioners to optimize the training programmes of the target group of youth golfers.

Further research is needed for determining the relationships between sport performance, fitness and psychological aspects in youth golf.

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EFFECTS OF FOUR DAYS OF COMPETITION MODELLING FOLLOWED BY SIX DAYS OF TAPERING ON SPORT PERFORMANCE IN JUNIOR GOLFERS: A CASE STUDY

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ABSTRACT

Background. The use of competition modelling or tapering to improve sport performance in golf has not been extensively studied. Due to the specific conditions of the main competition, the simulation of competition modelling followed by tapering has been suggested as a means of improving junior golfers' sport performance. The aim of this study was to determine the most suitable precompetition model and taper for junior golfers to optimize their performance.

Methods. Two male golfers (subject A: age 17 years, height 1.75 m, body mass 62 kg, basal heart rate 60 beats·min⁻¹, handicap index 10.1; subject B: age 17 years, height 1.87 m, body mass 68 kg, basal heart rate 60 beats·min⁻¹, handicap index 11.2) participated in this study. Sport performance indicators in golf were recorded using a personal sport performance statistical protocol. Locomotion and physiological demands were recorded using the FRWD W⁴⁰⁰ Series (Finland) device. Furthermore, tapering training programmes were recorded.

Results. The simulation of four days of competition modelling followed by six days of tapering allowed the subjects to improve their performance; their scoring average at the Lithuanian Amateur Open Golf Championship 2011 was by 6.02% (subject A) and 3.77% (subject B) lower than that for the four-day competition modelling stage.

Conclusions. Findings suggest the effectiveness of four days of competition modelling, which allowed the simulation of the specific conditions of the main competition, and also of the practice round held three days before the competition for junior golfers.

Keywords: golf, simulation, locomotion, physiological demands, training loads.

INTRODUCTION

Golf is a game in which a small advantage in one area can mean the difference between finishing first or finishing 20th (Draovitch & Simpson, 2007). For this reason, sports scientists, coaches and athletes are constantly looking for ways to provide a slight, legal advantage in sport performance (Nevill, Atkinson, & Hughes, 2008; Hellström, 2009 a). The sport performance indicators (Hellström, 2009 a), physiological demands (Smith, 2010) and psychological hallmarks (Hellström, 2009 b) of elite golfers are the fundamental factors in the development of golf performance. Furthermore, an overall analysis of each golfer's performance is

an excellent way to keep track of improvements, identify areas that need practice, and build players' confidence (Schempp & Mattsson, 2005). For coaches or players who do not acknowledge and integrate physiological aspects of performance into their development plan, the chances of reaching optimal movement capabilities will not be realized (Smith, 2010).

How a player's physical state is managed during the play could therefore have a significant effect on optimal golf performance in the latter stages of the round or competition (McKay, Selig, Carlson, & Morris, 1997). The training process involves the

manipulation of the training variables – intensity, duration and frequency – with training load being the combination of all three elements (Smith, 2003). A taper is the training phase characterized by a reduction in the amount of training that athletes undergo during the final days leading up to a major competition (Mujika, 2010). The primary question for coaches and athletes is how to manipulate the type, frequency, duration and intensity of training to enhance or optimize performance (Pyne, Mujika, & Reilly, 2009; Toubekis et al., 2013) depending on the competition structure.

In general, golf competitions in Lithuania last one or sometimes two days (two or three times per season) and golfers play off the yellow tees (as used by amateur men golfers). The development of golf in Lithuania has increased dramatically, and in attempts to raise the level to professional competition standards, the Lithuanian Amateur Open Golf Championship 2011 (LAOGC 2011) was held over three days and golfers played off the white tees (as used by professional men golfers). Therefore, golfers had to adjust their preparation programmes to optimize their performance at LAOGC 2011. Research and professional experience support the concept of the specificity of training: the more closely that conditioning can assimilate the physiological demands and conditions of competition, the greater the performance improvement that can be expected will be (Rhea, Hunter, & Hunter, 2006). Furthermore, with tapering, fitness and skills should reach relatively high levels so that the level of performance is optimized through physiological adaptations (Smith, 2003; Mujika, 2010).

The aim of this study was to evaluate the effects of four days of competition modelling followed by six days of tapering on the sport performance of junior golfers.

METHODS

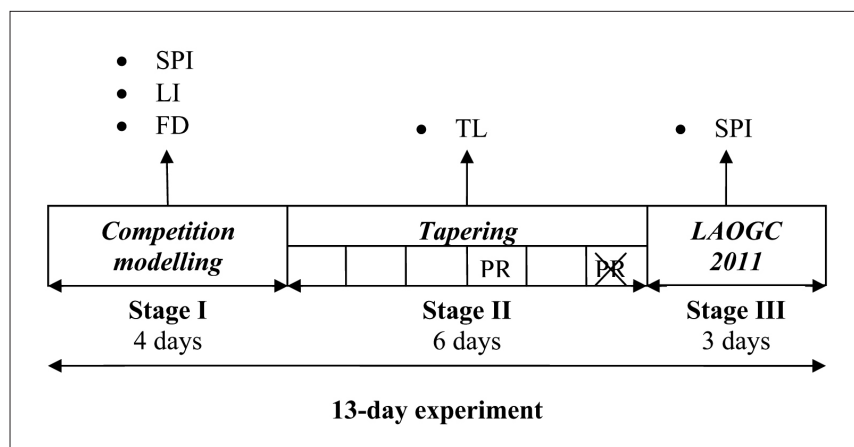
Participants. Two male golfers participated in this study; subject A: age 17 years, height 1.75 m, body mass 62 kg, basal heart rate 60 beats·min⁻¹, golf handicap index 10.1; subject B: age 17 years, height 1.87 m, body mass 68 kg, basal heart rate 60 beats·min⁻¹, golf handicap index 11.2. The experimental procedures were performed in accordance with the Declaration of Helsinki. The participants and their parents gave their written informed consent. The Ethics Committee of Kaunas Regional Biomedical Research approved this study.

