

LASE JOURNAL OF SPORT SCIENCE
is a Scientific Journal published two times per year in Sport Science
LASE Journal for sport scientists and sport experts/specialists

Published and financially supported by
the Latvian Academy of Sport Education in Riga, Latvia

p-ISSN: 1691-7669
e-ISSN: 1691-9912
ISO 3297

Language: English
Indexed in Index Copernicus

Printed in 100 copies

Executive Editor:
Inta Bula – Biteniece
Ilze Spīķe
Language Editor:
Iveta Boge

Printed and bound: "Printspot" Ltd.
Cover projects: Uve Švāģers - Griezis
Address: 14-36 Salnas Street
Riga, LV1021, Latvia
Phone: +371 26365500
e-mail: info@printspot.lv
website: www.printspot.lv

Editorial Contact Information,
Publisher Contact Information:
Inta Bula-Biteniece
Latvian Academy of Sport Education
Address: 333 Brivibas Street
Riga, LV1006, Latvia
Phone.: +371 67543410
Fax: +371 67543480
E-mail: akademija@lspa.lv

The annual subscription (2 issues) is 35 EUR
(20 EUR for one issues).
Order form of LASE Journal of Sport
Science Exemplary order form of
subscription is accessible
in our website: www.lspa.lv/research

Please send the order to:
LASE Journal of Sport Science
Latvijas Sporta pedagoģijas akadēmija
Address; 333 Brivibas Street
Riga, LV1006, Latvia
Phone: +371 67543410
Fax: +371 67543480
E-mail: akademija@lspa.lv

Method of payment:
Please send payments to the account of
Latvijas Sporta pedagoģijas akadēmija
Nr. 90000055243
Account number: LV97TREL9150123000000
Bank: State Treasury
BIC: TRELLV22
Postscript: subscription LASE Journal
of Sport Science

Full-text available free of charge at <http://journal.lspa.lv/>

All papers are reviewed



Copyright © by the Latvian Academy of Sport Education in Riga, Latvia

INTERNATIONAL EDITORIAL BOARD

Chief Editor

Juris Grants (Latvia)

PhD, Professor

Latvian Academy of Sport Education

Members of the board:

Agita Ābele (Latvia)

PhD, Professor

Latvian Academy of Sport Education

Miklos Banhidi (Hungary)

PhD, Professor

University of West Hungary

Rolf Carlson (Sweden)

PhD, Professor

Swedish School of Sport and Health Sciences

Dmitriy Cherenkov (Russia)

PhD, Assoc. Professor

Russian State University of Physical Education, Sport Youth and Tourism

Antonio Cicchella (Italy)

PhD, Professor

University of Bologna

Leonīds Čupriks (Latvia)

PhD, Professor

Latvian Academy of Sport Education

Andra Fernāte (Latvia)

PhD, Assoc. Professor

Latvian Academy of Sport Education

Uldis Grāvītis (Latvia)

PhD, Professor

Latvian Academy of Sport Education

Juri Hanin (Finland)

PhD, Professor

Research Institute for Olympic Sports

Vello Hein (Estonia)

PhD, Assoc. Professor

University of Tartu

Anita Hökelmann (German)

PhD, Professor

Otto von Guericke University Magdeburg

Vladimir Issurin (Israel)

PhD, Professor

Wingate Institute for Physical Education and Sport

Rasma Jansone (Latvia)

PhD, Professor

Latvian Academy of Sport Education

Toivo Jürimäe (Estonia)

PhD, Professor

University of Tartu

Jānis Lanka (Latvia)

PhD, Professor

Latvian Academy of Sport Education

Artur Litwiniuk (Poland)

PhD, Assoc. Professor

The Jozef Pilsudski Academy of Physical Education

Kazys Milasius (Lithuania)

PhD, Professor

Vilnius Pedagogical University

Vahur Ööpik (Estonia)

PhD, Professor

University of Tartu

Krzysztof Piech (Poland)

PhD Assoc. Professor

The Jozef Pilsudski Academy of Physical Education

Inese Pontaga (Latvia)

PhD, Professor

Latvian Academy of Sport Education

Oscar Romero Ramos (Spain)

PhD, Professor

University of Malaga

Jerzy Sadowski (Poland)

PhD, Professor

The Jozef Pilsudski Academy of Physical Education

Roland Seiler (Switzerland)

PhD, Professor

University of Berne

Jānis Žīdens (Latvia)

PhD, Professor

Latvian Academy of Sport Education

ISSN 1691-7669 (ISO 3297)

LASE JOURNAL OF SPORT SCIENCE

Vol. 4, (2013) Nr. 2, pp. 2-135

CONTENTS

Publisher`s Note.....	3
<u>Original research papers</u>	
OUTDOOR EDUCATION AND OUTDOOR LIFE EXPERIENCE OF STUDENTS OF THE LATVIAN ACADEMY OF SPORT EDUCATION (LASE) Krauksta D., Liepiņa I.	4
THE ANALYSIS OF SUCCESSFULLY APPLIED TECHNIQUES IN PART 1 IN JU-JITSU FIGHTING Staller M.	14
EMG AND JOINT ANGULAR DISPLACEMENT DURING RUNNING AT DIFFERENT TERRAIN AND GROUND SURFACE CONDITIONS Nilsson J., Gjerset A., Johansen E., Lund M.	21
VALUE CONGRUENCE IN THE CONTEXT OF SOCIAL RESPONSIBILITY: BEST PRACTICES FOR SPORTS ORGANIZATIONS Vveinhardt J.	31
HIGH PERFORMANCE ATHLETES` DUAL CAREER POSSIBILITIES IN LATVIAN HIGHER EDUCATIONAL INSTITUTIONS Ābelkalns I., Geske A.	47
RELATIONSHIPS BETWEEN ADOLESCENTS' SELF-ESTEEM, AGGRESSION, TOBACCO AND ALCOHOL CONSUMPTION AND INVOLVEMENT IN SPORT ACTIVITIES AND GENDER Kisieliene A., Arlauskaitė D.	61
THE PHYSICAL EDUCATION TEACHERS' PROFESSIONAL ACTIVITY MOTIVATION AND PLANNING COMPETENCE Fernāte A.	72
ANALYSIS OF PRECOMPETITIVE PREPARATION OF THE ELITE ROWERS TOWARDS EUROPEAN CHAMPIONSHIP Petkus E., Dadelienė R., Raslanas A.	85
FUNCTIONAL CHANGES OF THE MUSCULAR-SKELETAL SYSTEM OF ATHLETES Solovjova J., Upītis I., Grants J., Kalmikovs J.J.	91
<u>Review papers</u>	
GYMS` SERVICE QUALITY EVALUATION IN KAUNAS CITY Grigaliūnaitė V., Pilelienė L.	98
THE EXISTENTIAL ASPECTS OF LEARNING IN PHYSICAL EDUCATION AND SPORTS ACTIVITY Veide M.	110
<u>Short communication</u>	
THE LIFELONG LEARNING STRATEGY FOR THE SPORT AND ACTIVE LEISURE SECTOR AT NATIONAL AND EUROPEAN LEVEL Grants J., Boge I., Budviķe I., Upītis I.	126
CURRENT NEWS.....	132
GUIDELINES FOR CONTRIBUTORS.....	133

Publisher`s Note

Dear Friends,

Welcome to the second annual edition of the LASE Journal of Sport Science in 2013. Every year the Latvian Academy of Sport Education (LASE) issues two editions of the Journal.

The second edition of the Journal 2013 comprises two parts. The first part of the issue, as traditionally, includes the Chapter of original research and review papers where young sport scientists together with supervisors present their original research in sport science, as well as the short communication, which is a small, but important part to inform society about different projects LASE academic staff are involved in, about immediate international conferences in sport science or summer schools. The second part of the issue is devoted to the 6th Baltic Scientific Conference “Sport Science for Sustainable Society” which took part on April 23-25, 2013 in Riga, Latvia. The Conference theme involves sustainable society where knowledge and skills are shared in the sport, health and active leisure sector. The Journal Editorial Board did selection of the manuscripts and welcomes the opportunity to publish few of them.

I express my deepest gratitude to the authors and reviewers of the manuscripts and to the International Journal Publishing Commission for their great job in the preparation of the two editions of our Journal in 2013.

On behalf of the Journal Editorial Board,
Prof. Juris Grants

ORIGINAL RESEARCH PAPER

OUTDOOR EDUCATION AND OUTDOOR LIFE EXPERIENCE OF STUDENTS OF THE LATVIAN ACADEMY OF SPORT EDUCATION (LASE)

Daina Krauksta, Inga Liepina

Latvian Academy of Sport Education,
Address: 333 Brivibas Street, Riga, LV 1006, Latvia
Phone: +371 67799543, mob.: +371 26525949
E-mail: Daina.Krauksta@lspa.lv, Inga.Liepina@lspa.lv

Abstract

Outdoor life – outdoor activities, outdoor education and gaining experience are becoming more and more significant in different education programs and for different target groups. What is outdoor life, outdoor life experience? In the world scientifically-methodological literature the notions “outdoor life and education” are defined as, for example, outdoor environment education, out-of-door education, education of outdoor life experience, outdoor classes.

The aim of the research is to investigate theoretical aspects of outdoor education – outdoor education tendencies in Latvia and to define what outdoor education is, as well as to analyze outdoor life experience, based on students’ studying at the Latvian Academy of Sport Education outdoor life experience during the summer camp process.

Taking the investigation of the literature sources and outdoor life education tendencies in Latvia as the basis, the theses defining outdoor education are given. It was also concluded in the research that the summer outdoor camp has increased students’ outdoor life experience of living in outdoor environment, adapting to nature and environmental conditions, communication, attitude and understanding about the protection of environment and nature, gaining also emotional satisfaction.

Key words: *outdoor education, outdoor life experience, tourism and orienteering studies.*

Introduction

Outdoor life – outdoor activities, outdoor education and gaining experience are becoming more and more significant in different education programs and for different target groups. Different outdoor life training

centers and organizations, for example, scout and guide organizations, children and youth interest education centers, children camps, and others work actively in Latvia, and their action directions are environment education, the studies of outdoor life skills and experience. The students of the Latvian Academy of Sport Education (LASE) are also acquiring outdoor life skills and experience in the summer outdoor camp and in the framework of the orienteering study program.

The aim of the research was to investigate theoretical aspects of outdoor education and to analyze outdoor life experience. The research tasks were as follows:

1. To investigate outdoor education tendencies in Latvia and define what outdoor education is.
2. To state students' outdoor life experience during the process of the summer camp.

Such research methods as the analysis of the literature sources and inquiry (questionnaire) were applied in the research.

The classes of tourism and orienteering study courses at LASE mostly involve student practical activity when students learn the best by practicing skills. One of the organizational forms of the classes where the necessary life skills are effectively learnt is the summer tent camp. During this camp students not only acquire knowledge and skills of tourism and orienteering, and take tests, but also learn outdoor life skills and abilities, that is, gain outdoor life experience.

What is outdoor life and outdoor life experience? In the world scientifically-methodological literature the notions "outdoor life and education" are defined as, for example, outdoor environment education, out-of-door education, education of outdoor life experience, outdoor classes.

In our opinion the most precise definition which combines and integrates all these categories is *outdoor education*. Outdoor education is linked with environmental education, with ecological education, with health improvement, with learning of outdoor life skills, with rest and adventure. Outdoor education, especially in recent years, is associated with the therapy of problem children and youth. Different authors consider the notions "environmental education", "outdoor education" and "outdoor experience education" as synonyms (Ford, 1986; Liedtke, Lagerstr-m, 2004).

In outdoor education most of authors, not rejecting the importance of formal education, emphasize more informal teaching, the teaching based on experience. In experience education informal education approach which is more dynamic, active and allows supplement the acquired knowledge and skills is prevailing (Kravale, 2006).

Learning based on outdoor life experience, that is learning by doing, facilitates not only application of definite knowledge in outdoor life conditions, but also develops problem solving skills, cooperation skills and the development of positive attitude towards each other, and, of course, one of the most essential real life skills – environment skill (Adkins, Simmons, 2002; Henderson, 2004; Higgins, Nicol, 2002; Liedtke, Lagerstr-m, 2004; Resnis, 2007; Turcova, Bartunek, Martin, 2007; Turcova, Neuman & Martin, 2004).

Simon Priest from the United Kingdom defines outdoor education as an experience based learning process following the principle “learning by doing” which mostly takes place being out of rooms. In outdoor education when learning a theme relationship between people and nature resources is emphasized (Priest, 1986).

Learning based on experience focuses on an individual’s experience in common learning process when every participant acquires the necessary essential cognitions to be applied later in life, and every participant can express and self-realize grounding on previously learnt knowledge.

Outdoor skills form an essential part of a many-sided personality, as they give the greatest experience and challenge, the most proper understanding about oneself and others, and what happens around. Outdoor occurrences – bruises, mosquito bites, rain – these are only some examples, which seem insignificant, but they have some importance in different situations.

Health specialists are worried and they warn us that our children will not live longer than their parents, as nowadays there are serious health problems. However, today farseeing and thinking education specialists have not put aside the questions linked with outdoor education and learning, and lead new generation back to ancestors’ life customs and traditions.

J. Neill has classified outdoor education definitions and divided them into two groups: the first – psychosocial definitions linked with a personality and social development; the second – definitions linked with environment, environment protection and ecology (Neill, 2008). The definitions of outdoor education are various, and A. Brookes points out that they should be developed both in time and space (Brookes, 2004).

Education specialists of different other fields – biology, ecology, medicine, sociology, pedagogy, psychology, also geography, sport and tourism, a.o., are linked with outdoor education, so it is interdisciplinary field education.

Having analyzed research literature and the tendencies of outdoor education in Latvia, it can be said that:

- outdoor education is a teaching and education process involving a set of activities corresponding to the education degree and target groups to acquire outdoor knowledge and skills (environment skills, outdoor basic skills, development of an individual and a group);

- the result of outdoor education is such a personality which in the situation of choice could critically analyze the situation and make adequate decisions facilitating staying of an individual and a group in outdoor conditions, create estimating attitude towards environment, teaching to live and do together with others;

- outdoor education in its broadest meaning cannot be imagined without learning based on experience and actually it is lifelong education where informal education plays the greatest role.

Why is life experience needed?

Firstly, because the most part of inhabitants in Latvia live in cities (69% – in cities, 31% – in the country), but at the same time many people strive to leave a city environment and gladly relax near nature, however it requires some skills and preparedness.

Secondly, outdoor life and staying in it give an individual values, understanding about the interrelation of the nature and people.

Thirdly, outdoor life experience gives an individual cognitions and findings about oneself (what I can do) in individual activities and participating in a group and team work.

Fourthly, when overcoming different hardships (the weather conditions, mosquito bites, bruises, overcoming obstacles, getting lost and various difficult tasks) an individual is forced to motivate him/herself more for action and getting solutions in overcoming hardships, at the same time getting moral, physical and emotional satisfaction, and confidence.

Fifthly, when acquiring experience directed towards outdoor knowledge, skills and abilities, every individual gains many valuable and essential cognitions, and he/she can interpret and use them in one's life more effectively than general applicable knowledge.

The summer camp program implemented at the Latvian Academy of Sport Education includes the development of essential knowledge and skills in real outdoor conditions with a definite aim to be able to apply the acquired knowledge and skills in one's further professional activity. It is important for future pedagogues. This process is linked with students' physical, emotional and mental experience, as:

1. It involves unusual physical load (hike for six hours, tourism rally race for four hours, moving in definite area and execution of various tourism technical elements, orienteering, tourism obstacle competition) where it is

necessary to express both an individual and team's knowledge and skill resources;

2. The process itself is very emotional involving uncertainty, excitement, even fear from individual up to the whole group and team participants' emotional feelings;

3. It involves staying (for five days) in outdoor conditions, and therefore it is significant for everyone's mental growth, as it helps a student be aware of the coexistence of environment, man and whole society, as well as it helps to cope with various more or less difficult changes associated with staying in nature.

An inquiry was carried out during the summer camp of the academic year 2010/2011. 71 students (40 male, 31 female) took part in the inquiry. The inquiry included 15 questions which according to outdoor experience acquiring were divided into four groups (parameters): group 1 – *Life in outdoor environment* (choosing the equipment and food, making a fire, cooking a warm meal); group 2 – *Adaptation to nature and environment conditions* (overcoming natural obstacles, the weather conditions, mosquitos, orienteering in a definite area, observing of individual hygiene); group 3 – *Interaction, communication and leadership* (the ability to survive and share with others, to undertake initiative, the ability to cooperate in a group or team); group 4 – *Understanding about the nature protection* (interrelation of a man and nature, understanding outdoor life in general).

The results of the inquiry before the camp showed that the least participants' outdoor experience was in the parameter *Life in outdoor environment* (according to the levels correspondingly 10.3%, 16.6%, 28.2%, 27.7%, 17.2%) (Fig. 1).