Experimental design. Both golfers participated in the three stages of the study. Stage I was the four-day period of competition modelling; Stage II was the six-day period of tapering; Stage III was the three-day period of LAOGC 2011 (August 12–14) (Figure). We recorded sport performance indicators, locomotion indicators and physiological demands in Stage I, training loads in tapering (Stage II) and sport performance indicators in the main competition (Stage III).

Measures. Sport performance indicators in golf (Table 1) were recorded using a sport performance personal statistical protocol (Schempp & Mattsson, 2005). Locomotion and physiological demands (Table 1) were recorded using the FRWD W⁴⁰⁰ Series (Finland) device, which allowed us to determine locomotion and physiological indicators according to the age, height, body mass and the basal heart rate indicators of the participants (Perez-Turpin et al., 2009).

Procedures. The study was conducted over 13 days (August 2–14) at the Capitals Golf Club, Lithuania (par 71; white tees 6255 m), a course that has moderate elevation changes.

Figure. Experimental design of four days of competition modelling, six days of tapering and three days of the main competition



Notes. SPI – sport performance indicators; LI – locomotion indicators; FD – physiological demands; TL – training loads; PR – practice round; LAOGC 2011 – Lithuanian Amateur Open Golf Championship 2011.

Table 1. Sport performance indicators, locomotion and physiological demands

Sport performance indicators	Driving accuracy (DA) (%); green in regulation (GIR) (%); scrambling (%); putts per GIR; putts per round; score (holes 1–9; 10–18; 1–18) (strokes).
Locomotion demands	Duration of play (h); distance covered (km); distance covered in excess of course distance (km and %).
Physiological demands	Heart rate (HR) (beats·min ⁻¹); maximal heart rate (HR _{max}) (beats·min ⁻¹); total energy expenditure (kcal); energy expenditure per minute (kcal·min ⁻¹); energy expenditure per kilogram (kcal·kg ⁻¹); maximal excess post-exercise oxygen consumption (EPOC _{max}) (mL·kg ⁻¹); maximal oxygen uptake (VO _{2max}) (mL·kg ⁻¹ ·min ⁻¹); maximal ventilatory response (L·min ⁻¹); maximal respiration rate (breaths·min ⁻¹); training effect (TE) (scale, 1–5).

Notes. **Driving accuracy (DA)**, the percentage of times a player hits the fairway with the tee shot on par 4 and par 5 holes (regardless of club). **Green in regulation (GIR)**, the percentage of times a player hits the green in regulation (greens hit in regulation/holes played); a green is considered hit in regulation if any portion of the ball touches the putting surface and the number of strokes taken is two or less than par. **Scrambling**, the percentage of times a player misses the GIR, but still makes par or better. **Putts per GIR**, the average number of putts per GIR. **Par**, a hole is classified by its par, meaning the number of strokes a skilled golfer should require to complete play of the hole; a hole is either par 3, 4 or 5. **Training effect (TE)**, this indicates how a work-out improves aerobic (endurance) fitness; TE has five levels (1–1.9 – easy recovery; 2.0–2.9 maintaining fitness; 3.0–3.9 improving fitness; 4.0–4.9 highly improving; 5.0 – overreaching).

According to LAOGC 2011 regulations, the competition comprised three rounds (with a practice round one day before) off the white tees with three players in one group. Therefore, our two subjects (plus a third player of similar skill: age 16 years, height 1.85 m, body mass 70 kg, basal heart rate 72 beats·min⁻¹, golf handicap index 14.0) played four rounds off the white tees with the aim of modelling the competition conditions of LAOGC 2011.

Over these four days, participants recorded sport performance indicators in golf (using the sport performance personal statistical protocol). For the validation tasks, the subjects exchanged protocols and checked them after every hole. Locomotion and physiological indicators were recorded (FRWD W⁴⁰⁰ Series). Play started at 10 a.m. each day (conditions of play: carrying their own golf clubs; sunshine and light breeze, average temperature 20°C).

Before the start of play, a global positioning system device (FRWD W⁴⁰⁰ Series) was attached to the upper right arm of the subjects to record locomotion indicators. After 1–2 minutes, a signal from the device indicated its connection with the satellite. A pulsometer (FRWD W⁴⁰⁰ Series) was also attached to the chest of the subjects. The recording of locomotion and physiological indicators was started by the subject pressing a button on the device when teeing up at the 1st hole and continued until play finished with the final putt at the 18th hole when the device was turned off. It should be noted that the procedure of recording sport performance protocol and using the FRWD W⁴⁰⁰ Series (Finland) device was usual for the golfers because they previously applied it in the

training and competition environment. In Stage II, the tapering training programmes were recorded and analysed; for the validation tasks, the coach of golfers observed that everything was correctly performed. In Stage III, the sport performance indicators were analysed using personal statistical protocols of sport performance and result protocols of LAOGC 2011.

Statistical analysis. The statistical analysis was carried out using SPSS 21.0 package for Windows. Standard statistical methods were used to calculate means and standard deviations (\pm *SD*), and percentages (%).

RESULTS

The four-day period of competition modelling. Subjects' driving accuracy was higher than 50% over the four-day period of competition modelling. It should be noted that both subjects hit all their tee shots at par 4 and par 5 holes (the driving accuracy percentage is recorded for these holes) with a 1-wood (driver). The green in regulation percentage, reflecting a player's skill in approach to the green, was lower or equal to 50% over the four days. The scrambling percentage, reflecting a player's ability around the green, was very low for both subjects, with an average of no higher than 15%. Ability on the putting green was assessed using putts per green in regulation and putts per round indicators. Over the four-day period of competition modelling, both subjects averaged no fewer than 36 putts per round; only once was the average (per round) of putts per green in regulation less than two putts (Table 2).

Despite these similar results, indices of scoring average for subject A varied while those for subject

B were more stable. The scoring average of the third player was slightly higher (4.25 and 5.25) than for subjects A and B respectively. The skill level of the third golfer was therefore roughly similar to that of subjects A and B.

Both subjects played the same duration on average (4 hours and 22 minutes), covering nearly 10 km; that is, they exceeded by 60% the course distance off the white tees (Table 3).

Four days of play confirmed that the physiological demands that arise from golf were not considered intense (Table 4). The indices of HR, energy expenditure, EPOCmax, VO₂max, maximal respiration rate and training effect varied slightly over the four-day period of competition modelling.

Seasonal training programme. Neither subject followed a physical conditioning programme to prepare for the 2011 golf season. During the pre-season, both subjects undertook different kinds of physical activity 2–3 times per week for about 1.5 h per training session: subject A played tennis, subject B played basketball. Furthermore,

subjects only did technical training (in the practice areas, playing rounds of golf) and not physical conditioning during the golf season.

The annual technical training programme before LAOGC 2011 was as follows: 57% of the time was spent on improving long-game skills (37% with low-numbered irons and 20% with woods, especially drivers), compared with 43% of the time spent on improving short-game skills (22% on the putting green, 17% in the practice areas for chipping and pitching, and 4% in the sand bunkers).

On average, subjects had four training sessions of roughly 2 h and played three 18-hole rounds of golf (not including the competitions) per week. In addition, subject A participated in two competitions per month and subject B in three competitions per month on average.

The six-day period of tapering. Subjects' training loads decreased during the six-day period of tapering. They had three training sessions of roughly 1 h 40 min on the first, third and fifth days; that is, the frequency (25%) and volume (16.67%)

Table 2. Sport performance indicators during the four-day period of competition modelling (mean \pm SD)

Sport performance indicators	Golfer	1st day	2nd day	3rd day	4th day	Average
Driving accuracy (%)	A	53.85	76.92	76.92	76.92	71.15 \pm 11.54
	B	61.54	69.23	76.92	69.23	69.23 \pm 6.28
Green in regulation (%)	A	44.44	22.22	50	50	41.67 \pm 13.23
	B	44.44	44.44	44.44	38.89	43.05 \pm 2.78
Scrambling (%)	A	10	14.29	11.11	0	8.85 \pm 6.17
	B	10	20	30	0	15 \pm 12.91
Putts per green in regulation	A	2.13	2.25	2	2.33	2.18 \pm 0.14
	B	1.88	2.25	2.63	2.14	2.23 \pm 0.31
Putts per round	A	38	36	36	38	37 \pm 1.15
	B	37	38	37	38	37.5 \pm 0.58
Strokes (1–9 holes)	A	41	48	42	46	44.25 \pm 2.87
	B	43	43	44	47	44.25 \pm 1.89
Strokes (10–18 holes)	A	46	44	39	43	43 \pm 3.37
	B	42	42	42	42	42
Strokes (1–18 holes)	A	87	92	81	89	87.25 \pm 4.65
	B	85	85	86	89	86.25 \pm 1.89

Table 3. Locomotion indicators during the four-day period of competition modelling (mean \pm SD)

Locomotion demands	Golfer	1st day	2nd day	3rd day	4th day	Average
Playing duration (h:min)	A	04:14	04:17	04:40	04:17	04:22 \pm 00:12.08
	B	04:13	04:18	04:41	04:16	04:22 \pm 00:12.83
Covered distance (km)	A	9.93	9.71	9.95	9.86	9.86 \pm 0.11
	B	10.05	9.80	10.16	9.86	9.97 \pm 0.17
Covered distance in excess of course distance (km and %)	A	3.68	3.46	3.70	3.61	3.61 \pm 0.11
	A	58.75	55.24	59.07	57.63	57.67 \pm 1.74
	B	3.80	3.55	3.91	3.61	3.72 \pm 0.17
	B	60.67	56.67	62.43	57.63	59.35 \pm 2.67

of training sessions decreased, but the intensity remained the same. In addition, subjects played two 18-hole rounds on the second and fourth days; that is, the frequency (33.33%) of playing rounds decreased, but the intensity and volume remained the same. The final day of tapering was given over to recovery.

The three-day period of the Lithuanian Amateur Open Golf Championship 2011. In total, 104 golfers (including 32 foreigners from seven countries) participated in LAOGC 2011. Both subjects performed well, taking 7th and 8th places overall, coming 2nd and 3rd in the Lithuanian ranking.

Subjects' driving accuracy percentage varied in the same range as in the modelling stage. It should again be noted that both subjects hit all their tee shots at par 4 and par 5 holes with a 1-wood (driver). The green in regulation percentage was higher than 44% over the three-day period of LAOGC 2011, while the scrambling percentage for both subjects was below 30%. Over the three-day period of LAOGC 2011, both subjects averaged no fewer than 33 putts per round; only once was the average (per round) of putts per green in regulation less than two putts (Table 5).

Subject A's sport performance score declined round by round, nevertheless he achieved individual

Physiological demands	Golfer	1st day	2nd day	3rd day	4th day	Average
HR response (beats·min ⁻¹)	A	116	112	109	114	112.75 ± 2.99
	B	115	108	109	111	110.75 ± 3.1
HR _{max} (beats·min ⁻¹)	A	155	151	150	157	153.25 ± 3.3
	B	155	147	148	156	151.5 ± 4.65
Total energy expenditure (kcal)	A	1447	1446	1594	1456	1485.75 ± 72.31
	B	1582	1590	1742	1573	1621.75 ± 80.47
Energy expenditure per minute (kcal·min ⁻¹)	A	5.69	5.63	5.69	5.67	5.67 ± 0.03
	B	6.25	6.16	6.19	6.14	6.19 ± 0.05
Energy expenditure per kilogram (kcal·kg ⁻¹)	A	23.34	23.32	25.71	23.48	23.96 ± 1.17
	B	23.26	23.38	25.62	23.13	23.85 ± 1.19
EPOCmax (mL·kg ⁻¹)	A	10	8	8	9	8.75 ± 0.96
	B	10	6	7	8	7.75 ± 1.71
VO ₂ max (mL·kg ⁻¹ ·min ⁻¹)	A	44	42	43	44	43.25 ± 0.96
	B	43	39	40	42	41 ± 1.83
Maximal respiration rate	A	40	38	39	39	39 ± 0.82
	B	41	38	38	40	39.25 ± 1.5
Maximal ventilatory response (L·min ⁻¹)	A	71	60	67	64	65.5 ± 4.65
	B	76	62	60	73	67.75 ± 7.93
Training effect (scale, 1–5)	A	1.3	1.2	1.2	1.3	1.25 ± 0.06
	B	1.3	1.2	1.2	1.2	1.23 ± 0.05