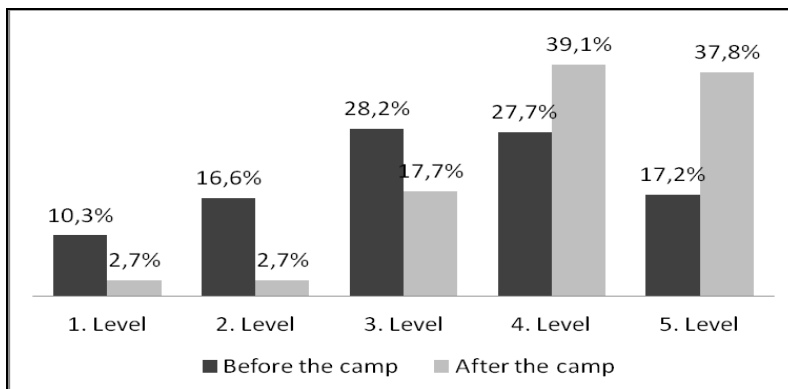


Figure 1. Life in outdoor environment (choosing individual and group equipment, choosing food, making a fire, cooking a warm meal)

In *Adaptation to nature and environment conditions* (according to the levels 11.6%, 19.0%, 24.6%, 25.4%, 19.4%) (Fig. 2).

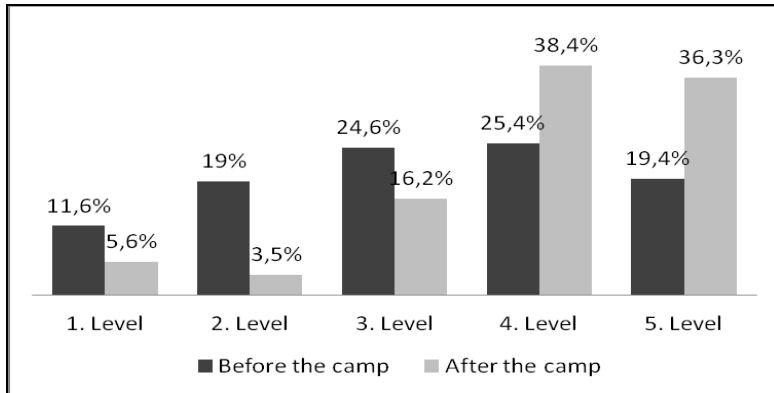


Figure 2. Adaptation to nature and environment conditions (overcoming natural obstacles, the weather and nature conditions, orienteering in a definite area, observing of individual hygiene)

In comparison with the parameter *Interaction, communication and leadership* (according to the levels correspondingly 1.4%, 8.5%, 25.4%, 39.3%, 25.4%) (Fig. 3).

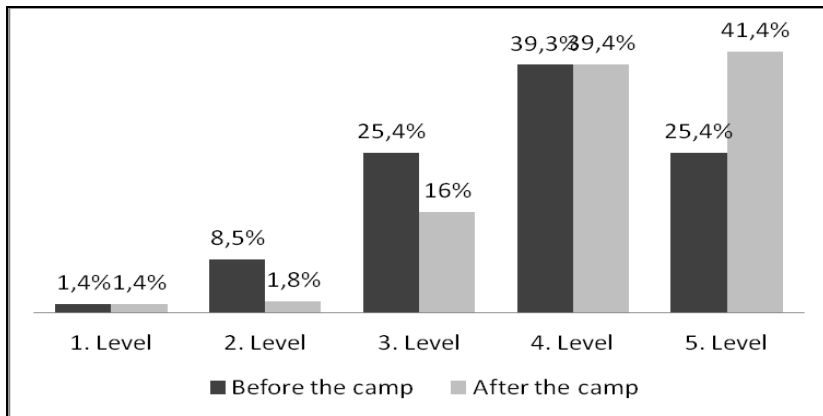


Figure 3. Interaction, communication and leadership (the ability to survive and share with others, to undertake initiative, the ability to cooperate in a group or team)

The parameter *Understanding about the nature protection* (according to the levels correspondingly 2.8%, 11.9%, 17.7%, 36.6%, 31.0%) where

the participants assessed this experience (in per cent) less on the 1st and 2nd level, but higher on the 3rd, 4th and 5th level (Fig. 4).

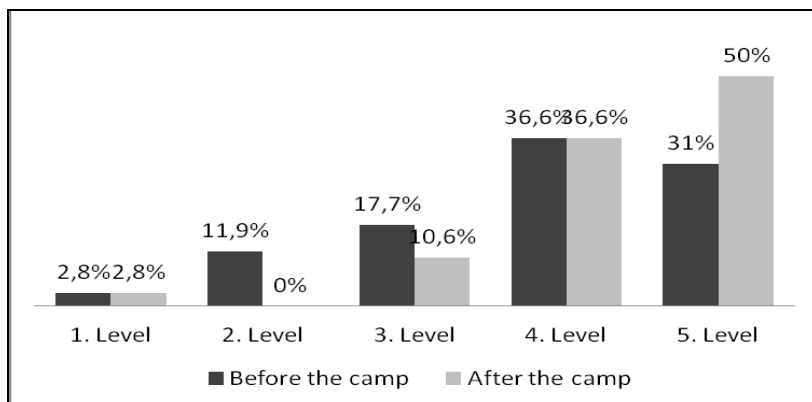


Figure 4. Understanding about the nature protection (interrelation of a man and nature, understanding outdoor life in general)

It is understandable, as the outdoor life skills and knowledge and adaptation to natural and environmental conditions mostly form and develop in practical activity, in real outdoor conditions, and only small number of students before the summer camp has the experience of sleeping outdoors, making a fire, cooking food on the fire, that is to live outdoor life. The interaction and communication skills are necessary for students not only in outdoor life, but also in other everyday activities (in a study group, training team, social life). Students have already acquired understanding and attitude about the nature protection while learning at general education schools and in general study courses at the Academy.

After the camp the indicators improved almost in all parameters and a greater number of students gave their assessment on higher levels, accordingly on the 3rd, 4th and 5th (Fig. 1, 2, 3, 4): *Life in outdoor environment*, correspondingly 2.7 %, 2.7%, 17.7%, 39.1 %, 37.8%; *Adaptation to nature and environment conditions*, correspondingly 5.6 %, 3.5%, 16.2%, 38.4 %, 36.3%; *Interaction, communication and leadership*, correspondingly 1.4 %, 1.8%, 16.0%, 39.4 %, 41.4% and *Understanding about the nature protection*, correspondingly 2.8 %, 0%, 10.6%, 36.6 %, 50.0%. The participants have given comparatively similar assessment on the levels and in parameters.

The participants' assessment about outdoor experience in general according to all parameters (Fig. 5) testifies that the summer camp process has succeeded students' acquiring of outdoor experience.

After the camp the indicators improved almost in all parameters and higher assessment was on the 3rd, 4th and 5th level.

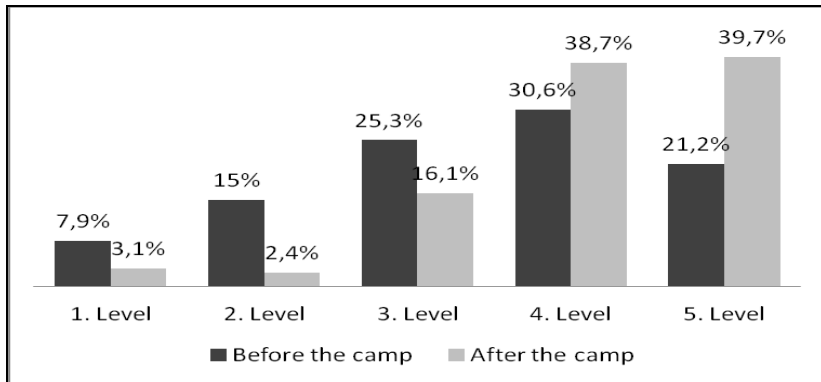


Figure 5. LASE students' outdoor experience before and after the camp

Before the camp 7.9 % of the participants have assessed their outdoor experience (Fig. 1) as corresponding to the 1st level, but after the camp the percentage was 3.1%; correspondingly 15.0 % and 2.4% of the participants have assessed their outdoor experience as suitable to the 1st level, 16.1% and 25.3% – to the 3rd level, 30.6% and 38.7% – to the 4th level and 21.2% and 39.7 % – to the 5th level.

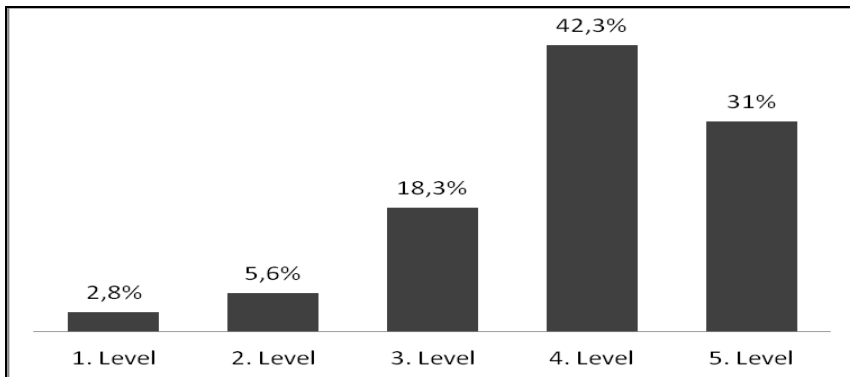


Figure 6. LASE students' assessment of emotional and mental renewal

The participants of the inquiry assessed also emotional and mental renewal after the camp (Fig. 6): level 1 – 2.8%, level 2 – 5.6%, level 3 – 18.3%, level 4 – 42.3% and level 5 – 31.0%.

Conclusions

Grounding on the investigation of the literature sources and outdoor education tendencies in Latvia the theses defining outdoor education are given.

The summer outdoor camp has increased students' outdoor experience of living in outdoor environment, adaptation to natural and environmental conditions, communication, attitude and understanding about the environment and nature protection, at the same time gaining emotional satisfaction.

References

1. Brookes, A. (2004). Astride a Long-Dead Horse. Mainstream Outdoor Education Theory and the Central Curriculum Problem. *Australian Journal of Outdoor Education*. 8(2), 22 – 33.
2. Enoiu, R., Moldovan, E., Enoiu, R.S. & Cioroiu, S.G. (2010). Experiential Outdoor Learning by Educational Tourism and Ecological Activities, Advanced Educational Technologies, 6th WSEAS/IASME *International Conference on Educational Technologies* (Edute 10), Kantaoui, sousse 3-6 May 2010, ISSN 1790-5109, ISBN 978-960-474-186-1, 129 – 133.
3. Ford, P. (1986). Outdoor Education: Definition and Philosophy. Retrieved January 21th, 2012 from <http://www.eric.ed.gov/PDFS/ED267941.pdf>
4. Henderson, K. (2004). Got Research in Experiential Education? Theory and Evidence. *Journal of Experiential Education*, 26(3), 184 – 189.
5. Higgins, P., & Nicol, R. (Eds.). (2002). Outdoor Education: Authentic Learning in the Context of Landscapes. *Kinda Kunskapscentrum*, Sweden, Vol. 2, 93.
6. Kravale, M. (2006). *Jauniešu neformālā izglītība Latvijā*. Doctoral Thesis, Daugavpils University, Daugavpils. ISBN 9984-14-315-5 [in Latvian]
7. Liedtke, G., & Lagerstr-m D. (2004). Outdoor Education or Education Outdoors – Educational Concepts Towards an Active Lifestyle? *Proceedings from the international symposium. Outdoor Sports Education*. Hrubá Skála, Czech Republic, 67 – 71.
8. Neill, J. (2008). *What is Outdoor Education? Definition (Definitions)*. Retrieved January 8th, 2012 from <http://wilderdom.com/definitions/definitions.html>
9. Priest, S. (1986). *Redefining Outdoor Education: A Matter of Many Relationships*. *Journal of Environmental Education*, Vol.17 (3), 13 – 15.

10. Resnis, M. (2007). *Patiesība ir tur – ĀRĀ*. Jaunatne, Vol. 17, 16 – 18. [in Latvian]
11. Turcova, I., Bartunek, D., & Martin, A. (2007). Outdoor Sports in Educational and Recreational Programmes. *Proceedings from 3rd International Mountain and Outdoor Sports Conference*, 23–26 November 2006, Hrubá Skála, Czech Republic. Praha: IYNF. ISBN 80-903577-4-1.
12. Turcova, I., Neuman, J., & Martin, A.J. (2004). Navigating the Outdoor Education Terminological Jungle: Outdoor Education in the Czech Republic. Pathways: *The Ontario Journal of Outdoor Education*, 16(2), 25 – 27.

Submitted: April 16, 2013
Accepted: October 31, 2013

ORIGINAL RESEARCH PAPER

THE ANALYSIS OF SUCCESSFULLY APPLIED TECHNIQUES IN PART 1 IN JU-JITSU FIGHTING

Mario Staller

Riga Teacher Training and Educational Management Academy,
Address: Imantas 7. līnija 1, Riga, LV-1083, Latvia
Phone: +371 67808010, mob.: +49(0)151-22289759
E-mail: mario.staller@gmail.com

Abstract

Empirical data of technical and tactical performance in ju-jitsu fighting (JJF) competitions are rare, making it hard to derive validated recommendations for JJF training. Therefore, the current study investigated successfully applied punching and kicking techniques, which were performed in JJF competition at a world-class level. For this purpose 399 techniques, which were applied at the 2010 World Championships and were awarded with points by the referees, were systematically analyzed. Results revealed that punches are more likely to score “ippon” than kicks. Furthermore, the straight punch with the backhand could be identified as the most successfully applied technique, which is most likely to score “ippon” as a single counter technique. Practical implications of the results for training and recommendations for tactics in competition are drawn. Therefore, it is suggested to focus on punches in order to score “ippon”. Furthermore, a more defensive fighting style increases the likelihood to be awarded “ippon” for a straight punch with the back hand, being the most dominant technique in part 1. Together with the existing literature it is suggested to behave tactically flexible and not to behave too defensive in ju-jitsu fighting fights. Further studies have to incorporate more techniques of different competitions at a world-class level.

Key words: *ju-jitsu fighting, straight punch with backhand, performance, training.*

Introduction

Ju-jitsu fighting (JJF) can be described as a high-intensity martial art and modern competition sport, in which the aim is to defeat the opponent using punches, kicks, takedowns, throws and ground techniques. JJF is one of three official competition systems of the Ju-Jitsu International Federation, and as such an official competitive sport at the World Games, which is

organized and governed by the IWGA, under the patronage of the International Olympic Committee (Ju-Jitsu International Federation, 2011). JJF is the most comprehensive discipline in ju-jitsu (Staller, 2008), since the competitors have to engage in distance combat (Part 1), in throwing and takedowns (Part 2), and in ground-fighting (Part 3). The system is divided into several categories according to sex and weight. A fight consists of one 3-minute round and has to be fought in every part. Three referees reward successfully applied techniques with “ippon” (2 or 3 points) or “waza-ari” (1 point). In order to win, an athlete has to have more points than his opponent after the regular fighting time. Another option to win is by “full ippon”, which means to have an “ippon” in every part. Penalties are divided into “light forbidden acts” (“shido”: 1 penalty point) and “forbidden acts” (“chui”: 2 penalty points). The addition of two forbidden acts results in losing the fight by “hansoku-make” (Ju-Jitsu International Federation, 2011).

Despite the growing professionalization, there is a lack of empirical studies focusing on JJF. Recommendations for practice are based on hypothetical considerations (Heckele, 2002) or are given on an abstract level (Renninghof & Witte, 1998), resulting in non-empirical validated curricula for JJF athletes. Since optimal performance at competition requires the integration of physiological, psychological, technical and tactical elements (Smith, 2003), the question arises regarding the technical and tactical elements to practice to which extent. Systematic video analysis of technical and tactical components of competitions provides a possibility to gain information about the technical skills used successfully in a competition setting. This gap has been first addressed by a systematic video analysis of 58 world-class ju-jitsu fights of the World Championships 2010 (Staller, under review), which aims at the technical performance of elite athletes. Table 1 shows the number of successfully applied techniques for each part.

Table 1

Successfully Applied Techniques and Their Awarded Points for Each Part

	Frequency	2-Point „Ippon“	3-Point „Ippon“	„Waza-ari“	Points	Ratio [%]
Part 1	399	225		174	624	78,69
Part 2	70	32		38	102	12,86
Part 3	30	17	10	3	67	8,45
All	499	274	10	215	793	100,00

Regarding part 1, results of the study revealed, that this part is the most dominant one in regards to awarded points. Nevertheless, it is unknown which techniques out of which tactical situations are the most promising ones to be awarded with “ippon”. The current study investigated successfully applied techniques in part 1 and their context in order to give recommendations for training and tactics in competition.

Material and Methods

Sample. 399 techniques in part 1 which were successfully applied in 58 JJF fights at the World Championships 2010 in Saint Petersburg, Russia, were analyzed.

Procedure. All analyzed fights were filmed during the World Championships 2010. The video clips were analyzed manually using the software “MPEG Streamclip 1.9.3b7”. Successfully applied punching and kicking techniques were categorized in regards to the awarded score (“waza-ari” or “ippon”), the kind of technique (single technique or combination) and the tactical context in which the technique occurred (defensive or offensive).

Statistical Analysis. Frequency tables were analyzed using χ^2 -test and log-linear analysis. The interpretation of a 2x2 crosstab table model was done using the odds ratio. A significance level of $p < .05$ was set for all tests and data was analyzed using SPSS version 20.0.