Table 4. Physiological demands during the four-day period of competition modelling (mean ± SD)

Sport performance indicators	Golfer	1st day	2nd day	3rd day	Average
Driving accuracy (%)	A	76.92	61.54	61.54	66.67 ± 8.88
	B	53.85	69.23	69.23	64.1 ± 8.88
Green in regulation (%)	A	61.11	44.44	44.44	50 ± 9.62
	B	44.44	55.56	50	50 ± 5.56
Scrambling (%)	A	28.57	10	10	16.19 ± 10.72
	B	10	12.5	22.22	14.91 ± 6.46
Putts per green in regulation	A	1.82	2.25	2.13	2.07 ± 0.22
	B	2	2.3	2.11	2.14 ± 0.15
Putts per round	A	33	35	37	35 ± 2
	B	36	37	35	36 ± 1
Strokes (1–9 holes)	A	37	46	41	41.33 ± 4.51
	B	39	41	45	41.67 ± 3.06
Strokes (10–18 holes)	A	38	38	46	40.67 ± 4.62
	B	44	41	39	41.33 ± 2.52
Strokes (1–18 holes)	A	75	84	87	82 ± 6.24
	B	83	82	84	83 ± 1

Table 5. Sport performance indicators in the Lithuanian Amateur Open Golf Championship 2011 (mean ± SD)

career record in the 1st round (Table 5). The scores for the front and back nine holes were variable. Subject B's score was stable over the three days, even though the round-by-round score increased for the front nine holes and decreased for the back nine holes.

DISCUSSION

The aim of this study was to determine a suitable precompetition model and taper for junior golfers to optimize their sport performance. The simulation of four days of competition modelling followed by six days of tapering, with the practice round held more than one day before the main competition, had a positive effect on our amateur junior golfers' sport performance. Hence, the findings suggest that adequate preparation is necessary for competitions with specific conditions, as was the case with LAOGC 2011, which expanded play to three rounds.

The modelling of competition conditions (Morya, Ranvaud, & Pinheiro, 2003; Rhea et al., 2006; Gore, McSharry, Hewitt, & Saunders, 2008) and the reduction in training load (tapering) just before a major competition (Mujika & Padilla, 2003; Bosquet, Montpetit, Arvisais, & Mujika, 2007; Pyne et al., 2009) are effective methods to improve athletes' sport performance. The more that training can mimic the physiological demands and conditions of competition, the greater will be the performance improvement that can be expected (Rhea et al., 2006). Coaches should model training sessions so that their duration and the amount of recovery time more closely mimic game situations (Rhea et al., 2006). When conditions of competition are specific, adequate preparation is necessary (Gore et al., 2008).

Because of the specific conditions of LAOGC 2011, our two subjects had to adjust their preparation programmes to optimize their performance in the main competition. This process involved a combination of four days of competition modelling followed by six days of tapering. Applying this kind of programme allowed the subjects to achieve their best sport performance (at LAOGC 2011) of their individual careers. Four days of competition modelling not only allowed them to simulate the competition conditions, but also to simulate the practice round. The scoring average over the four days of competition modelling was 87.25 strokes for subject A and 86.25 for subject B. The scoring

average (A, 86.67; B, 85.33) of the first three days (1–3) of competition modelling was 0.66 strokes (A) and 1.34 strokes (B) less than the scoring average (A, 87.33; B, 86.67) of the last three days (2–4) of competition modelling. The results showed that the fourth day of play could worsen sport performance, which implies that three days of play without a practice round may be more suitable for our subjects than four days of play with the practice round held on the first day. It is for this reason that our subjects did not participate in the practice round one day before LAOGC 2011. Their practice round was played three days before LAOGC 2011, in the tapering stage.

The locomotion and physiological demands of subjects (recorded during the four days of competition modelling) were in line with the findings of other studies. A single round of golf can last from 2.5 to 6 h (Smith, 2010); the distance covered is generally less than 10 km (Kobriger, Smith, Hollman, & Smith, 2006; Zunzer, von Duvillard, Tschakert, Mangus, & Hofmann, 2013). The HR response range is reported as 100–120 beats·min⁻¹ (McKay et al., 1997; Burkett & von Heijne-Fisher, 1998; Stauch, Lui, Giesler, & Lehmann, 1999); the range for total energy expenditure is 960–1954 kcal and that for energy expenditure is 6.0–11.8 kcal·min⁻¹ (Smith, 2010). Our additional findings suggest, that playing golf did not have a positive training effect on the subjects' aerobic fitness (1.2–1.3 – recovery zone). In considering the player's optimization from a multidisciplinary perspective, the role of physiology should be seen as equally important as other contributing factors (Smith, 2010). Therefore, young golfers should be advised to include aerobic training sessions in their training programmes with the aim of improving sport performance.

Subjects' sport performance indicators recorded over the four-day period of competition modelling and the three-day period of LAOGC 2011 revealed that subjects' long-game skills (DA, GIR) were at a higher level than their short-game skills (scrambling; putts per GIR; putts per round). In the future, it is necessary for junior golfers to improve their short-game skills because indicators describing these skills have the strongest correlations with scoring average (Hellström, 2009 a).