Results

Analysis of all successfully applied techniques in part 1 showed, that there were more successfully applied punches than kicks (Tab. 2). Furthermore results revealed that there were more “ippons” awarded than “waza-aris”.

Table 2

Frequency of Successfully Applied Punches and Kicks in Part

	„Ippon“		„Waza-ari“		All	
	Frequency	Ratio [%]	Frequency	Ratio [%]	Frequency	Ratio [%]
Punches	186	63.92	105	36.08	291	72.93
Kicks	39	36.11	69	63.89	108	27.07
All	225	56.39	174	43.61	399	100.00

The relationship between the applied technique (punch or kick) and the awarded score (“ippon” or “waza-ari”) was analyzed using χ^2 -test. The results showed that there is a significant relation between the applied technique and the awarded score, $\chi^2(1) = 24.77, p < .001$. Based on the

odds ratio the likelihood to score “ippon” with punches is 3.13 higher than it is with kicks.

Out of all techniques in part 1, the straight punch with the backhand was the most successfully applied technique (39.35%), followed by the punch with the front backhand (12.53%) and sidekick with the front leg (9.21%).

Following-up the dominance of straight punches with the backhand, the awarded points, the kind of technique and the tactical situation in which it was applied was analyzed. The results are displayed in table 3.

Table 3
Frequency of the Straight Punch with the Backhand Regarding the Tactical Situation and the Awarded Points

	„Ippon“		„Waza-ari“		All	
	Frequency	Ratio [%]	Frequency	Ratio [%]	Frequency	Ratio [%]
Single Technique	64	40.76	29	18.47	93	59.24
Offensive	22	14.01	9	5.73	31	19.75
Defensive	42	26.75	20	12.74	62	39.49
Combination	35	22.29	29	18.47	64	40.76
Offensive	28	17.83	25	15.92	53	33.76
Defensive	7	4.46	4	2.55	11	7.01
All techniques	99	63.06	58	36.94	157	100.00

The relationship between the kind of technique, the tactical context and the awarded score, was analyzed using log-linear analysis. The results revealed that there is no significant relationship between the kind of technique, the tactical context and the awarded score, $\chi^2(3) = 3.769$, $p = .287$. A partial effect was discovered regarding the kind of technique and the awarded score, $\chi^2(1) = 38.796$, $p < .001$. Based on the odds ratio the likelihood of a successfully applied single technique in a defensive situation is 9.64 times higher than a single technique in an offensive situation.

Discussion

The current study points out that punches were more likely to be awarded with “ippon” than kicks and that the straight punch with the backhand is the most successfully applied technique in part 1. Furthermore results indicate that the straight punch with the backhand is successfully applied as a single technique out of defensive situations.

In a study of Lattke (2005), who analyzed successfully applied techniques on a national level in Germany, the straight punch with the

backhand was as well the technique, which scored the most in part 1. The author did not perform further analysis regarding this technique. Further analyses of straight punches of the backhand in a ju-jitsu fighting competition setting are not known until now.

Similar studies have been conducted for other martial arts, like judo (Heinisch, 2003, 2008), which proved themselves useful for practice and training. In this context, Müller-Deck (2002) points out that continuous analysis of the technical and tactical performance of high class athletes have to be conducted in order to be able to compete at a world class level. Furthermore, he puts emphasis on the fact that such analysis have to be conducted on a regular basis to be able to adapt to the changes which take place in competition performance. Therefore it is suggested to analyze the technical performance in JJF regularly.

Implications for practice. The current results have implications for practice concerning JJF.

First, in order to score “ippon” it is recommended to punch rather than to kick. Especially the straight punch with the backhand should be explicitly trained and used in a competition setting.

Second, in order to be awarded “ippon” for a straight punch with the backhand it is recommended to fight more defensive in part 1. This could be an option if the “ippon” in part 1 is still needed to win by “full ippon”. Nevertheless, this tactical concept may not prove successful when the athlete is in need of points. In that case, it is suggested to attack with combinations in an offensive way.

Third, if the likelihood of “ippon” in a defensive situation is much higher, it seems to be better for the athlete if he or she has not necessarily to attack the opponent. Therefore, it is suggested to take the lead by points even in the beginning. With more points than the opponent, it is easier to switch to defensive tactics and to score further points, than being behind with points and having to attack, which makes it easier for the opponent to increase the lead.

Fourth, the athlete has to be careful not to behave too passively, when trying to score out of a defensive strategy. Results from Staller (under review) showed, that most penalties are given due to passive behavior.

Limitations. Some limitations of the study have to be acknowledged.

First, in the study there were only analyzed techniques, which were performed at one competition. It is suggested for further studies that the techniques of more competitions are included in the analysis. Like Müller-Deck (2002) proposed longitudinal studies have to be conducted in order to get a grasp of the development of tactical behavior of world-class athletes

and to be able to change strategies and tactics in training as early as possible, if it is needed.

Second, it has not been analyzed if the athlete switched to a defensive behavior because of being ahead of points. It is possible that this situation occurred as often because the pressure for the athlete was increased and therefore he or she made more mistakes when attacking. Therefore, it is suggested to enlarge the view of tactical context in which successful punches with the backhand are applied.

Conclusions

The current study showed that the straight punch with the backhand is best performed as a single technique out of a defensive situation in order to score “ippon”. Therefore, it is recommended in competition to take lead by points as early as possible in order to switch to defensive tactics in part 1 afterwards. Like this it seems to be easier to increase the lead by using straight punches with the backhand as single counter techniques when the opponent attacks.

Furthermore, systematic video analyses of world-class fights, which provide detailed information of technical and tactical performance, are needed. Such analysis can provide validated technical aims for training. Proper practice of technical and tactical skills, which have to be learned for elite competitions, can increase performance in competitions.

References

1. Hecke, S. (2002): Anforderungsprofile im Ju-Jitsu [Requirement profiles in ju-jitsu]. *Ju-Jitsu Journal*, (10) 2002, 3-4.
2. Heinisch, H.-D. (2003). Ergebnisse wettkampfanalytischer Untersuchungen im männlichen Spitzenbereich [Results of competition-analysis regarding male world-class athletes]. In U. Modebach (Ed.), *Judo in Bewegung* (pp. 77-100). Bonn: Bern.
3. Heinisch, H.-D. (2008). Merkmale des Kampfverhaltens und der technischen Vielseitigkeit für internationale Spitzenleistungen im Judo [Parameters of fighting behaviour and technical versatility for international top performance in judo]. *Zeitschrift für angewandte Trainingswissenschaft*, 15(1), 55-71.
4. Ju-Jitsu International Federation (2011). *Competition Rules*. Retrieved from http://www.jjifferees.com/datas/downloads/en/Competition_Rules_v2_1.pdf
5. Lattke, S. (2005). *Entwicklung und Erprobung eines Verfahrens zur computergestützten Wettkampfanalyse in der Sportart Ju-Jitsu*

- Disziplin Fighting* [Development and testing of a computer-assisted procedure for competition analysis in ju-jitsu fighting]. (Unpublished dissertation). Sportwissenschaftliche Fakultät der Universität Leipzig, Leipzig.
6. Müller-Deck, H. (2002). Zu den Wechselbeziehungen von Kreativität und Methodik im modernen Judotraining [The interrelation between creativity and methodology in modern judo training]. *Beitrag zum 5. Bundesoffenen Fortbildungskurs für Sportlehrerinnen und Sportlehrer – „Judo als Schulsport“* – vom 05. bis. 07. April in Magdeburg.
 7. Renninghoff, J., & Witte, F. (1998). *Ju-Jutsu Training: Das Modell des Budosport-Trainings* [Ju-jitsu Training: a Model for the Training of Budo Sports]. Berlin: Sportverlag.
 8. Smith, D. J. (2003). A Framework for Understanding the Training Process Leading to Elite Performance. *Sports Medicine*, 33(15), 1103–1126.
 9. Staller, M. (2008). *Anforderungsorientiertes Koordinationstraining im Ju-Jutsu Fighting* [Requirement-Oriented Training of Coordination for Ju-jitsu Fighting System]. Norderstedt: GRIN Verlag.
 10. Staller, M. (under review). Zur ausgewählten Ergebnissen der Wettkampfanalyse im Ju-Jutsu Fighting – Merkmale des Kampfverhaltens im technisch-taktischen Bereich [Selected Results of a Competition Analysis in Ju-jitsu Fighting – Parameters in Technical and Tactical Performance at an Elite Level]. *Leistungssport*.

Submitted: September 30, 2013

Accepted: November 27, 2013

ORIGINAL RESEARCH PAPER

**EMG AND JOINT ANGULAR DISPLACEMENT
DURING RUNNING AT DIFFERENT TERRAIN AND
GROUND SURFACE CONDITIONS****Johnny Nilsson¹, Asbjörn Gjerset², Egil Johansen² and Mikkel Lund²**¹ The Swedish School of Sport and Health Sciences, Stockholm Sweden² The Norwegian School of Sport Sciences, Oslo, Norway

Address: Johnny Nilsson

The Swedish School of Sport and Health Sciences (GIH)

Box 5626, S-114 86 Stockholm, Sweden

Phone: +46 8 12053739

E-mail: johnny.nilsson@gih.se

Abstract

The purpose was to study joint angular displacement and myoelectric activity (EMG) of the hip, knee and ankle extensor muscles during running in different terrain-surface-gradient (TSG) settings at competition speed. In total six male regional to national level elite orienteers participated in the study. Mean (range), height and weight were 25 (19-32) years, 180 (1.74-1.88) m and 71 (67-75)kg. Joint angular displacement was determined by electrogoniometers taped over the hip, knee and ankle joints of the right leg. Surface electrodes were used to record the EMG activity in m. gluteus maximus, m. vastus lateralis and m. soleus. The data was recorded by means of a data logger at 1000Hz and stored for later computer analysis. The participating orienteers performed runs in six different TSG settings: forest, forest uphill, forest downhill, timber felling, wet moss and gravel road. The time in each TSG setting was recorded by means of an ultrasound based timing unit and the mean speed was calculated. The results showed a mean perceived competition speed in all test conditions of approximately $5 \text{ m}\cdot\text{s}^{-1}$ with the exception of wet moss and forest uphill which showed a competition speed of about $3 \text{ m}\cdot\text{s}^{-1}$. Despite of this the cycle duration in the different TSG settings was not significantly different. The basic angular displacement pattern was consistent in most TSG settings with exception of forest uphill and wet moss. The mean EMG activation level differed between the TSG settings. It can be concluded from the results in this study that different TSG settings put specific demands on joint angle amplitude and muscle action as well as activation, which has to be taken under consideration in the training design.

Key words: *angular displacement, electromyography, running, terrain.*

Introduction

Surprisingly few scientific studies have been conducted on orienteering. Among the research performed on this sport the aerobic energy demands has gained the largest interest (Creagh & Reilly 1997). This research on aerobic processes cover for example energy cost during running on different surfaces. The increase in energy cost during running on sand compared to treadmill running increase the energy cost by 15 to 40% as reported by Zamparo et al. (1992). A similar comparison concerning forest terrain showed an increase in energy cost from 26 to 72% depending on surface undergrowth density and gradient (Jensen et al. 1994, Creagh & Reilly 1996, Sloniger et al. 1997).

The relative aerobic demand in orienteering competition among female orienteers has been estimated on the basis of a maximum oxygen uptake of 52ml O₂/kg/min to be 80%, which was approximately at the anaerobic threshold level (Creagh 1996). Thus, orienteering competition cause a large energy demand. The reported data do not exclude that even higher relative work intensities can be reached during an orienteering competition. This is plausible during e.g. sprint distances in orienteering competitions. Also anaerobic energy processes, as indicated by blood lactate accumulation, among male elite orienteers varied between 4.4 and 6.7mmol/L on different stages of an orienteering competition as shown by Dresel (1985). As a result of severe ascent the lactate concentration increased to 7.3mmol/L (Dresel 1985). Average blood lactate concentration levels of 3.4mmol/L have been recorded on female orienteers in the Norwegian national team (Gjerset et al. 1997).

Muscle strength is another area that has been sparsely described in the orienteering literature. Only a few studies on muscle fiber composition and knee joint torque production have been presented (Thorstensson et al. 1977, Johansson et al. 1988). These data are important pieces of information but not extensive enough to allow any conclusions about the strength demands in orienteering.

Biomechanical knowledge about the running performance in orienteering is very sparse (Creagh & Reilly 1997). Temporal and kinematical characteristics of running in rough terrain through high grass were described by McArdle and co-workers (1991). The effects of running speed and surface on EMG activation level was described by Havas & Kärkkäinen (1995). Still there is a great lack of information on biomechanical aspects of running in different terrain, on different surfaces

and with different gradient (TSG). In order to specifically adapt to movement demands for different types of terrain, surface and gradient we need detailed information about joint angular displacement and muscle activity (EMG) pattern under these conditions. This may clarify the specific movement demands in different situations and the adaptation in running technique and muscle strength etcetera that are needed to better cope with the different external demands.

Thus, the purpose was to investigate joint angular displacement and EMG activity of “prime movers”, i.e. musculature that are prominent in the propulsion of the body, during running in different TSG (terrain-surface-gradient) settings at competition speed.

Material and methods

Participants. In total six male regional to national level elite orienteers participated in the study. Mean (range), height and weight were 25 (19-32) years, 180 (1.74-1.88) m and 71 (67-75)kg. The study was approved by the Regional Ethic Committee. The participants wore traditional orienteering shoes and light clothes during the tests.

Electrogoniometry. Joint angular displacement was determined by electrogoniometers that were attached by elastic tape and adhesive straps over the hip (*trochanter major*), knee (*articulatio genu*) and ankle (*lateral malleolus*) joints of the right leg (Fig. 1A). The left and right leg symmetry was assumed. Angular displacement in the sagittal plane was recorded. Cycle duration or stride rate was calculated from consecutive cycles of the knee angular displacement.

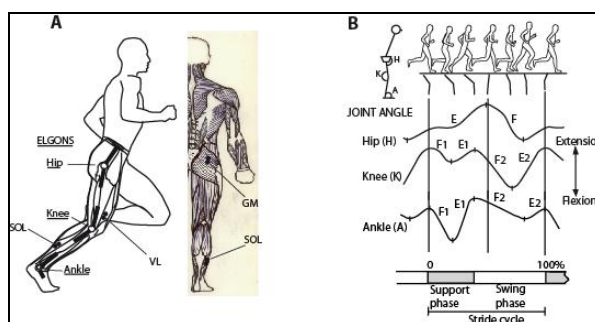


Figure 1. (A) Hip, knee and ankle joint electrogoniometers (elgons) and locations of surface electrodes above gluteus maximus (GM), vastus lateralis (VL) and soleus (SOL). (B) Angular displacement of the hip, knee and ankle joint cycle normalized to the stride cycle (100 percents). The hip joint cycle contain one extension phase (E) and one flexion phase (F). The knee and ankle joint angle cycle contains two Flexion phases (F1 and F2) and two extension phases (E1 and E2).

Electromyography (EMG). The electrical activity in *m. gluteus maximus* (GM), *m. vastus lateralis* (VL) and *m. soleus* (SOL) of the right leg was recorded with bipolar surface electrodes taped over the belly of the muscles (see Figure 1A for placements of the electrodes). The site of the electrode placements was carefully shaved and cleaned with alcohol before application of the surface electrodes.

Data logging. Electrogoniometric and EMG data were recorded by means of a portable data logger (ME3000P, Mega Electronics, Finland). The data was sampled at 1000Hz and temporarily stored in the data logger and subsequently transferred to the hard disc of a personal computer for further analysis.

Test settings and test speed. The participating orienteers performed, after a warming up period, runs at perceived competition speed in six different TSG settings: forest (horizontal level, low density undergrowth), forest uphill (seven degrees elevation, low density undergrowth), forest downhill (seven degrees descent, low density undergrowth), timber felling (horizontal level, medium roughness), wet moss and gravel road (horizontal level). The test intervals were marked in the terrain and the time between markers in the test intervals was recorded by means of an ultra sound based timing system (Time-it, Eleiko AB, Sweden). The mean speed (Fig. 2A) was calculated by dividing the length between time markers by the time spent in this interval. The duration of each run at preferred competition speed was shorter than 15 seconds. The participants were allowed repeated runs in the test intervals if the preferred competition speed was not reached and rest periods were allowed between runs to avoid fatigue. The rest periods were about 90 seconds or longer.

Analysis. The stored data was analyzed by means of a custom made program script in the Matlab[®] software (Matlab Inc., USA). The stride cycle for the hip angular displacement was divided into two phases; the extension phase (E) and the flexion phase (F) (see Figure 1B). The knee and ankle angular displacement in the stride cycle was divided into four phases; the first flexion phase (F1), first extension phase (E1), second flexion phase (F2) and second extension phase (E2) (see Figure 1 B).

The cycle duration was measured between onset F1 knees in consecutive cycles. The absolute mean cycle duration were calculated and are presented in graphical form (Figure 2B). Also the onset and termination of the angular phases and the EMG bursts were normalized with respect to cycle duration and presented in graphical form (Figure 3). Each EMG burst was rectified and filtered and the mean EMG amplitude was calculated by dividing the area under the EMG curve by burst duration.

Statistics. Standard descriptive statistics including means, standard deviations (sd) and ranges were employed in the data analysis. Differences between mean data were tested using repeated measures ANOVA and the alpha level was set to 0.05 to assume statistical significance. Post hoc comparisons were made using the Tukey procedure.

Results

In the result section the speed in the different TSG settings will be presented together with the absolute stride cycle duration (Figure 2 A and B). From the stride cycle duration the angular phase duration has been normalized together with the EMG burst duration (Figure 3). Finally, the mean EMG amplitude for the different TSG settings will be presented (Figure 4).

Speed and stride cycle duration. There was no significant difference between the perceived competition speeds in forest terrain, forest downhill and horizontally on a gravel road with an average speed of approximately $5 \text{ m}\cdot\text{s}^{-1}$. However, the speed during uphill running and running in wet moss was approximately $3 \text{ m}\cdot\text{s}^{-1}$ and significantly lower than the other TSG settings. Despite the difference in competition speed presented above there were only small differences (n.s.) between T_c in all TSG conditions the exception being wet moss. Most surfaces showed a T_c of approximately 0.65 s, which corresponds to a stride frequency of approximately 1.54 Hz.

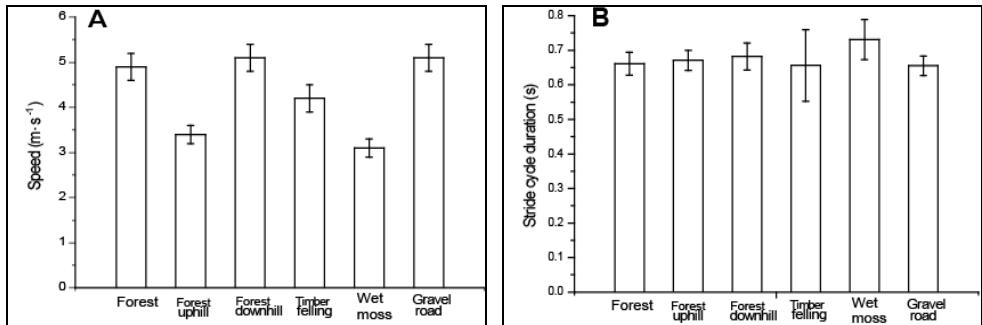


Figure 2. (A) Mean speed (\pm sd) in different TSG. (B) Mean (\pm sd) stride cycle duration during running in different TSG settings.

Relative phase duration, timing and displacement. Despite the difference in TSG the basic pattern of the two angular phases of the hip joint and four phases for knee and ankle joint were present. Only in the ankle joint angular displacement uphill the E2 phase was not present i.e. the F2 phase continued directly into F1 in the subsequent cycle (see Figure 3: ankle

joint, forest uphill). The F1 and E1 knee and ankle angular phase duration of the normalized cycle represent approximately the support phase in the running stride (Nilsson et al. 1985). The relative duration of this phase was about 30 % of Tc in most TSG conditions with exception of forest uphill and wet moss where it reached about 40 %, thus, a longer relative duration. Also note the longer relative duration of the E1 phase of the knee and ankle in these situations. The net angular amplitude over the whole cycle is similar in all TSG conditions except in forest downhill, which shows smaller net amplitude for the hip and ankle joint. The reduction in F1 phase amplitude for the knee joint during running forest uphill and wet moss is also prominent. A similar basic timing pattern of the recorded muscles was seen in all TSG settings. This pattern shows a pre-activation of the muscles prior to the F1 phase in the knee and ankle joint and mainly activation during the F1 and in some cases also during the E1 phase (Figure 3).

Mean EMG activation level. The inter-muscular amplitude pattern is similar in the recorded muscles in all situations except running in forest terrain (horizontal) (Figure 3). There are amplitude differences between TSG:s, e.g. a larger mean activation of the musculature is needed uphill compared to downhill despite lower mean velocity (Figure 2 and 4).

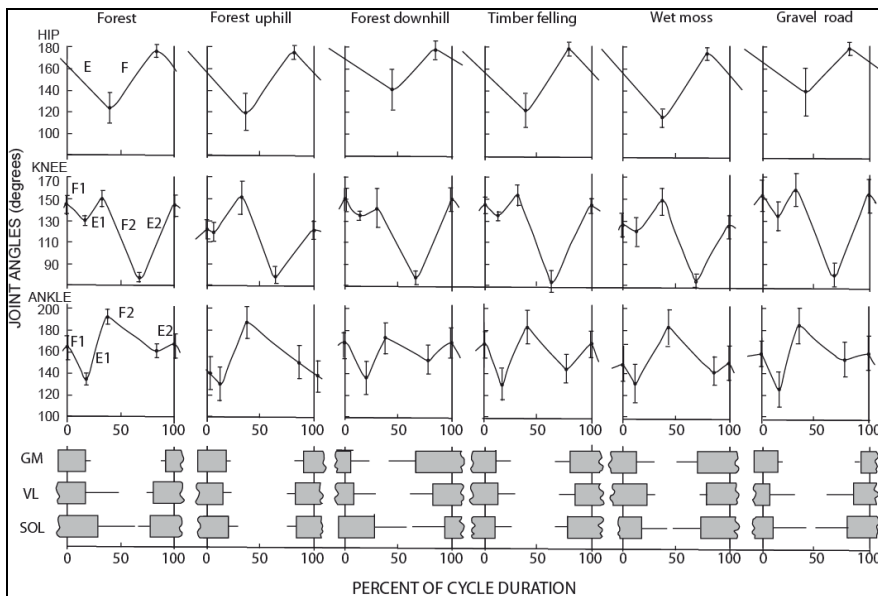


Figure 3. Mean (\pm sd) angular displacement and EMG burst duration in different TSG:s during running at perceived competition speed.

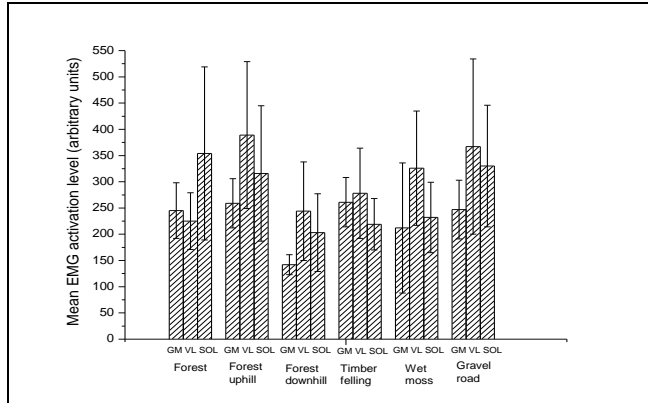


Figure 4. Mean (\pm sd) EMG activation level in different TSG settings during running at perceived competition speed.

Discussion

It is obvious from Figure 2A and B that the stride cycle duration is not significantly different i.e. similar stride frequency despite significantly lower speed during running uphill and in wet moss. As indicated by the equation: $v = s \cdot f$, v (mean speed) is equal to mean stride length (s) times mean stride frequency (f). If f is constant and speed changes the stride length must be the parameter that changes the speed. Thus, the stride length seems to be the parameter that is most affected by the different TSG settings. In this context it is interesting to compare the speed, stride length and frequency parameters with the EMG output during running in TSG settings. Here forest downhill running show about 30% lower EMG output compared to forest and gravel road running despite similar speed, which presumably is related to the difference in performed work per unit of time. Despite the lower speed during running in timber felling and wet moss (horizontal run) the mean EMG output is approximately equal to forest running on the horizontal level. Thus, different terrain and surfaces demand different muscle activation, which may explain the differences in energy cost (Jensen et al. 1994, Creagh & Reilly 1996).

The difference in EMG output between GM, VL and SOL is not possible to compare due to factors such as difference in electrical impedance between electrodes and muscles due to skin resistance, interfacing tissue between muscle fibers and electrodes etcetera. Therefore, the analysis is focused on specific muscles in different TSG settings. Cross-talk between muscles is another factor that has to be taken into consideration. Due to the size and thickness of GM and VL it is less likely that the EMG signals in

these muscles are subjected to cross-talk. The electrodes over SOL are very close to m. gastrocnemius, which cause a risk of cross-talk. Moritani and co-workers (1989) reported an average overall cross talk of 6 percent between soleus and medial gastrocnemius peak to peak EMGs. However, the soleus and gastrocnemius muscles have a similar role in the displacement in the ankle joint which makes the problem of possible cross talk less disturbing.

Running in the different TSG settings showed a rather consistent basic phase structure but still there are interesting deviating details. One such detail is the rudimental F1 phase in the knee joint during uphill and wet moss running. This implies that the stretch-shortening contraction for VL may be strongly reduced and that VL in these situations (uphill and wet moss) is mainly utilizing concentric contractions. Further, the smaller knee angle at onset F1 indicates that the VL muscle has to work with another muscle length, which in turn can affect performance.

The longer relative duration of the E1 phase of the knee and ankle joint indicate that the speed of contraction of e.g. VL and SOL may be lower in these phases. Muscle length (joint angle amplitude), type of muscle action and speed of contraction are important aspects of specific strength training (Sale & McDougal 1981, Jones et al. 1989). The results indicate that the orienteer has to adapt to a large range of joint amplitudes, speed of contraction and also type of muscle action. The specificity in muscle strength adaptation (Sale & McDougal 1981, Jones et al. 1989) thus demand that the training among orienteers has to meet a variety of TSG settings in order to optimally adapt to the demands in running technique, strength and muscle endurance. If these demands are not adapted for it is possible that the orienteer will suffer from local fatigue and fail to produce large enough muscle force in critical joint angle phases which may cause a less optimal running technique and an impairment in running economy.

At this point we have only addressed different TSG settings at perceived competition speed. The fact that also the perceived competition and absolute speed may fluctuate considerably during an orienteering race makes the adaptation demand even greater. Thus, the training design of the orienteers should indicate that the physical training contain specific elements i.e. training in different TSG settings and should also be performed at different speeds. The use of specific strength might benefit from “overload” of the musculature in a running like pattern which may be performed in different TSG settings (Nilsson et al. 2013b). The optimal combined or separated generic and specific designs of training need to be further discussed by athletes, coaches and sport scientists.

Conclusions

It can be concluded from the results in this study that different TSG settings put specific demands on joint angle amplitude and muscle action as well as activation, which has to be taken under consideration in the training design.

Acknowledgement

The authors are grateful to Gunhild Maria Gjerset for valuable and competent assistance in the data analysis process.

References

1. Creagh, U, Reilly, T. (1996). The Energy Cost of Running in Forest Terrain [abstract]. First Annual Congress: Frontiers in Sport Science: the European Perspective; May 28-31; Nice: 78-79.
2. Creagh, U. (1996). Physiological Tresses in Female Orienteering [PhD thesis]. Liverpool: Liverpool John Moores University.
3. Creagh, U., & Reilly, T. (1997). Physiological and Biomechanical Aspects of Orienteering. *Sports Med* 24(6): 409-418. U. (1985) Lactate Acidosis with Different Stages in the Course of a Competitive Orienteering Performance. *Scientific Journal of Orienteering*, 1: 4-13.
4. Gjerset, A. Johansen, E. & Moser, T. (1997). Aerobic and Anaerobic Demands in Short Distance Orienteering, *Scientific Journal of Orienteering*, 13(1-2), pp.4-25.
5. Havas, E. & Kärkkäinen O. P. (1995) The Effects of Running Speed and Surface on Muscle Activity a Field Study in Orienteering. Kirjassa: 15th Congress of the International Society of Biomechanics. Book of abstracts. The University of Jyväskylä.
6. Jensen, K., Franch, J., Kärkkäinen, O., et al. (1994). Field Measurements of Oxygen Uptake in Elite Orienteers During Cross-Country Running using Telemetry. *Scand J Med Sci Sports*, 4: 234-238.
7. Johansson, C., Lorentzen, R., Rasmuson, S., et al. (1988). Peak Torque and OBLA Running Capacity in Male Orienteers. *Acta Physiol Scand*, 132: 525-530.
8. Jones, D.A., Rutherford, O.M., & Parker, D.F. (1989). Physiological Changes in Skeletal Muscle as a Result of Strength Training (Review article). *Quarterly J Experimental Physiol*, 74: 233-256.
9. McArdle, W.D., Katch, F.I., & Katch, V.L. (1991). Exercise Physiology: Energy, Nutrition and Human Performance. 3rd ed. London: Lea & Febiger.
10. Moritani, T., Oddsson, L., Thorstensson, A. & Åstrand, P.-O. (1989). Neural and Biomechanical Differences Between Men and Young Boys During a Variety of Motor Tasks. *Acta Physiol Scand* 137: 347-355.

11. Nilsson, J., Gjerset, A., Johansen, E. & Lund, M. (2013b). Speed Adaptation in Cycle Duration and EMG During Running at Different Terrain and Ground Conditions. Submitted to *LASE Journal of Sport Science*.
12. Nilsson, J., Johansen, E., Gjerset, A. & Lund, M. (2013c). Muscle Activation Level in Generic and Specific Strength Training Exercises for Orienteers. Submitted to *LASE Journal of Sport Science*.
13. Sale, D.G. & McDougall, D. (1981). Specificity in Strength Training: A Review for the Coach and Athlete. *Can J Appl Sport Sci*, 6(2): 87-92.
14. Sloniger, M.A., Cureton, K.J., Prior, B.M. & Evans, E.M. (1997). Anaerobic capacity and muscle activation during horizontal and uphill running. *J Appl Physiol* 83(1): 262-269.
15. Thorstensson, A., Larsson, L. & Tesch, P. (1977). Muscle Strength and Fiber Composition in Athletes and Sedentary Man. *Med Sci Sports*, 9: 26-30.
16. Zamparo, P., Perini, R., Orizio, C., et al. (1992). The Energy Cost of Walking or Running on Sand. *Eur J Appl Physiol*, 65: 183-187.

Submitted: October 4, 2013
Accepted: November 27, 2013

ORIGINAL RESEARCH PAPER

VALUE CONGRUENCE IN THE CONTEXT OF SOCIAL RESPONSIBILITY: BEST PRACTICES FOR SPORTS ORGANIZATIONS**Jolita Vveinhardt**

Lithuanian Sports University
Address: Sporto str. 6, Kaunas, LT-44221, Lithuania
Phone: +370 698 06668
E-mail: jolitaw@gmail.com

Abstract

In the 9th decade of the last century Lithuania turned into a market economy, business freedom was brought as the main idea and social market principles have long been ignored, so some searches for business and social harmony, such as corporate social responsibility bores. Different sciences (psychology, cultural studies, philosophy, political science, management, etc.) in various aspects discuss, analyze and classify values and determine their importance in society. Often economic and spiritual, moral and ideological as well as other values are juxtaposed. But no matter how contradictory we regard the values, their diversity make cultural background in our society and determine behavior of each subject as a social system and interpersonal relationships. The aim of the article is to discuss the development of the concept of value congruence of sports organizations in the context of social responsibility. To achieve the aim, the following tasks are formulated: (1) to discuss the situation of the development of social responsibility in Lithuania, paying attention to the lack of attention of the government to sports organizations; (2) to highlight the role of congruence of individual, organizational and public values in organizations of any type and sector; (3) to discuss the interaction of the concept of social responsibility and the congruence of individual, organizational and public values. After the analysis of documents and scientific literature it was concluded that almost no attention is paid to social responsibility in the activity of public sector organizations of Lithuania, and in particular in organizations engaged in sports activity, regardless of the sector. Organizations developing social responsibility can encourage the development of the idea in the society by their example.

Key words: *values, social responsibility, organizational culture, sport.*

Introduction

The aims of business organizations are often at odds with the interests of employees or the public, therefore, some tension occurs, promoted by suspicious preconceived approach of the society towards business organizations as well. The global financial crisis and following economic recession undoubtedly had an influence on the growth of mistrust, as well as on relations between employees of organizations. At the end of the crisis, the investment must be directed to the companies, advocating social and ethical values in order to restore citizens' trust in financial markets. In fact, it can be argued that after this crisis there will no longer be business as usual (Pinto, 2011). Long ago it was noticed that the culture of the organization is closely related to the employees' job satisfaction and quality of service (Johnson, 1996; Davidson, 2000; Glisson et al., 2006; etc.). Organizations, declaring social responsibility, appeal to sustainability within the organization and sustainable interaction between the organization and the public, to the change of the preconceptions. But there is axiological content difference between social responsibility as a marketing tool and the change in the culture of the organization. Frequently the organization, in the absence of a sudden effect, becomes disappointed in the concept of social responsibility, on development of which economic recession had a negative impact as well. This means that the organization gives insufficient attention to axiological changes and value congruence, which increases the internal focus of the organization, orientation towards the quality of services, maintaining the balance between the interests of the organization and the public. This balance is an especially sensitive issue in service providing organizations of recreational, cultural and sporting activities, whose relationship with the service user is extremely close and characterized by dynamism.

The problem of the research is brought forward by the question how the congruence of personal, public and organizational values matches the implementation of the concept of social responsibility in organizations?