Because neither subject undertook any physical conditioning during the golf season, only the technical training loads were decreased in the tapering stage. Subjects decreased training frequency (25%) and volume (16.67%) in the

practice areas, and frequency (33.33%) of playing rounds of golf in the tapering stage compared with their annual training programme, while the intensity of training sessions in the practice areas and of playing rounds of golf was the same as previously. This mode of reduction of training load is not in line with recommendations for effective tapering, where the general guidelines indicate a 2–3-week period incorporating a 40–60% reduction in training volume following a progressive non-linear format, maintaining training intensity, and a modest (if any) reduction (~20%) in training frequency (Mujika & Padilla, 2003; Bosquet et al., 2007; Pyne et al., 2009). However, these recommendations are for endurance sports athletes and relate to physical training loads. The expected mean improvement in individual performance time with an effective taper is 2–3%, ranging from 0 to 6% in trained athletes (Mujika & Padilla, 2003).

A combination of four days of competition modelling and six days of tapering allowed our junior golfers to improve their sport performance: the scoring average at LAOGC 2011 was 6.02% (A) and 3.77% (B) lower than for the four days of competition modelling. These results might be determined by the key indicators of sport performance in golf (Hellström, 2009 a): the green in regulation percentage was 8.33% (A) and 6.95% (B) higher at LAOGC 2011 compared with that in the competition modelling stage. The scrambling percentage was also 7.34% (A) higher at LAOGC 2011. Furthermore, subject A recorded two putts per round and subject B 1.5 putts per round fewer at LAOGC 2011 compared with the competition modelling stage. However, the driving accuracy

percentage was 4.48% (A) and 5.13% (B) lower at LAOGC 2011 compared with the competition modelling stage.

Comparative analysis of different cases showed different effects on sport performance (scoring average) at LAOGC 2011. Both models (1–3 days and 2–4 days of competition modelling) also indicated an improvement in sport performance. The scoring average at LAOGC 2011 was 6.1% (A) and 4.23% (B) lower compared with that for the last three days of competition modelling, while the scoring average at LAOGC 2011 was 5.39% (A) and 2.73% (B) lower compared with that for the first three days of competition modelling. The decision not to play a practice round one day before LAOGC 2011 was correct (Mujika & Padilla, 2003; Pyne et al., 2009); this is confirmed by the scores for the third day, which were worse compared with those for the first and second days for both subjects at LAOGC 2011, and by the results of the competition modelling stage with the practice round held on the first day.

CONCLUSIONS

The simulation of four days of competition modelling followed by six days of tapering including a practice round held three days before competition was effective in improving the sport performance of junior golfers in a three-day competition.

Further research is needed for detecting the effectiveness of competition modelling and tapering on sport performance in golf.

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IS IT IMPORTANT TO TEACH LITHUANIAN CHILDREN SWIMMING? ANALYSIS OF DROWNING AND SCHOOLCHILDREN'S KNOWLEDGE OF SAFE CONDUCT AT THE WATER

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ABSTRACT

Background. Research aim was to investigate statistical data of children and youth's (19 years old and under) deaths from drowning in the period from 2000 to 2012, as well as to establish the I–IVth form students' self-assessment of swimming skills and knowledge of safe swimming and safe conduct at the water.

Methods. Statistical data analysis and questionnaire survey methods were used in the research. The content of the questionnaire consisted of questions about the subjective self-assessment of personal swimming skills and knowledge of safe swimming and safe conduct at the water. Research sample included I–IVth form students, $n = 949$ (459 girls and 490 boys). The research results were analysed using statistical methods and SPSS 15.0 for Windows.

Results. Statistical data analysis showed the facts that during the period of 2000 to 2012, deaths of 487 children and youths (19 years old and under) were caused by accidental drowning, which on average accounts for 37.5 deaths yearly; 80.3% of all drowned persons were males.

The data of the questionnaire survey showed that 67.2% of students reported that they could swim. Boys evaluated their swimming skills better than girls ($\chi^2 = 12.486$; $p < .05$), although in most cases they were able to swim only short distances. The knowledge of children of the same age about safe conduct at the water was not statistically different in the aspect of gender ($p < .05$) and it was correct enough. However, even 22.7% of students (23.1% of the girls and 22.2% of the boys) would dare to swim alone if they had an inflatable wheel, mattress or other tool ($p > .05$).

Conclusions. Among the research participants, 30.4% of the girls and 20.4% of the boys could not swim ($\chi^2 = 12.486$; $p < .05$). Most of the students were aware of the rules of safe conduct at the water, but some of them had rather poor knowledge about this. In case of emergency in the water students would respond differently to the situation: 84.2% of the students themselves would not jump to rescue drowning people, but they would turn to adults for help or cast life-saving tools. However, part of the boys (16.6%) were more likely than girls (6.9%) to jump to rescue friends ($p < .05$) at the risk of their own life. Children's responses show that even in primary grades it is important to familiarise children with ways and means to rescue drowning people.

Keywords: drowning, swimming skills, water safety, self-assessment.

INTRODUCTION

Children are the future of the nation; considering this, WHO, UNICEF, European Council and other international organizations are concerned about each country's measures to provide conditions for children to grow up healthy, get appropriate education and

possibility to study, to develop health and safety related habits. Lithuania is not exclusion in this, as one of the priorities of its system of education is the development of habits that would allow children to feel safe and comfortable under different conditions throughout their life.

However, the data of WHO show 42 thousand deaths were caused by unintentional injuries in the 0–19 age group in Europe in 2004. Car accidents, fires, drowning, poisoning, falling down are the main causes of death for children and adolescents. Even 14% of all the recorded cases were drowning (WHO European, 2009). In this context, teaching children to swim and instructing them about safe conduct at the water plays a particularly important role as a preventive means to decrease the number of cases of drowning.

The Government of the Republic of Lithuania, considering children's ability to swim as a unique and vitally important habit, approved the programme "Teaching children to swim in Lithuanian schools of general education" for the period of 2008 to 2015 as a preventive means for accidents in the water. The programme is targeted at uniting a potential of various institutions and using current swimming infrastructure as well as human resources as effectively as possible in order to reach the main aim of the programme – to teach as many Lithuanian schoolchildren as possible to swim and observe rules of safe conduct at the water.