Material and methods

The article provides analysis of theoretical literature, analysis of documents has been carried out. The first part of research results, in which aspects of social responsibility in organizations engaged in sports activities are presented, is based on academic publications of Hall (2001), Cable and DeRue (2002), Hestroni and Asya (2002), Erdogan et al. (2004), Kristof-Brown et al. (2005), Klenke (2005), Edvardsson et al. (2006), Halstead and Taylor (2006), Piasentin and Chapman (2006), Elfenbein and O'Reilly III

(2007), Lawrence and Lawrence (2009), Žibinskaitė (2009), Godrich (2010), Posner (2010), Gedvilaitė (2011), Simanavičienė et al. (2011), Vveinhardt and Gulbovaitė (2012), Bulotienė et al. (2012), Čepelionienė et al. (2012), Šimkus et al. (2012), Vveinhardt and Gulbovaitė (2013).

In the second part of the research results, when discussing the role of value congruence in different types of organizations, the analysis of scientific insights of the following authors is carried out: Wiener (1988), Schmit and Allscheid (1995), Kristof (1996), Johnson (1996), Thompson (1996), Morrison (1997), Amstronng (1999), Stacknam *et al.* (2000), Jewell (2002), Lusthaus *et al.* (2002), Verplanken and Holland (2002), Teerikangas (2004), Robbins (2006), Zohar and Marshall (2006), Schwartz (2006), Vveinhardt (2007), Reino *et al.* (2007), Vveinhardt and Nikaitė (2008), Amos and Wheathington (2008), Vaitiekauskaitė (2008), Paužuolienė and Trakšelys (2009), Posner (2010), Vveinhardt and Gulbovaitė (2012).

In the third part of the research results, when presenting consistency of values in the concept of social responsibility, theoretical and empirical researches of Rubino (1998), Vandenberghe (1999), Zabelavičienė (2009), Gregory *et al.* (2010), Posner (2010), Pinto (2011), Litiukas (2011), Vveinhardt and Gulbovaitė (2012) are analyzed.

The article is based on the analysis and synthesis of scientific literature, providing the author's insights.

Results

Aspects of social responsibility in organizations engaged in sports activities. There is no lack of congruence research in works of various scientists (Hall, 2001; Cable & DeRue, 2002; Hestroni & Asya, 2002; Erdogan et al., 2004; Kristof-Brown et al., 2005; Klenke, 2005; Edvardsson et al., 2006; Halstead & Taylor, 2006; Piasentin & Chapman, 2006; Elfenbein & O'Reilly III, 2007; Lawrence, A. & Lawrence, P., 2009; Godrich, 2010; Posner, 2010; Vveinhardt & Gulbovaitė, 2012, 2013; etc.). However, there is a lack of such research in the analysis of the concept of social responsibility. Sport is becoming an object of support for organizations, declaring social responsibility, however, sports organizations themselves in both the public and the private sectors are not involved in socially responsible activities or do not declare it. For instance, according the data of the Lithuanian Ministry of Social Security and Labor for the year 2013, only 130 Lithuanian organizations of the private and public sectors (non-governmental organizations) belonged to the National network of socially responsible companies, but none of the organizations is directly linked to sports activities. Although there can be seen some individual examples, more satisfying the interest of public relations, but not elaborated

to socially responsible activities. For example, participation of popular basketball teams in social actions, etc.

The authors of the project of Development strategy of physical culture and sports (2008–2020) focus on the social mission of sport, on the aim to facilitate the involvement of all social groups in physical culture and sports activities (Gedvilaitė, 2011), but the strategy has not encouraged a breakthrough of sports organizations themselves in the context of social responsibility. And the State program for 2009-2013, which was allocated almost one million euros, was more focused on the development of responsibility in the private sector. As Simanavičienė et al. (2011) note, the state does not use the opportunity to involve the public sector, which together could become an example of socially responsible activity for private businesses.

The organizations, the values of which are more or less clear, transparent and supported by the clients themselves, are closer to the customers. For example, the ways of spending leisure time are the person's right of choice, by which the person expresses his/her will, reveals the approach towards values and shows the overall internal culture (Bulotienė et al., 2012). The results of the research have proved that physical activity influences self-confidence, suggesting that high level of self-confidence is characteristic to those who go in for sports and is one of the most important values of the personality – it is awareness that he/she can achieve the goals set to himself/herself (Čepelionienė et al., 2012). But another research, conducted in the budgetary sports school “Klevas”, shows that the most difficult thing for the heads of sports organizations is to form the mission, vision, values and ethical principles of the organization, as well as to communicate them to their employees (Šimkus et al., 2012). The problem is dual. First, there is a prevailing stereotypical view that business companies should aim at social responsibility, and companies engaged in sports activities are more attributed to “soft business”, social activities. Second, resulting from the named attitudes, a number of sports organizations are public budgetary institutions, private public institutions, which although engaged in commercial activity, participate in the market, are traditionally attributed to non-governmental organizations. Although the same issues of social responsibility, sustainability are relevant to both the public and private sectors: law enforcement, transparency, anti-corruption activities, environment protection, partnership with the organization's internal and external target groups, behavior on the market, etc. For example, Žibinskaitė (2009), analyzing the aspects of social identity of the University

girls team, emphasized the significance of relation with the external social environment: the crowd, supporters, judges and others.

There is another essential problem – the society, which is not active enough in raising the issues of social responsibility of organizations.

The role of value congruence in different types of organizations. An individual starts to adopt the value system from the first steps of the development as a personality. These are the values of the family, national, social, cultural, sub-cultural, political and many other groups, with which the individual is associated and associates himself. Social relations, culture shape a value system. The value system is individual values set out in accordance with the importance of the relations, which an individual attaches to freedom, pleasure, self-esteem, honesty, obedience and equality (Robbins, 2006). A value is considered important in one cultural context, in the other it may be negated, less appreciated or accepted only by members of a certain social group (Lewis, 2002).

Culture, according to Zohar and Marshall (2006), includes our common motives, our usual behavior and our general approach. It includes meaning models and universal values. Usually, if we do not observe and consider, the culture affects our, as individuals', subconsciousness. The culture of the organization is dual – it is a naturally formed culture that employees “bring to the organization” and artificial (organizational), formed in the organization. According to Wiener (1988), the norms and values of the organization are the product of persons working in the organization.

Jewell (2002) distinguishes the following components of organizational culture: characteristic to all businesses ideology, beliefs and values that dictate how people should work in those organizations; organization's customs and traditional way of thinking and action, which are more or less followed by all its members and which must be perceived and at least partially recognized by newcomers to be accepted in those organizations; the values are manifested by observable things, such as history, rituals, language and jargon, interior design and space planning, and even the style of clothing of staff. Beliefs, attitudes, assumptions and values (even not very highlighted) as a whole, shaping the way of human activities and interaction, from which very much depends how people perform the work (Amstrong, 1999). Thus, these statements outline the culture of the organization as its fundamental values and beliefs, shaping employees' behavior.

Values is a key element defining the culture of the organization, regulating a lot of processes (Stacknam et al., 2000; Teerikangas, 2004; Reino et al., 2007; Vveinhardt & Nikaitè, 2008; Vaitiekaukaitè, 2008;

Paužuolienė & Trakšelys, 2009; Posner, 2010; Vveinhardt & Gulbovaitė, 2012; etc.).

Culture is what distinguishes one organizations from the other; organizations differ by their types of activities (production, sports, leisure, educological, etc.), but the role of values does not change because of that, only the values may differ, their relevance in the aspect of the objectives of the organization. Empirical studies confirm that person-organization value fit is positively related to the job satisfaction, commitment to the organization and reduces employees' intentions to quit work (Amos & Wheathington, 2008). A statistically positive relationship was found between the evaluation of their environment by employees and customer satisfaction by the products the organization develops (Schmit & Allscheid; 1995; Johnson, 1996; Morrison, 1997) and a greater profit margin (Thompson, 1996). Researchers and practitioners believe that the person-organization value fit is the most important factor that helps retain flexible and committed labor force (Kristof, 1996). If a person's values are close to the organization's ideas, according to Lusthaus et al. (2002), general agreements are standardized, honesty, quality and integrity increase.

The lack of attention to the elements forming the cultural framework of an organization, low involvement and the distance between a person's and organization's values deepen internal employee's relationship with the organization. Research shows that the objectives and vision of the organization, not even known to a large part of respondents, are not a strong incentive. Values are merely adequate to efficiency, individual's activities (Vveinhardt & Nikaitė, 2008).

Schwartz (2006) defines values as pursued aims, varying in their significance, which serve as the leading principles of person's life or other social organization. Thus, values can be used not only to characterize the person; they may also describe the working group or organization. Personal, public and organizational values form a triad of values, the elements of which are closely related to each other and have a significant effect on employees' professional activities and ensure a sustainable internal environment in the organization. Many of the values basically coincide, as they are based on universal principles, fundamental values and common benefit (Vveinhardt, 2007).

Individual and organizational values are related by typical of all the socio-culture, recognized values. Thus, values can determine not only such characteristics of the organization as force structures or norms of behavior, but also condition less obvious but no less important aspects of the organization as expectations of employees and the organization from each

other, social climate and social identity (Verplanken & Holland, 2002). Values, common to an individual, the organization and the public, are presented in Table 1.

Table 1

Values in respect of the subject

Subject	Values
Individual	Family, friendliness, responsibility, loyalty, integrity, kindness, honesty, rightness, wisdom, love, self-sacrifice, economic prosperity, etc.
Organization	Economic prosperity, cooperation, kindness, team spirit, loyalty, training, discipline, carefulness, dutifulness, professionalism, thoroughness, creativity, honesty, wisdom, unity, democracy, competence, selflessness, dedication, etc.
Society	Economic well-being of the society, dedication, kindness, social responsibility, justice, freedom, loyalty, mercifulness, sociability, unity, public spirit, love for people, patriotism, democracy, etc.

Source: Vveinhardt, J. (2007). Vertybinė individo, organizacijos ir visuomenės triada: kongruencijos paieškos organizacijoje. *Ekonomika ir vadyba: aktualijos ir perspektyvos*, 2(9), p. 333.

When combining the elements of the triad of values, such time-tested forms as organization's symbols, stories, rituals, which are coded and transmitted values, become an important factor (Vveinhardt, 2007). Congruence of individual and organizational values is a natural and artificial process, which, as a component of formation of culture, must be supported and developed by the management, representing the organization. In order to achieve optimal value congruence, the management culture based on leadership should be developed (Vveinhardt & Gulbovaitė, 2012).

Briefly summing up, it should be stated that value congruence in a modern organization gives a sense to employee's value incentives and the role of the society. Most of the personal, organizational, and societal values basically coincide, but the search for consensus, for which the values represented by social responsibility, such as sustainability and consistency, serve, remains relevant.

Consistency of values in the concept of social responsibility. The exclusive objective of the organization, which causes the most discussion, especially in social responsibility discourse, is the profit of the organization. Basically, it is agreed that part of the organization's profits should be allocated to the implementation of ideas of social responsibility, looking for balance with stakeholder groups and without affecting the interests of the

owners. In this context, value congruence may become an additional incentive for the development of the concept of social responsibility in the organization. Therefore, congruence of personal and organizational values may be perceived as compatibility of personal values with the values and norms of other members of the organization and the organization as a whole (Gregory et al., 2010), which, according to Rubino (1998), is useful to both the organization and persons working for it. Thus, congruence between personal and organizational values exists when a person and an organization are characterized by similar values, when an individual is willing to obey the rules and norms of the organization (Posner, 2010). Vandenberghe (1999) also expresses a similar idea, and argues that the congruence of personal and organizational values represents person-organization fit, and raises the assumption that employees adapt better to work environment when characteristics of the organization coincide with their value orientations.

Standard ISO 26000 denotes essential guidelines for social responsibility. The essence of the standard is the organization's responsibility for the consequences of its decisions, activities in the society and the environment, what contributes to sustainable development, including health and public welfare. Activities are based on transparency and ethical behavior, are integrated and applied in practice, comply with legal and international norms, and take into account the stakeholders' expectations. Socially responsible activities integrate the community, take into account the interests of consumers, and take care of the working environment and human rights. Social responsibility of the organization is impossible without a holistic approach towards the organization and its environment. In other words, the idea of social responsibility is based on universal values, the dominance of which allows organizations to aim at consistency and sustainability, together with the society and governmental institutions.

The initiative of *Business Centre Club*, one of the largest Polish entrepreneurs' organizations "*Medal of Social Solidarity*" could be a suitable example of the best practice, when the efforts of representatives of business and the authorities are brought together. Implementing this initiative, the special prize is awarded to individuals as well as company executives, who advocate the idea of corporate social responsibility. Hundreds of company executives, ministers, diplomats, the Prime Minister of Poland or even the President, the President of the European Commission or the Chairman of EESC participate when the medals are awarded (Pinto, 2011). In practice of organizational functioning the ratio of values of

organizations and common (social) values often experiences major or minor crises, which have a significant impact not only on consumers', market participants', partners', but also on the employees' relationship with the employing organization. In such cases we speak about the incongruence of the values of organization and employees. Values unfold as daily requirements and personal challenges; therefore, a clear understanding of the importance of creativity in the hierarchy of the company values is necessary. If his value orientation coincides with the orientation of the other members, he becomes a great coordinator, uniting the team (Zabelavičienė, 2009).

Discrepancy of values, i.e. incongruence, induces the conflict between the employee and the organization, between organization and the society. In the context of social responsibility the values tell when social responsibility is just a marketing tool, and when it is the cultural self, the philosophy of the organization. Incongruence negatively affects psychological climate of the organization, it can become a cause of interpersonal conflicts. The objectives of business organizations can often vary from the aims of employees and the society, therefore, not only the problem of interpersonal, but also the problem of identity of individual and organizational values occurs. The identity of the values, or, in other words, congruence, is expressed by the fact that holders of similar values have warmer, friendlier feelings to each other, experience a sense of identity.

The task set for the organization is to create such an environment, in which values would coincide as much as possible. The idea of value congruence and social responsibility is based on the understanding that the organization's values cannot differ from the content of moral values accepted in the society. Organizations grounding their activities on universal values can expect greater success; therefore, these values should become the foundation of the organizational culture. The pursuit of congruence is the search for value balance, identity, and spontaneous harmonization of organizational, individual and public values is a key factor of the triad of values, corresponding to the concept of social responsibility.

By collective identity a person accepts the norms and typical characteristics of a specific group, as well as forms self-awareness matching the identity of the group. The comparison of the various social characteristics of the group, with which the identity is shared and other groups of different identity allows the individual to perceive himself/herself. Collective identity can show itself in fostering specific values – loyalty, self-devotion, solidarity, faithfulness, respect, etc. (Litiukas, 2011).

The values of the organization must be oriented towards fundamental socio-cultural attitudes, generally, accurately formulated, defined, formalized in digests and explained to all employees. All actions of the organization, both directed towards the organization of activities and towards the partners and the markets, must be based on the declared values, therefore, there should not remain any larger space for interpretation (Vveinhardt & Gulbovaitė, 2012). An ambition to become a socially responsible organization encourages the “inventory” of its values, setting up their relationship with the internal and external environments – interest groups.

Discussion

The number of the researches on personal and organizational values congruence shows the relevance of the value congruence in modern organizations, which gain their competitive advantage investing in personnel management. Congruence of personal and organizational values leads to a more favorable climate in the organization, minimized interpersonal friction, employee focus on the personal activities, inspiration to act compatibly (Vveinhardt & Gulbovaitė, 2012).

The implementation of ideas of congruence of personal and organizational values would effectively contribute pursuing the goals of sports organizations, as a strong motivator for both employees and trained athletes. Harmonization of values, as an incentive to strive for higher results, is not sufficiently researched and properly estimated yet.

In recent decades, the interest in and an increasing number of studies on the topics of congruence of personal and organizational values were inspired by the perception of importance of this concept. Although quite a lot of studies were carried out and there are quite a large number of methods to evaluate value congruence, the justification of the choice of instruments to examine value congruence remains not fully clarified (Vveinhardt & Gulbovaitė, 2013).

But there is still a lack of studies, which would analyze the problematic aspects of matching of values in sports organizations. So far it is the wide area for the future research, especially when analyzing closely related issues of managerial culture of organizations and social responsibility.

In spite of global trends and formed traditions of management, organizations and their international departments function in a particular cultural-value environment, which they cannot manage, therefore, they must

adapt its values matching them with the values of socio-culture and individual employees' values influenced by them.

In the process of value congruence the culture of the organization's managerial staff plays an important role. This is a significant and effective link, on the quality of which (individual values of the managerial staff and style of activity) depends the congruence of values of the organization existing the specific cultural context and the employees. Socio-culture, as the widest context, becomes a landmark in this process. Consensus is achieved only by matching all these aspects.

There is an increasing discussion about management by values; however, before the implementation of this principle, managerial changes in an organization are necessary. For example, the international standards ISO 9001 and ISO 14001, which require substantial changes in organization's approaches towards management, received the largest popularity in Lithuania in recent years. The standards express the approach that the organization's objectives must be achieved efficiently and effectively in the management of processes and their interaction (Bagdonienė, Paulavičienė, 2010). These management quality standards to be used for implementing the social responsibility guidelines defined in ISO 26000 (Guidance on social responsibility). Even in the developed countries (Hassan, 2007) most organizations take corporate social responsibility programs favorably, however, nothing less than a major part of them integrate social responsibility values into practical activity. This approach could be changed by integration of values representing the concept of social responsibility into the management culture of the organization.

The development of social responsibility has not received greater acceleration neither in Lithuanian organizations, nor in organizations of the Baltic countries. This can be explained by the trends of development of the society and the organizations themselves. This is shown by the sparse participation of the organizations in the United Nations Global Compact network, in which the organizations declare their social responsibility. Although organizations acquire the standards witnessing social responsibility, this in itself does not guarantee high operational standards that are related to internal perception of social responsibility and decision determined by values. Deeper and wider studies of the issues should encourage sport organizations to evaluate the significance of value congruence, management culture and social responsibility in order to achieve their objectives and matching them with the expectations of the members of the organization and the society.

Conclusions

The example of Lithuania shows that corporate social responsibility is perceived inadequately to the meaning of the concept by both the state authorities and the society. Public, sports organizations are not encouraged to aim at social responsibility, regardless of the significance of the idea to the organizations, in their relation to the various interest groups, from members of the organization to the state authorities.

Congruence of individual, organizational and public values is significant for any type of organizations, as it strengthens social ties between the members of the organization, promotes loyalty and orientation, concentration in pursuing the goal. Value congruence is significant for internal consistency of the organization, which positively affects the relationship with the external environment.

The organization aiming at value congruence must be oriented towards generally accepted values, what corresponds to the idea of corporate social responsibility, therefore, concerted policy provides synergy.

Sports organizations do not make use of the opportunities to participate in socially responsible activities, and the involvement of famous, popular organizations would encourage the development of the ideas of social responsibility in the society.

References

1. Amos, E. A., & Weathington, B. L. (2008). An Analysis of the Relation Between Employee–organization Value Congruence and Employee Attitudes. *The Journal of Psychology*, 142(6), 615-631. doi: 10.3200/JRLP.142.6.615-632
2. Armstrong, M. A. (1986). *Handbook of Human Resource Practice*. London: Kogan Page.
3. Bagdonienė, D., & Paulavičienė, E. (2010). Socialinės atsakomybės ir organizacijos vadybos sistemos integravimas. *Ekonomika ir vadyba. Economics & Management*, 15, 366-373.
4. Bulotienė, D., Alekrinskis, A., & Šimkus, A. (2012). Nuotykinio turizmo plėtojimo Kaune ir Kauno rajone galimybių vertinimas. *Sportinį darbingumą lemiantys veiksniai*, 5, 16-24.
5. Cable, D. M., & DeRue, D. S. (2002). The Convergent and Discriminant Validity of Subjective fit Perceptions. *Journal of Applied Psychology*, 87(5), 875-884. doi: 10.1037/0021-9010.87.5.875
6. Čepelionienė, J., Ivaškienė, V., Velička, D., Vyskupaitis, E., & Danilevičienė, A. (2012). Studentų fizinio aktyvumo ir pasitikėjimo savimi sąsajos. *Sportinį darbingumą lemiantys veiksniai*, 5, 39-44.

7. Davidson, M. C. G. (2000). *Organizational climate and its influence upon performance: A study of Australian hotels in South East Queensland*. Dissertation. School of Marketing and Management Griffith University.
8. Edvardsson, B., Enquist, B., & Hay, M. (2006). Values-Based Service Brands: Narratives from IKEA. *Managing Service Quality*, 16(3), 230–246. doi: 10.1108/09604520610663471
9. Elfenbein, H. A., & O'Reilly III, C. A. (2007). Fitting in: The Effects of Relational Demography and Person–culture Fit on Group Process and Performance. *Group & Organization Management*, 32(1), 109–142. doi: 10.1177/1059601106286882
10. Erdogan, B., Kraimer, M. L., & Liden, R. C. (2004). Work Value Congruence and Intrinsic Career Success: The Compensatory Roles of Leader-member Exchange and Perceived Organizational Support. *Personnel Psychology*, 57(2), 305–332. doi: 10.1111/j.1744-6570.2004.tb02493.x
11. Gedvilaitė, A. (2011). Kūno kultūros ir sporto strategijos formavimas Lietuvoje. *Management theory and studies for rural business and infrastructure development*, 5(29), 74–80.
12. Glisson, C., Dukes, D., & Green, P. (2006). The Effects of the ARC Organizational Intervention on Caseworker Turnover, Climate, and Culture in Children's Services Systems. *Child Abuse & Neglect*, 30(8), 855–880. doi: 10.1016/j.chiabu.2005.12.010
13. Godrich, Stephen G. (2010). Organizational Ft: the Value of Values Congruenc in Context. In: *British Academy of Management Annual Conference*, 14–16 Sep 2010, Sheffield, and University of Sheffield.
14. Gregory, B. T., Albritton, M. D., & Osmonbekov, T. (2010). The Mediating Role of Psychological Empowerment on the Relationships Between P–O Fit, Job Satisfaction, and In-role Performance. *Journal of Business Psychology*, 25(4), 639–647.
<http://dx.doi.org/10.1007/s10869-010-9156-7>
15. Hall, B. P. (2001). Values Development and Learning Organizations. *Journal of knowledge management*, 5(1), 19–32. doi: 10.1108/13673270110384374
16. Halstead, J. M., & Taylor, M. J. (Eds.). (2006). *Values in education and education in values*. London: The Falmer Press.
17. Hassan, A. (2007). Human Resource Development and Organizational Values. *Journal of European Industrial Training*, 31(6), 435–448. doi: 10.1108/03090590710772631

18. Hestroni, A., & Asya, I. (2002). A Comparison of Values in Infomercials and Commercials. *Corporate communications: An International Journal*, 7(1), 34-45. doi: 10.1108/13563280210416026
ISO 26000:2010. Available at: <http://www.iso.org/iso/iso26000>.
19. Jaques, E. (1987). *The Changing Culture of a Factory*. New York: Garland.
20. Jewell, B. R. (2002). *Integrutos verslo studijos*. Vilnius: Vilspa.
21. Johnson, J. W. (1996). Linking Employee Perceptions of Service Climate to Customer Satisfaction. *Personnel Psychology*, 40(4), 831-851. doi: 10.1111 /j.1744-6570.
22. Klenke, K. (2005). Corporate Values as Multi-level, Multi-domain Antecedents of Leader Behaviors. *International Journal of Manpower*, 26(1), 50-66. doi: 10.1108/01437720510587271
23. Kristof, A. L. (1996). Person-Organization Fit: An Integrative Review of its Conceptualizations, Measurement, and Implications. *Personnel Psychology*, 49(1), 1-49. doi: 10.1111/j.1744-6570.1996.tb01790.x
24. Kristof-Brown, A. L., Zimmerman, R. D., & Johnson, E. C. (2005). Consequences of Individuals' fit at Work: A Meta-analysis of Person-job, Person-organization, Person-group, and Person-supervisor. *Personnel Psychology*, 58, 281-342.
25. Lawrence, A., & Lawrence, P. (2009). Values Congruence and Organisational Commitment: P-O Fit in Higher Education Institutions. *Journal of Academic Ethics*, 7(4), 297-314. doi: <http://dx.doi.org/10.1007/s10805-010-9103-2>
26. Lewis R. D. (2002). *Kultūrų sandūra: kaip sėkmingai bendrauti su kitų tautų ir kultūrų atstovais*. Vilnius: Alma Littera.
27. Litiukas, D. (2011). Tapatumo raiška sporto aistrulių kelionėse. *Filosofija. Sociologija*, 22(2), 214-225.
28. Lusthaus, C., Adrien, M. H., Anderson, G., Carden, F., & Montalvan, G. P. (2002). *Organizational Assessment*. Washington: International Development Bank.
29. Morrison, K. A. (1997). How franchise job satisfaction and personality affects performance, organizational commitment, franchisor relations, and intention to remain. *Journal of Small Business Management*, 35(3), 39-67.
30. Paužuolienė, J., & Trakšėlys, K. (2009). Komunikacijos reikšmė organizaciniame kultūroje. *Vadyba*, 2(14), 157-162.
31. Piasentin, K. A., & Chapman, D. S. (2006). Subjective person - organization fit: Bridging the gap between conceptualization and

- measurement. *Journal of Vocational Behavior*, 69, 202-221. doi: 10.1016/j.jvb.2006.05.001
32. Pinto, C. T. (2011). *Opinion of the European Economic and Social Committee on 'Socially responsible financial products' (own-initiative opinion)*. *EUR_Lex*. Available at: <http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2011:021:0033:0038:EN:PDF>
33. Posner, B. Z. (2010). Another Look at the Impact of Personal and Organizational Values Congruency. *Journal of Business Ethics*, 97(4), 535-541.
34. Reino, A., Kask, T., & Vadi, M. (2007). Organizational Culture and Environment: Dynamics in Dynamics. Dynamics Aound and within Organisations. *Journal of the Humanities and Social Sciences*, 11(2), 124-138.
35. Robbins, S. P. (2006). *Organizacinės elgsenos pagrindai*. Vilnius: Poligrafija ir informatika.
36. Rubino, J. A. (1998). Aligning Personal Values and Corporate Values: a Personal and Strategic Necessity. *Employment Relations Today*, 25(3), 23-35. doi: 10.1002/ert.3910250304
37. Schmit, M. J., & Allscheid, S. P. (1995). Employee Attitudes and Customer Satisfaction: Making Theoretical and Empirical Connections. *Personnel Psychology*, 48(3), 521-536. doi: 10.1111/j.1744-6570.1995.tb01768.x
38. Schwartz, S. H. (2006). Value Orientations: Measurement, Antecedents and Consequences Across Nations. In Jowell, R., Roberts, C., Fitzgerald, R. & Eva, G. (Eds.) *Measuring attitudes cross-nationally - lessons from the European Social Survey* (pp.169-203). London, UK: Sage.
39. Šimanavičienė, Ž, Kovaliov, R. & Šubonytė, J. (2011). Įmonių socialinės atsakomybės skatinimo politikos Lietuvoje SSGG analizė. *Economics and Management*, 16, 605-611.
40. Stacknam, R. W., Pinder, C. C., Connor, P. E. (2000). Values Lost: Redirecting Research on Values in the Workplace, 37-54. *Handbook of Organizational Culture and climate*. Edited by Askanasy, N., M., Wilderom, C. P. M., Peterson, M. F. London: Sage Publications.
41. Šimkus, A., Alekrinskis, A., Bulotienė, D. (2012). BĮ sporto mokyklos „Klevas“ veiklos kokybės vertinimas taikant EFQM tobulumo modelį. *Sportinį darbingumą lemiantys veiksniai*, 5, 144-152.
42. Teerikangas, S. (2004). Systems Intelligence in Mergers and Acquisitions – a Myth or Reality // *Systems Intelligence. Discovering a*

- hidden competence in human action and organizational life*. Helsinki: Helsinki University of Technology.
43. Thompson, J. W. (1996). Employee Attitudes, Organizational Performance, and Qualitative Factors Underlying Success. *Journal of Business and Psychology*, 11(2), 171-196.
 44. Vaitiekuskaitė, R. (2008). *Įmonės kultūros įtaka kokybės vadybai*. Available at: http://www.vgtu.lt/leidiniai/leidykla/JMKMMIPIV_2008
 45. Vandenberghe, C. (1999). Organizational Culture, Person–culture Fit, and Turnover: A Replication in the Health Care Industry. *Journal of Organizational Behavior*, 20(2), 175-184.
 46. Verplanken, B., & Holland, R. W. (2002). Motivated Decision Making: Effects of Activation and Self-centrality of Values on Choices and Behavior. *Journal of Personality and Social Psychology*, 82(3), 434-447. doi: 10.1037/0022-3514.82.3.434
 47. Vveinhardt, J. (2007). Vertybinė individo, organizacijos ir visuomenės triada: kongruencijos paieškos organizacijoje. *Ekonomika ir vadyba: aktualijos ir perspektyvos*, 2(9), 332-338.
 48. Vveinhardt, J., & Gulbovaitė, E. (2012). Asmeninių ir organizacinių vertybių kongruentiškumo Lietuvos organizacijose diagnozavimas. *Organizacijų vadyba: sisteminiai tyrimai*, 63, 99-112. doi: 10.7720/MOSR.1392-1142.2012.63.7
 49. Vveinhardt, J., & Gulbovaitė, E. (2013). Comparative Analysis of the Researches on Personal and Organizational Value Congruence. *Organizacijų vadyba: sisteminiai tyrimai*, 67, 127-142. doi: <http://dx.doi.org/10.7720/MOSR.1392-1142.2013.67.9>
 50. Vveinhardt, J., Nikaitė, I. (2008). Vertybių, kaip organizacijos kultūros elemento, poveikis viešbučių darbo veiksmingumui. *Jaunujų mokslininkų darbai*, 1(17), 176-186.
 51. Wiener, Y. (1988). Forms of Value Systems: A Focus on Organizational Effectiveness and Cultural Change and Maintenance. *Academy of Management Review*, 13(4), 534-545. doi: 10.5465/AMR.1988.4307410
 52. Zabelavičienė, I. (2009). Komandinio darbo specifika inovacijų sferoje. *Verslo ir teisės aktualijos*, 3, 87-103.
 53. Zohar, D., Marshall, I. (2006). *Dvasinis kapitalas: gerovė, kuri gali padėti išlikti*. Vilnius. Tyto Alba.
 54. Žibinskaitė, E. (2009). VDU merginų krepšinio komanda: tapatumas ir socialinė aplinka. *Grupės ir aplinkos*, 1, 261-274.

Submitted: June 15, 2013

Accepted: November 27, 2013

ORIGINAL RESEARCH PAPER

**HIGH PERFORMANCE ATHLETES' DUAL CAREER
POSSIBILITIES IN LATVIAN HIGHER EDUCATIONAL
INSTITUTIONS****Ilvis Ābelkalns, Andrejs Geske**

University of Latvia

Address: Raina bulv.19, Riga, Latvia, LV1586

Phone: + 371 67034041

E-mail: ilvis.abelkalns@lu.lv, andrejs.geske@lu.lv

Abstract

This article aims to provide an overview of high performance athletes-students' dual career management opportunities in Latvian higher education institutions. This paper analyzes the scientific literature and high performance athletes' survey results. The authors in the paper explore and analyze the possibilities for high performance athletes to get an education and to improve their training process. This paper provides a theoretical overview and analysis of high performance athletes' survey results in respect of the subject. Analyzing high performance athletes' study process in a higher educational institution the authors conclude that the number of high performance athletes – students in the first two years of study, that is respectively 19-21 years of age, which is the transition period from early youth to youth age group, have problems with carrying out the study plan. Students - athletes make multiple mistakes in the management functions in the study process: time planning, organizing, controlling, lack of motivation. High performance athletes have four important indicators for dual career: the learning environment, the sport environment, the support that they have, athletes' self-contribution in the dual career process. As a result, dual career management guidelines suited to successful management of high performance athletes' dual careers in Latvian higher educational institutions have been worked out.

Key words: *dual career, education, high performance athletes, sport.*

Introduction

In modern society sport has a social, economic and education – promoting role. Sport is an area of human activity that is of particular

interest to European Union citizens and it has a great potential to bring people together, regardless of age and social background. A high level sport is becoming increasingly important, and it contributes to the social role of sport. Sport not only improves health, but also educates, and it plays an important role in social and cultural life, as well as recreation. Social role of sport can strengthen the European Union's external relations (White Paper on Sport, 2007).

Sport is a dynamic and fast growing industry, whose macro – economic impact is underestimated. Economic value of sport is increasingly associated with intellectual property rights. These rights relate to copyright, publicity, trademark, image and media rights of an athlete. In a dynamic industry that is subject to increasing globalization, the intellectual property rights become an underlying factor for a healthy economy. It is important to promote sport meaning in the field of education. The values conveyed through sport help develop knowledge, motivation, skills and perseverance. Time spent in sport activities at schools and higher educational institutions is good for health and education; such benefits should be further encouraged.

To ensure high performance athletes' reintegration into the labor market at the end of their sporting careers, European Athletes as students dual career network (EAS) points out that already at the very beginning particular attention has to be paid to young athletes' dual professional training and there have to be formed high quality local training centers (such as in France - National Sports Institute, expertise and performance, Great Britain - The Talented Athlete Scholarship Scheme), that would correspond to athletes' moral, educational and professional interests (EAS, 2013).

Nowadays, education is more important, without it no one can compete in the labor market and in other areas of life as well. Not only is the level of education important, but also the personality characteristics which are developed when educating. An essential role is the individual creativity, the ability to flexibly adapt to any situation, the ability to create new, competitive ideas.

An important initiative of the European Union in the field of sport was to announce the year 2004 as *the European Year of Education through Sport* that aimed at raising awareness of the potentially beneficial links between education and sport, and to introduce young people to the knowledge and skills that are needed not only to develop their physical potential and willingness to participate, but also to promote young people's social skills in a multicultural context (European Year of Education through Sport, 2004).

The transition from a secondary school to a higher educational institution for young people associates with major changes in their personal lives (environmental change, a shift in sport from a young age to the junior age and adult sport) and it often causes additional stress. For athletes it is difficult to shift to adult society, feeling that they are unable to achieve high results in sport, young people often make premature decisions - stop the high performance sport in favor of good education to get a future profession.