The aim of this work was to carry out analysis of statistical data of deaths of children and young people (19 years and under) caused by drowning in the period of 2000 to 2012, as well as to establish primary grade students' knowledge levels by subjective self-evaluation of their own swimming skills and safe conduct at the water.

METHODS

Analysis of statistical data. On the basis of the data provided by the Lithuanian Department of Statistics (<http://osp.stat.gov.lt/statistiniu-rodikliu-analize?id=1490&status=A>), analysis of the number of accidental drowning cases for children and young people aged 19 years and under during the period of 2000 to 2012 was carried out.

Questionnaire survey was used to collect data on students' subjective self-evaluation of their swimming skills, as well as their knowledge about safe conduct at the water. A special questionnaire was developed for the research following the compulsory recommendations and requirements. The questionnaire was approved by Lithuanian Swimming Federation specialists and the study was approved by the Department of Physical Education and Sports under the Government of the Republic of Lithuania (hereinafter – Department of Physical

Education and Sports). Eighteen questions were included into the questionnaire concentrating on respondents' subjective self-evaluation of personal swimming skills as well as on their knowledge about safe conduct at the water. Anonymous questionnaire survey was carried out in May, 2012, prior to the beginning of the Department of Physical Education and Sports supported programme for teaching schoolchildren to swim. All the respondents participated in the research on voluntary basis, with the approval of their school administration and parents. At first, pupils were informed about the aim of the research and instructed how to fill in the questionnaire. They were asked to answer the questions independently and honestly. Average duration of filling in the questionnaire was 15 to 20 minutes. The investigated group included the children from I–IVth grades of Kaunas, Šakiai, Šiauliai, Prienai, Vievis, Kaišiadorys, Utena and Druskininkai schools, participating in the Department of Physical Education and Sports supported programme projects. The results of the survey were processed applying the χ^2 analysis criteria in different gender groups. Chi square (χ^2) criterion was used to validate the significance of differences in the results.

To validate statistical hypothesis, significance level $p < .05$ was applied.

RESULTS

Analysis of the accidental drowning data for children and youth in the group of the investigated persons aged 1 to 19 years produced 487 recorded cases in 2000 to 2012, 37.5 cases per year on average. Average annual records in separate age groups were the following (respectively): from 1 to 4 years – 9.1 cases, from 5 to 9 years – 7.9 cases, from 10 to 14 years – 6.9 cases, from 15 to 19 years – 13.5 cases (Figure 1).

As to gender, the numbers of drowning cases were 4 times greater for male persons (80.3%) than female (19.7%). Drowning explains 15.6% of all external death cases. The data analysis of different age groups demonstrated the greatest percentage of all the drowned persons being from 15 to 19 years olds (36.1%) (Figure 2).

Questionnaire survey aimed at establishing children's self-assessment of their ability to swim as well as their knowledge about safe conduct at the water. The results of the survey demonstrated that subjectively assessing their swimming skills, even 67.2% of the respondents stated they were

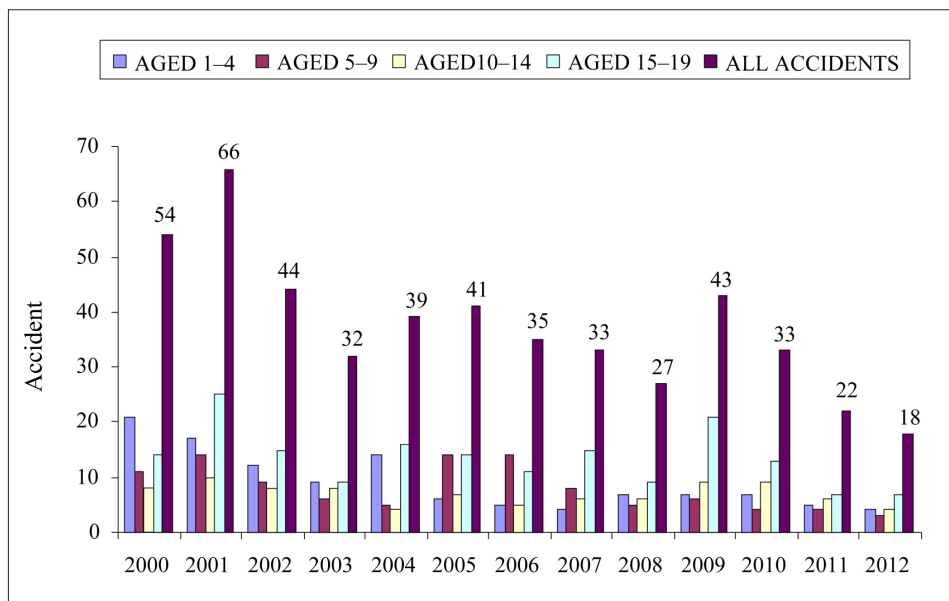


Figure 1. Statistics of accidental drowning of children and youth aged from 1 to 19 years, in the period from 2000 to 2012 (number of cases)

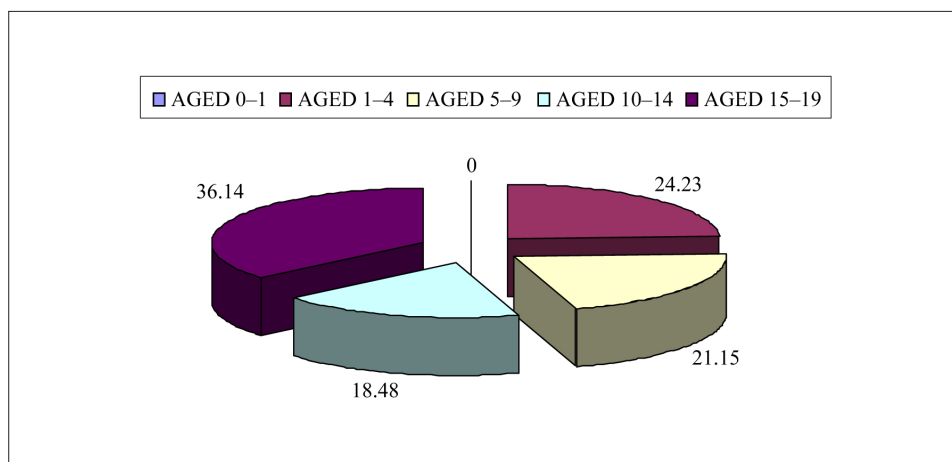


Figure 2. Percentage distribution of accidental drowning cases according to the age of children and youth

able to swim; 25.6% reported their inability to swim, while 7.2% of the respondents could not assess their swimming skills. In the aspect of gender, statistically significant differences were established: 30.4% of the girls and 20.4% of the boys reported that they could not swim ($\chi^2 = 12.486$; $p < .05$).

Aiming at finding out schoolchildren's perceptions of the statement "I can swim", they were asked to point out the distance which they would be able to overcome by swimming in a more detailed way: "I can swim the distance similar to a sports hall", "I can swim the distance similar to a classroom", "I can't swim". Following the answers to such statements, 35.7% of children pointed out that they were able to swim the distance close to a sports hall, 40% of them indicated the distance similar to a classroom, and 24.3% of them reported

their inability to swim. The results show that the boys more (42.3%) than the girls (29.6%) think they can swim a longer distance (similar to a sports hall). More girls (43.7%) than boys (36.2%) stated that they could swim a shorter distance (similar to a classroom) ($\chi^2 = 16.603$; $p < .05$). However, the interviews with swimming instructors showed that starting their participation in the swimming programme, students can hardly stay up in the water and are not able to swim longer distances during their first practice sessions. This has been also confirmed by the research of Grigonienė and others (2009) showing that children who think they can swim in fact are able to cover only some meters in the water, and very few of them can swim a 50 m distance.

Answering the question "In your opinion, can children go into the water alone, without the

supervision of adults?”, 95.4% of the schoolchildren (96.3% of the girls and 94.3% of the boys) agreed that children could not go into the water alone. Rather few children, 3.4% (2.2% of the girls and 4.6% of the boys), were self-reliant and thought that they could go into the water alone. There was no statistically significant difference between the girls’ and the boys’ answers ($\chi^2 = 4.131$; $p > .05$). However, even 22.7% of the respondents (23.1% of the girls and 22.2% of the boys) would go into the water alone if they had inflatable wheels, mattresses or other tools; the percentage of girls keeping to that opinion was slightly greater than that of boys. Nevertheless, the majority of the children – 71.0% (69.6% of the girls and 72.5% of the boys) thought that going into the water alone was dangerous, even with inflatable tools; 6.3% of the respondents were not sure if they could go into the water alone even with inflatable tools ($\chi^2 = 2.047$; $p > .05$).

Most pupils (95.1% of the girls and 94.1% of the boys) were aware that swimming was not allowed straight after meal. This is one of the rules of safe conduct at the water. According to the recommendations of swimming specialists, the interval between having a meal and swimming should be no less than 60 minutes (Skyrienė & Tarūtienė, 2004). Only 1.7% of the pupils (1.2% of the girls and 2.2% of the boys) saw no danger in going into the water straight after a meal ($\chi^2 = 1.305$; $p > .05$).

The children admit that during their stay in the water, eating and chewing gum is prohibited because of the risk of a choke. Only 0.8% of the girls and 1.7% of the boys thought that chewing gum in the water was not dangerous ($\chi^2 = 1.647$; $p > .05$).

Bathing in the sea, lake or river under unfavourable weather conditions (strong wind, rain, lightening) is dangerous, and 98.8% of the pupils were aware of this information. Comparison of girls’ (99.2%) and boys’ (98.5%) answers did not reveal significant differences ($\chi^2 = 2.022$; $p > .05$).

Answers to the question “Is it safe to walk and play on a frozen river, lake or pond” showed that 94% of children (94.9% of the girls and 93% of the boys) knew it was unsafe; 2.5% of children would have enough courage to walk on the frozen water, while 3.5% could not tell how they would behave. The answers were not significantly different between the groups of the girls and the boys ($\chi^2 = 1.547$; $p > .05$).

It was interesting to learn about schoolchildren’s possible behaviours if their friends accidentally

found themselves in the water under ice. Almost half of the respondents (44.7%) (45.5% of the girls and 43.8% of the boys) would not move towards the ice-hole, instead they would pass a stick or other thing to a friend for assistance thus rendering help. As many as 4.7% of the girls and 5.9% of the boys would not be afraid and they would try to help their friends giving them a hand; 37.3% of the children thought that they would not be able to help a friend, and they would rather turn to adults for help. Even 10.6% of the children would call Single Emergency Call Number 112. The rest 2.2% of the respondents marked the answer “I don’t know” or “other” ($\chi^2 = 4.025$; $p > .05$).

Analysis of the results, provided by the children’s answers to the question “What would you do if you saw your friend drowning?”, showed that 84.2% of children (88.6% of the girls and 79.5% of the boys) would throw some unsinkable device or tool to a friend and would run to adults for help; 6.9% of the girls and 16.6% of the boys were self-reliant, they would jump into the water to help their friend, 0.6% of the respondents would run home, and 2.1% would not know what to do ($\chi^2 = 21.958$; $p < .05$).

According to the results of the answers to the question “Do you feel you can swim well enough to be able to render help to drowning friend?”, 49.2% of the boys and 38.2% of the girls thought that they could swim well and could help their drowning friend; 44.5% of the girls and 35.3% of the boys did not feel strong enough to render help to a drowning friend themselves, while 16.4% of the respondents (17.3% of the girls and 15.5% of the boys) would admit to be rather weak swimmers in this situation ($\chi^2 = 12.192$; $p < .05$).