This period coincides with Erikson's (1998) human psychological division by life stages. Erikson distinguishes eight life stages, but in this paper the authors analyze only two stages of human development - adolescence (12 - 18 years old and young adulthood (19 - 25 years old).

In Latvia young people from about 16 - 19 years of age learn at a secondary school and from 19 to 25 years of age study at a higher educational institution. In a higher educational institution the problem group is youth in the first two years of study, which corresponds to an average age of 19 - 21 years, as a transitional period, so the authors in the study analyze youth, high performance athletes two age groups (maturity stage).

In the process of high performance athletes' dual careers the environment is important in which high performance athletes - students spend most of the day (lectures, library, laboratories, trainings, competitions, etc.). In formation of dual careers we are faced with educational and sport environments as well as with social environment which is closely related to the two previous ones. In this study, the authors mainly focus on the educational and sport environments.

In society (especially for children, young people) high performance athletes are often seen as idols, whom resemble to. Thus the athlete's behavior and attitude is an example of how to live in harmony with the surrounding environment (e.g. do not pollute the surroundings, use of ecological detergents, etc.). The society has an equally significant interaction between the natural environment, the physical and psychological environment. The sport environment can be compared to the learning environment, just with different conditions, because in training process as well as in competition process teaching and learning takes place. In dual career it is important - how high performance athletes are able to make the transition from educational environment into the sport environment, identifying common factors in the interaction.

Material and methods

The aim of the article is to study and analyze high performance athletes' dual career possibilities in Latvian higher educational institutions.

The study used a qualitative method – analysis of scientific literature and a quantitative method – 319 surveys of Latvia's high performance athletes aged between 16 and 33 years.

High performance athletes are athletes who are included in the Latvian national or junior team, athletes who participate in the higher division national championships (Ābelkalns, 2012).

Dual career (in English) – dual/double career. Duale Karriere (in German) – a dual career in German means a career connecting two main areas – especially for young people – high performance athletes to successfully combine obtaining of education and sport career development (Forster, 2010).

Kaksoisura (Finnish) – (opiskelun ja urheilun yhdistäminen) in English combination of studies and competitive sport (Keskitalo, 2012).

"Dual career" is a career with two main activities (e.g. sport and education). For student – athlete "dual career" in a higher educational institution means that in a certain period of time a person connects sport with studies at school, leading to high achievement in sport and acquired academic education (Uebel, 2006).

While Stambulova (2010) explains that "dual career" is coordinated action process in which an athlete develops his athletic and academic competence, contributes to psychosocial and psychological development (Stambulova, 2010).

In order to successfully develop high performance athletes' dual career, the authors analyze the educational and sport environment. To better understand high performance athletes' education and sport career formation processes, it is necessary to analyze the environment in which students - athletes develop their competencies. Nowadays, the environment and the educational environment are defined from different aspects.

Environment – are all the conditions and factors both living and non-living, which affect the body, or even a body system throughout its life, or existence. The term "environment" can be extended to the whole area and the specific aspects of it. Content of the concept is formed of: nature environment, human modified environment, social environment, human internal environment.

Paik and Selby describing the environmental concept, name four interrelated elements that make it up:

- Nature environment – all the wildlife, bio-regulatory mechanisms, animals and plants;

- Human built environment – infrastructure, buildings, transport, communications, houses, schools, stadiums, public buildings, structures and roads;

- Social environment – the relationship between persons in group or in the country, as well as relationships between the countries;

- Internal environment – the human as a personality physical, mental, emotional and intellectual level of orderliness and balance (Paiks, Selbijs, 1996).

The learning environment is an environment where children, pupils, students purposefully create their own experience, values, skills, knowledge and attitudes towards themselves and the world around them. Describing learning environment it is necessary to take into account three generalized pillars: matter environment, mental conditions and human resources (Ivanova, Žogla, 2011).

The learning environment is as purposefully organized situation where pupils, teachers, students and lecturers, make up their own experience, values, skills, knowledge and attitudes towards themselves, others and the world around them.

Ivanova and Žogla (2011) emphasize that there is purposefulness in organizing the learning environment, in the case of environment in educational institution, but there are also random learning situations that are deliberately organized, but which specific features allow the individual to learn new or re-evaluate existing knowledge, skills, competences and values (Ivanova, Žogla, 2011).

Sport environment is characterized as macro environment as an essential factor in socialization process of the personality. That includes: society – its economic, political, cultural, climatic, ecological, geographical and sanitary environment and the factors that directly interact with the personality in its life time, a certain set of social conditions – social, material and spiritual – that in one way or another affect the formation and development of personality. Particularly important are social issues, welfare, customs and traditions in certain part of the society. The second, no less influential environmental factor is the microenvironment. It is related to athlete's daily activities surrounding social environment. The greatest impact of the microenvironment traditionally is provided by family, family education, childhood experience, peers, friends, school environment and the media. In high performance athlete's personal growth also is essential influence of a coach, sport school, sport club, team members, sport federation, judges and supporters, which generally drives athlete's actions, respecting athlete's needs, interests, abilities and opportunities. Trainings

and competitions need to create an environment where all young people are given the opportunity: to fully realize their abilities and skills in accordingly organized trainings and competitions; to enjoy movement activities in a positive emotional environment; to train without injury and excessively long physical and mental load; to be right, good, with a positive evaluation and self-esteem, even if victory or records are not achieved; to train individualized according to personal growth and development characteristics; to train at competent coaches with high sport ethical principles, norms and personal value priorities that are set out in Sport ethics and coach ethics codes; simply to be young and enjoy a full and comprehensive life (Masteralexis, Barr, Hums, 2005).

On the basis of the above mentioned statements, the authors define sport environment as purposefully organized environment where high performance athletes build their own experience, values, skills, achievements, knowledge and attitudes towards themselves and the world around them.

When organizing high performance athletes' dual career process, it is essential to understand psychological traits of the student – athletes' age group.

17 – 20 years old young people start to think seriously about their place in life and career choices. For them peer group still remains important, but a lot more young people start to show their individuality. At this age, young people intensely assert themselves, systematically trying to create and invent something new; work in all possible directions and areas. Young people in this age group like to talk about life; they philosophize, reason and look for the meaning of life. It is important that young people know what they succeed in and what they like, it helps to choose a future profession. While the previous age group youngsters willingly take to do something voluntarily, then at this age they ponder what this action will bring – young people everywhere are looking for the benefits (Ieteikumi darbam ar jauniešiem, 2011).

20 – 25 years old people know what they want and know how to accomplish it, or at least they know whom to ask how to do it. This is the time when young people engage in student life, they form serious relationships; it is an independent start in life. It is a very good time for starting a business. It becomes important to receive reward for their work, or at least see these perspectives. At this age, young people participate in activities in pairs; the company has become less important (Ieteikumi darbam ar jauniešiem, 2011).

Šmitiņa (2011) points out that 57% of students who interrupt studies are 18 – 20 years old and they have started studying immediately or very shortly after secondary education (this is the largest age group in the first year of studies as a whole). As age increases, this number decreases – studies at the age of 21-23 stops 32.6% of students, 24 – 26 years of age group contains only 5.7% of all students who interrupted their studies. This can be explained by an age distribution in the first year, however, it should also be noted that it is possible for older students to select studies more deliberate and purposefully, so they are more motivated to continue ongoing education (Šmitiņa, 2011).

In the introduction of the article it has been written about the high performance athletes' problems that arise in the transition from secondary school to a higher educational institution, it is a big change in one's personal life (environmental change, a shift in sport from a young age to the junior age and adult sport) that often leads to additional stress for athletes, this fact is also confirmed by several researchers in their works - Petitapas et al (1997); Engström (2011).

In a number of world and European countries (USA, Australia, New Zealand, UK, France, etc.) there are high performance athlete support programs dealing with formation of high performance athletes dual careers. These support organizations organize athletes - students support in their life-skills development, combining a career in sport with obtaining an education.

Analyzing the experience of the world's countries in high performance athletes – students' dual career management, the question arises: what and how to manage a high performance athletes' dual career process in Latvian higher educational institutions.

Results

In order to achieve the objective of the research there were interviewed high performance athletes on issues related to dual career: what support they receive and what would be required for athletes in learning process and sport improvement. Respondents were given statements about learning and sport, as well as four multiple choice in Likert scale: strongly agree, agree, disagree, and completely disagree, of which one had to choose the most appropriate answer. The data were processed by SPSS program.

Based on an analysis of theoretical knowledge (Petitapas et al, 1997; Eriksons, 1998; Engström, 2011; Šmitiņa, 2011) the authors divided all respondents into two age groups – young people under 19 years of age (n – 125) and young people from 20 years of age and older (n – 194), which also

coincides with studies in a secondary school and studies in a higher educational institution.

There were surveyed high performance athletes who participate in the Olympic Games, World Championships and European Championships, various kinds of international competitions and are the Latvian championship prize winners.

In order to determine the differences in the views between the two age groups of athletes there was conducted t-test. This analysis allows drawing conclusions about the dual career development opportunities in higher educational institutions.

As table 1 shows, for young people – high performance athletes under 19 years of age it is more important to prove themselves in sport and to their friends ($p < 0.01$), and they are not sure that they can achieve higher average marks in some subjects. The fact that for younger athletes it is more important to learn in a particular school to be able to combine studies and high performance sport ($p < 0.01$), the authors explained by the fact that most of this group of young people were enrolled in specialized sport classes or schools.

Young people – high performance athletes when getting older, begin to pay more attention to education in order to secure their future after the sport career. This means that young people over 20 years of age choose studies more for their future interests, which results in showing a greater interest in the subjects which are acquired ($p > 0.001$). Young people in this age group more often participate in high – level competitions ($p < 0.001$), as well as participate in training camps outside the country. It is important for them to know what has to be acquired in study courses ($p < 0.01$) in order to participate in the learning process using e-learning and study on an individual learning plan when they are outside the educational institution ($p < 0.001$) which in the high performance athletes' point of view is very importance when linking education with high performance sport.

Comparing the responses of the two groups of young people it can be concluded that after 20 years of age, young people more carefully plan their time and devote it more to their learning process. At this age, young people begin to develop independent relationships with the opposite sex partners, establish a family, as a result of which they often change their attitude toward life and the people around them. The fact that older young people spend a lot of time at the computer ($p < 0.015$), the authors explain by the fact that in today's interactive era the computer is used in the study process and in communication with close people.

In the next block of questionnaire there were analyzed high performance athletes' responses about support for education and sport. In the process of the work, the authors recognize that young people under 19 years of age receive more support in education from their coach than young people over 20 years of age ($p < 0.001$). In sport at the secondary school age athletes are more supported by a coach ($p < 0.001$), parents ($p < 0.014$) and teachers ($p < 0.04$). (Tab. 1)

Table 1
High performance athletes' views on sport and education

<i>Statements</i>	<i>Athletes to 19 years (M) *</i>	<i>Athletes 20 years of age and older (M) *</i>	<i>p-value</i>
I have some doubts as to obtain a higher average grade in certain subjects.	2,77	2,49	0,01
I have a greater satisfaction to win the competition than to get score "10" in a particular subject.	3,43	3,19	0,004
I am willing to devote more time to reach higher achievements in sport.	3,73	3,57	0,01
It is important for me to learn skills and abilities from my coach.	3,56	3,39	0,01
I spend a lot of time with friends.	2,57	2,38	0,014
It is important for me to know what has to be acquired in courses.	3,14	3,38	0,01
The knowledge that I get in the courses, I will be able to use in various aspects of life outside the school.	3,08	3,28	0,05
I am interested in most of the study program courses.	2,53	2,91	0,001
I have a possibility to use e-learning in learning process.	2,20	2,84	0,001
I have an opportunity to learn after the individual plan.	1,98	2,47	0,001
I take part in designing of my training plan	2,27	2,86	0,001
I often participate in high-level competitions.	2,74	3,16	0,001
I go in for high performance sport, because so I can earn money.	2,18	2,53	0,001
I always plan my time.	2,73	3,07	0,001
I spend a lot of time with my family.	2,33	2,59	0,001
I spend a lot of time moving from school to training base.	2,16	2,54	0,001
I spend a lot of time at the computer.	2,25	2,44	0,015

*Four-point Likert scale average values

Whereas young people over the age of 20 the main support in sport receive from the agent ($p < 0.001$). High performance athletes in their responses noted that both in education and in sport they receive some support from the sponsors ($p < 0.004$) and the Latvian Olympic Team (LOV) ($p < 0.001$).

High performance athletes were asked to select the type of support – financial, advisory and moral or any other that would be more necessary in the development of their dual career. Data analysis showed that all athletes need financial support, in particular, the higher the athletic achievements, the greater the financial support needed. Young people older than 20 years of age stress the need for a consultative, organizational support in organizing dual career.

The authors believe that it is important to clarify the relationship between the beneficiaries high performance athletes receive and what support they would need. Data analysis showed that high performance athletes receive the greatest support in education and sport from parents, teachers/lecturers and schools. The biggest difference between the amount of received and the desired support is from the agent, consultant and psychologist. The support from those persons in athletes' perspective is insufficient.

Studying the experience of foreign researchers in dual career forming process and taking into account the athletes' need for consultant support in organizational issues, the authors conclude that in Latvia in dual career forming process there should be involved a dual career manager, a person who advises, helps to organize high performance athletes' dual careers. Working with young people it is important to find out what they want at the moment, and give a possibility to achieve it. Often for parents it is hard to perceive young people's errors and first falls. It is good, if there is a neutral adult (dual career manager) who will not evaluate, condemn, will not scold, but will simply be side by side, and the young person will know that he can talk to or ask advice. Sense of humor and joking is very important. Young people, especially younger ones, severely perceive peer rating, criticism and remarks; their self-esteem is fragile and dependent on others. By learning how to turn the situation into a joke, to laugh at the situation and, most importantly, at themselves, young people become stronger, freer, more creative.

Analyzing the facts about high performance athletes' dual career possible development the educational and sport environment is important. The athletes' survey shows that there is a strong correlation between education and sport environment in a number of components – technically

assured ($r \geq 0.92$), corresponding to individual needs ($r \geq 0.97$), motivating ($r \geq 1.0$) and entertaining environment ($r \geq 0.98$), which is important to be able to successfully organize high performance athletes dual career.

Athletes (81.3%) note that it is important that study and sport environment is appropriate for an individual's requirements, but in the real situation in Latvia several sport facilities do not meet the needs of high performance athletes, especially dissatisfied are track and field athletes (91.3%).

Discussion

Results of this study coincide with the findings of several authors on the typical criteria in formation process of dual career. We must agree with several authors' (Petitapas et al, 1997; Eriksons, 1998; Engström, 2011; Šmitiņa, 2011) research on young people's life stages psychological groupings in age groups till 19 years of age and from 20 years of age and older. During the research, the authors divided all respondents into three age groups: up to 19 years of age, from 20 – 23 years of age and older than 24 years of age. In an analysis it was found that between the second and third age groups there is no statistically significant difference, so in further study, the authors combined the second and the third age group. It should be noted that in the course of the research it was confirmed that young people under the age of 19 communicate with friends more ($p < 0.014$), but getting older priorities change – young people are starting to listen more to professors, coaches and family advice. In high performance athletes dual career formation process acute phase is exactly the transition from secondary school to a higher educational institution, which is marked on a scale of age 19 – 20 years.

As this study confirmed, an important role in athletes dual career development has qualitative educational and sport environment interactions, technically assured ($r \geq 0.92$), corresponding to individual needs ($r \geq 0.97$), motivating ($r \geq 1.0$) and entertaining environment ($r \geq 0.98$), these statements also comply with a number of scientists' (Paiks, Selbijs, 1996; Masteralexis, Barr, Hums, 2005; Ivanova, Žogla, 2011) theories.

Researching the experience of the world countries' high performance athletes' dual career development process, the authors find that athlete support centers in a number of countries are running successfully (e.g. France, UK, Australia, USA, etc.) (Engström, 2011; EAS, 2013). Analyzing athletes' questionnaires the authors conclude that for young people especially during this transition period it is necessary to have support from organizational consultant in order to achieve their objectives in education

and sport without any stress. Analyzing foreign high performance athletes' support center work organization we are faced with an advisor, mentor and coach who within the organization are trying to support athletes in their dual career. So far, in Latvia there are only few studies on high performance athletes' dual career and the associated processes (e.g. Grants, 2011; Абелькалнс, 2012; Fernate, 2013).

Summarizing the assumptions the authors propose to introduce in higher educational institutions of Latvia high performance athletes' dual career managerial system including consultant - mentor and coach competencies.

Conclusions

In the course of the work, researching and analyzing scientific literature on dual career support opportunities in education and sport the authors conclude that young people from the age group 19 to 20 years of age are in the transition period from youth to maturity age group; that this period coincides with the transition from a secondary school to a higher educational institution; as well as there is a change in sport from youth group to the junior/adult group. This theory is confirmed in the study because the high performance athlete survey analysis shows statistically significant correlations between the two age groups.