Even 70.2% of the girls and 75.6% of the boys thought that ability to swim was very important; 26.1% of the girls and 20.3% of the boys reported swimming habit to be important enough, and only 3.9% did not see much importance of it ($\chi^2 = 5$; $p > .05$).

DISCUSSION

Swimming and other entertainment at the water give pleasure to the majority of children; it is the source of joy and positive emotions. However, each year in Europe number of cases of drowning children exceeds 500, which is on average 14 drowned children yearly. Drowning not causing death occurs at least twice often. The latter is dangerous because it might cause a long-

term disability including brain violation, memory or learning ability disorders, or temporary loss of the main body functions (Meyer, Theodorou, & Berg, 2006). Lithuania is in a leading position in Europe according to the number of drowned children (Sethi, Towner, Vincenten, Segui-Gomez, Racioppi, & Sethi, 2008).

The greatest drowning risk is faced by people who cannot swim and get into the water. Nevertheless, dangers can await people who can swim as well, in particular the ones whose behaviours at the water are risky and irresponsible. Due to unsafe conduct at the water, at the beginning of the swimming season in open waters, many severe injuries occur. Disasters occur when the swimming environment and personal capacities are inadequately estimated. Often people get injuries when jumping into the water in shallow places, especially jumping into the water head down. Integral part of children and adults' teaching swimming process is the development of their habits of safe conduct at the water (Bielec & Saklak, 2013).

Although teaching swimming is included into General Programmes of Lithuanian General Education (2011), swimming lessons do not receive sufficient attention yet. The Program of teaching schoolchildren to swim receives allocations from the budget of Department of Physical Education and Sports, as well as from the budgets of certain Lithuanian municipalities concerned, however, the programme still lacks professional coordination and sufficient financing. During summer holiday programmes, children are taught to swim only in educational institutions with active management traditions, or the activity is run by the administration of swimming facilities (Zuozienė, Kavaliauskas, Skyrienė, Grigonienė, & Pečiūnas, 2007).

The results of the questionnaire survey carried out in 2012, showed that prior to beginning of the programme funded by the Department of Physical Education and Sports, many schoolchildren were aware of some rules of safe conduct at the water. The comparison of girls' and the boys' answers about safe conduct at the water allows suggesting that opinions of schoolchildren of the same age do not differ in the aspect of gender ($p > .05$). However, boys gave higher evaluations to their swimming skills than girls ($\chi^2 = 12.486$; $p < .05$), although in fact most often they could swim only short distances. Boys (16.6%) more often than girls (6.9%) would jump into the water to save their friend ($\chi^2 = 21.958$; $p < .05$). They feel more

confident in the water and very often too much rely on their abilities. Thus it is important to explain to the children that saving a drowning person is not an easy task, which requires much physical effort and good swimming skills. According to statistical data, male persons are at a higher risk of drowning than the female ones. Such tendencies are observed both in Lithuania and other countries (Sethi et al., 2008).

Analysis of the cases of drowning in the group of children and youths under 19 years of age, as well as discussions of the means of prevention of such cases place teaching swimming to an important position. In the United Kingdom, which is considered to be one of the most successful countries in drowning prevention, much attention is given to teaching children to swim. The country implements the programme "Swim 4 Free", and swimming lessons are included into school curriculum together with the requirements for all children to be able to swim a 25 meter distance.

Children swimming programmes are carried out in many countries of high economy level. Swimming lessons are compulsory in Austria, Belgium, Check Republic, Estonia, Sweden (MacKay & Vincenten, 2007). Starting from 5 years of age, children have a possibility to learn to swim and improve their swimming skills. During swimming lessons, children are taught to dive, swim underwater, breath correctly and keep vertical position in water. WHO promotes the notion of teaching children to swim considering it as a component for safety in the water, altogether reminding that being able to swim does not itself guarantee drowning prevention.

Thus children and adults' safe and responsible conduct at the water, at open water resources, proper exploitation of swimming pools, preparation of lifeguards, qualified assistance of lifeguards and medical personnel in case of accident in the water is very important (Brenner, 2003; Li Yang, Quan-Qing Nong, Chun-Ling Li, Qi-Ming Feng, & Sing Kai Lo, 2007).

CONCLUSIONS

1. Statistical data analysis demonstrated that in Lithuania, during the period of 2000 to 2012, unintentional drowning were the death causes for 487 children and youths (aged 19 and under), which on is 37.5 cases yearly average. Even 80.3% of all the drowned children were boys.

2. As many as 30.4% of the girls and 20.4% of the boys who participated in the research reported that they were not able to swim. The students, having indicated their ability to swim, very often tended to overestimate their personal swimming skills.

3. Analysis of students' knowledge about safe conduct at the water showed that the majority of them were aware of it; however, some students possessed poor knowledge in this field. No significant differences were established between gender groups.

4. In case of accident in the water, students would respond differently to the situation: 84.2% of them would not jump straight into the water to render help, but they would rather address adults for assistance or pass tools to a drowning person for rescue. However, some boys (16.6%) and girls (6.9%), saving a friend, would jump into the water, thus risking their lives. Children's responses show that even in primary grades it is important to teach children to swim and familiarise them with ways and means of rescuing drowning people.

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The manuscript must be written in English. The guideline for the preparation of manuscripts is the *Publication Manual of the American Psychological Association (6th edition)*.

The title page should contain the title of the article; the authors' names and surnames and their institutional affiliations (indicating the city and the country); mailing address, telephone and fax number, and e-mail address for the corresponding author.

Page 2 should include the **abstract** (250 words) revealing the scientific problem and providing the major data of the research. It must be structured into the following sections: Background. Methods. Results. Conclusion. **Keywords** (from 3 to 5 informative words and/or phrases) should not duplicate words in the title.

The full text of the manuscript should begin on page 3. It should be structured as follows:

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Acknowledgements. On the Acknowledgement Page the authors are required to state all funding sources, and the names of companies, manufacturers, or outside organizations providing technical or equipment support (in case such support had been provided).

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Scientific supervisor Prof. Dr. Habil. Laimutė Kardelienė.
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