17 – 19 years old people start to think seriously about their place in life and career choices. For them peer group still remains important, but a lot more young people start to show their individuality. 20 – 25 years old people know what they want and know how to accomplish it, or at least they know whom to ask how to do it. This is the time when young people engage in student life, they form serious relationships; it is an independent start in life.

In order to successfully accomplish the dual career process, for high performance athletes is important the environment in which they learn and the environment, where the training and sport competitions take place. Athletes recognize that it is easier to achieve the objectives of education and sport, if the educational and sport environment interact.

Data analysis showed that the high performance athletes receive strongest support in education and sport from parents, teachers/lecturers and schools. The biggest difference between the amount of received and desired support is from the agent, consultant and psychologist.

Taking into consideration all previously mentioned facts, it is concluded that high performance athletes need support mainly when beginning studies in 1st and 2nd year. Taking into account the experience of

the world's countries in athletes dual-career organization, the authors conclude that in Latvian higher educational institutions the best way to develop a dual career, is the introduction of a dual career manager in high performance athlete learning and sport management process.

This work has been supported by the European Social Fund within the project «Support for Doctoral Studies at University of Latvia».

References

1. Engström, C. (2011). Dual Career for Student-athletes: A Longitudinal Study of Adaptation during the First Six Months at the Sport Gymnasium in Sweden, (*Master-thesis sport psychology*), Lund University.
2. European Athlete as Student (EAS) Dual Career Network. Retrieved April 15, 2013, from: <http://www.dualcareer.eu/pages/archives.html>.
3. European Year of Education through Sport 2004. Retrieved December 1, 2011, from: http://europa.eu/legislation_summaries/education_training_youth/sport/135008_en.htm.
4. Eriksons, E. (1998). Identitāte: jaunība un krīze. Rīga: Jumava.
5. Fernate, A. (2013.) Student Athletes' Perceptions of Career Transition in Sport and Higher Education. Retrieved May 10, 2013, from: <http://www.lspa.lv/files/2013/Abstracts.pdf>.
6. Forster, J. (2010). Students as Top-Athletes "Promotion of the „Dual Career “In Sports and Academics”. Report presented at the EAS conference in Berlin, German.
7. Grants, J. (2011), Kā uzvarēt gudri. Retrieved October 12, 2011, from: http://www.sporto.lv/raksts/ka_uzvaret_gudri.
8. Ieteikumi darbam ar jauniešiem (2011). Ludza. Retrieved March 28, 2013, from: <http://www.ludzasbjc.lv/uploads/news/26/ieteikumi-darbam-ar-jauniesiem.pdf>. 6.
9. Ivanova, I., Žogla, I. (2011). Izglītības vide. *Izglītības zinātņu modulis*. Rīga: LU. 20.-24.lpp, 111.-127.lpp.
10. Keskitalo, R. (2012). Cooperation Between Elite Sport and Education. Report presented at the EAS Board Meeting in Paris, France.
11. Masteralexis, L. P., Barr, C. A., Hums, M. A. (2005). Principles and Practice of Sport Management. London: J&B publishers, p. 107-138.
12. Paiks G., Selbijs D. (1996). Pasaule ienāk klasē. Rīga: Vide.
13. Petitapas, A., Champagne, D., Chartrand, J., Danish, S., Murphy, S. (1997). Athlete's Guide to Career Planning - Key to Success from the Playing Field to Professional Life. Human Kinetics.

14. Stambulova, N. (2010). Why a Dual Career? Consideration Based on Career Development Research in Sport Psychology, Paper presented at the Dual Career Conference, Bosön, Sweden.
15. Šmitiņa, A. (2011). Studentu atbalsta pilnveidošanas iespējas un studiju pārtraukšanas samazināšanai Latvijas augstākās izglītības iestādēs: promocijas darbs doktora zinātniskā grāda iegūšanai vadībzinātnē. Apakšnozare: izglītības vadība. Latvijas Universitāte. Rīga: LU. 215. lpp.
16. Uebel, M. (2006). Nya perspektiv på riksidrotts-gymnasierna – vad flickor och pojkar värdesätter i RIG – verksamheten. Retrieved October 20, 2012, from:
http://rf.se/ImageVault/Images/id_153/scope_128/ImageVaultHandler.aspx
17. White Paper on Sport. (2007). Commission of the European Communities. Retrieved October 12, 2012, from:
http://ec.europa.eu/sport/documents/wp_on_sport_en.pdf.
18. Абелькалнс И., (2012). Возможности формирования среды для дуальной карьеры спортсменов высокого мастерства. Физическая культура и студенческий спорт: проблемы реализации стратегии развития. Казань: гос. техн. ун-та, 2012., 194-199стр.

Submitted: June 15, 2013

Accepted: November 27, 2013

ORIGINAL RESEARCH PAPER

RELATIONSHIPS BETWEEN ADOLESCENTS' SELF-ESTEEM, AGGRESSION, TOBACCO AND ALCOHOL CONSUMPTION AND INVOLVEMENT IN SPORT ACTIVITIES AND GENDER

Alma Kisieliënė¹, Diana Arlauskaitė²

¹Lithuanian Sports University,

Address: Sporto str. 6, LT-44221 Kaunas, Lithuania

² Lithuanian Judo Federation

Phone: +372 861619761

E-mail: alma.kisieliene@gmail.com, sfinksas.judo@gmail.com

Abstract

Involvement in sport activities has a positive effect on the adolescent's self-esteem, encourages the development of their identity and positive self-respect. It stimulates communication with their peers, helps to develop their physical abilities, shapes their character, encourages creativity, forms the system of values, prevents from bad habits and fosters their integration into society. The aim of our study was to determine the relationships between adolescents' self-esteem, aggression and tobacco and alcohol consumption and involvement in sport activities and their gender. The study was carried out at some comprehensive and specialized sport schools in Kaunas. The study applied questionnaire survey. The analysis did not reveal any statistically reliable differences in smoking habits with regard to sport activities and gender. Alcohol drinking habits differed in relation to gender and sport activities. The comparison of the respondents with respect to their gender revealed the differences in alcohol drinking and physical aggression. Boys distinguished themselves in a considerably higher physical aggression than girls. The sport involved female demonstrated lower hostility among their peers. The comparison of the indexes of self-esteem, smoking, physical and verbal aggression and anger among sport involved adolescents and the non-sport-involved ones did not reveal the statistically significant differences between the tested groups. Sport involved female demonstrated lower hostility than non-sport-involved peers. Sport involved male used alcoholic drinks more frequently than non-sport-involved peers. In the analyzed sample, the statistically reliable relations between the adolescents' sport achievements and their self-esteem and aggression were not determined.

Key words: *adolescents, aggression, self-esteem, tobacco and alcohol consumption, sport, gender.*

Introduction

Involvement in sport activities has a positive effect on the adolescents' self-esteem, encourages the development of their identity and positive self-respect. It stimulates communication with their peers, helps to develop their physical abilities, shapes their character, encourages creativity, forms the system of values, prevents from bad habits and fosters their integration into society.

Socialization can take place through participation in sports since sports provide learning environments where participants have the opportunity to learn competition, cooperation, roleplaying and discipline regarding rules, regulations, and goals. In this sense, sports can be seen as a laboratory of human experience. The structure of social relations in organized sports can give participants experience in various roles and group interaction, and contribute to the development of social characteristics that integrate them into existing larger social structure (Nucci, Young-Shim, 2005).

Unfortunately, a "win-at-all-costs" philosophy has often led to unethical and aggressive behaviors, impacting negatively and destructively on the development and well-being of young athletes and of society at large (Willemse et al., 2011). Research on behaviors of adolescents engaged in sports show that during a match cases of aggressive behavior are more common than those of pro-social behaviors (Kavussanu et al., 2009). Besides, older adolescent athletes display more frequent antisocial and less frequent pro-social behaviors (Romand, Pantaléon, Cabagno, 2008), they tend to view aggression as more acceptable behavior (Chow, Murray, Feltz, 2009). Some studies also indicated that males and females did not differ in pro-social behaviors, but males engaged in more antisocial acts than females (Kavussanu et al., 2009).

The links between health behaviors and sporting activities are very well documented. The use of psychoactive substances plays an important part in the studies. Ethnological and epidemiological studies have been conducted on different types of subject: athletes (Peretti-Watel 2001) and adolescents (Guilbert, Baudier 1998). In particular, the relationship between physical activity and tobacco consumption in youth has been explored and studies have found that the most active adolescents were less likely to smoke (Donato *et al.* 1997), particularly among girls (Aaron *et al.* 1995). Other researchers have drawn attention to the need for further analysis to

explore the effects of exercise on smoking cessation (Nishi *et al.* 1998; Usher *et al.* 2000). Concerning alcohol, similar studies have sometimes led to contradictory results.

On the one hand, some researchers have found that those most involved in sport have the lowest alcohol consumption (Donato *et al.* 1997), while other studies have shown that they consume more alcohol than others (Faulkner, Slaterry 1990; Machaud, Jeannin, Suris, 2006), especially among boys (Aaron *et al.* 1995). Other studies, more cautiously, failed to find a simple relationship between the two behaviors (Overman, Terry 1991). In order to try to go beyond those apparent contradictions, a curvilinear link between alcohol use and sporting activities has been mooted: as a whole, athletes drink less alcohol than those who perform no physical activity, but those who play sports intensively drink more than those who practice sports in moderation (Choquet, Hassler 1997).

The aim of the study was to determine the relationships between adolescents' self-esteem, aggression and tobacco and alcohol consumption and involvement in sport activities. In this study we extended previous research by (1) examining relationship between adolescent athletes' substance use and their self-esteem and aggression, and (2) evaluating adolescent substance use, self-esteem and aggression by gender.

We hypothesized (H1) that self-esteem and aggression would be negatively correlated with involvement in sport activities, and alcohol consumption values would be positively correlated with involvement in sport. Also we hypothesized (H2) that female athletes' scores on verbal aggression values would be higher than those of males, and scores on physical aggression would be lower.

Material and methods

Participants. The total sample consisted of 609 adolescents (236 girls and 373 boys) from secondary schools and specialized sports schools in Kaunas. Their age ranged from 12 to 18 years (mean = 14.58; SD = 1.53). 262 adolescents (61 girls and 201 boys) were involved in various sport activities (basketball, track-and-field athletics, judo, boxing, and wrestling) while 347 adolescents (172 boys and 175 girls) were not involved. The adolescents involved in sport activities filled in their questionnaires at sports school after their training time; the adolescents uninvolved in sports – at school time during the breaks. The test procedure was performed with the permission of parents and school administration.

Measures. The survey-style assessment questionnaire was used in this study and it contained five sections. The first requested the participants'

gender and age. The other sections assessed adolescents' involvement in sports activities, self-esteem, aggression and substance use. (Each specific scale is described below).

Adolescents' involvement in sport activities was assessed by asking questions such as: "Are you playing any sport now?" Involvement in sports was considered as formal belonging to some sports club, school, circle, or group for a period longer than half a year, but did not include independent physical activities in leisure time.

Adolescents' level of self-esteem was determined by Rosenberg Self-Esteem Scale (1965). The 10 items of the RSES assess a person's overall evaluation of his or her worthiness as a human being (Rosenberg, 1979). Responses were coded on a 4-point scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). Negatively worded items (3, 5, 8, 9, and 10) of the Rosenberg Self-Esteem Scale were reversed such that higher scores indicate higher levels of global self-esteem (Cronbach's $\alpha=0.80$).

The expression of aggression was examined with the use of the Aggression Questionnaire (Buss, Perry, 1992), consisting of 29 items using a 7-point scale, ranging from *extremely uncharacteristic of me* (1) to *extremely characteristic of me* (7). AQ 29 items based on 4 factors: physical aggression, verbal aggression, anger and hostility (Cronbach $\alpha=0.90$).

Alcohol drinking and smoking was determined with the Health Behavior in Schoolaged Children HBSC (*Variable List for HBSC Mandatory Questionnaire 2005/06*) questionnaire worked out for the international research concerning the state of the school-aged children's health and way of life. There were questions about smoking frequency and different kind of alcohol (beer, wine, champagne, vodka, weak alcoholic drinks, such as Fizz) usage frequency from „never” to „every day”.

Statistical analysis. The data were analyzed using SPSS for Windows 13.0 (*Statistical Package for Social Science 13 for Windows*). The differences of aggression were determined by a Mann-Whitney test for nonparametric data. Percentage distribution of tobacco and alcohol consumption was calculated using χ^2 statistic. Spearman's rank correlation coefficient (T_s) was used in the relationship between variables. The results were considered statistically significant if $p < 0.05$.

Results

The results of the analysis did not reveal any statistically significant differences in smoking habits with regard to sport activities and gender. 51.5% sport activities involved adolescents and 53% non-sport-involved ones claimed that they had never tried smoking; among them 56.4% female

and 49.9% male. During the research 90.8% sport activities involved adolescents and 87% non-sport-involved ones, among them 89.3% boys and 87.7% girls admitted that they were no-smokers.

Alcohol drinking habits differed in relation to gender. Boys drank alcoholic drinks, such as beer ($\chi^2 = 17.84$; $df = 4$; $p < 0.01$) and vodka ($\chi^2 = 18.64$; $df = 4$; $p < 0.01$) more frequently. Girls drank champagne ($\chi^2 = 11.66$; $df = 4$; $p < 0.05$). Boys admitted more cases of alcohol intoxication frequency ($\chi^2 = 27.08$; $df = 4$; $p < 0.01$). 6.5% sport involved adolescents and 6.1% non-sport-involved ones were alcohol intoxicated for more than 10 times, among them 6.8% boys and 2.5% girls. 53.8% sport involved adolescents and 59.7% non-sport-involved adolescents claimed that they had never been alcohol intoxicated, among them 53.1% male and 63.6 % female.

The comparison of the indexes of physical or verbal aggression, anger, self-esteem did not show statistically significant differences between the sport activities involved adolescents and the ones non-sport-involved ($p > 0.05$). It is interesting to note that between the sport involved and non-sport-involved adolescents the difference was discovered only in hostility ($p < 0.01$) (Tab. 1).

Table 1

Distribution of girls, boys and sport- involved and non-sport-involved adolescents by aggression and self-esteem

Variable	Involvement in sport		p	Gender		p
	Involved in sport R	Non-sport-Involved R		Boys R	Girls R	
Physical aggression	317.09	295.87	0.14	345.42	241.12	0.000**
Verbal aggression	290.09	316.26	0.69	292.93	324.08	0.03*
Anger	307.87	302.83	0.73	307.31	301.35	0.68
Hostility	281.33	322.87	0.004**	293.31	323.48	0.04*
Self-esteem	305.63	304.52	0.94	313.81	291.08	0.12

Notes. R — mean rank. * — $p < 0.05$. ** — $p < 0.01$.

Next we explored differences of adolescent aggression and self-esteem by their involvement in sport (Tab. 1). Research results did not reveal statistically significant differences comparing physical, verbal aggression and anger. But adolescent involved in sport scores in hostility was significantly higher than non-sport involved ($p < 0.01$). Research results did not reveal statistically significant differences comparing self-esteem by involved and non-involved in sport adolescents.

The comparison of the respondents with respect to their gender revealed the differences in physical and verbal aggression and hostility. Boys distinguished themselves in a considerably higher physical aggression than girls ($p < 0.01$). Girls distinguished themselves in higher verbal aggression and hostility than the boys ($p < 0.05$). Meanwhile, the differences between the indexes of smoking habits and self-esteem with regard to gender were not determined ($p > 0.05$).

In order to find out the differences under the impact of sport activities, the sport involved female were compared with the non-sport-involved ones and the sport involved male with the non-sport-involved ones (Tab. 2).

Table 2

Distribution of sport-involved and non-sport-involved boys and sport-involved and non-sport-involved girls by aggression and self-esteem

Variable	Boys		p	Girls		p
	Involved in sport R	Non-sport-involved R		Involved in sport R	Non-sport-involved R	
Physical aggression	185.00	189.33	0.70	118.2	118.61	0.97
Verbal aggression	179.57	195.68	0.15	117.08	118.99	0.85
Anger	188.98	184.69	0.70	117.58	118.82	0.90
Hostility	179.37	195.91	0.14	103.51	123.73	0.046*
Self-esteem	182.24	192.56	0.36	123.28	116.83	0.52

Notes. R— mean rank. * — $p < 0.05$.

The sport involved girls distinguished themselves in lower hostility ($p < 0.05$) and drank fizz more frequently than the non-sport-involved girls ($\chi^2 = 11.12$; $df = 3$; $p < 0.01$). Sport involved boys drank beer ($\chi^2 = 16.43$; $df = 4$; $p < 0.01$), champagne ($\chi^2 = 11.84$; $df = 4$; $p < 0.05$) and vodka ($\chi^2 = 10.53$; $df = 4$; $p < 0.05$) more frequently than non-sport involved ones. The indexes showing smoking and self-esteem did not differ statistically significantly ($p > 0.05$). It is interesting to note that between the sport involved and non-sport-involved boys the difference was discovered only in alcohol drinking that was discussed above. Sport involved boys drank beer ($\chi^2 = 16.43$; $df = 4$; $p < 0.01$), champagne ($\chi^2 = 11.84$; $df = 4$; $p < 0.05$) and vodka ($\chi^2 = 10.53$; $df = 4$; $p < 0.05$) more frequently than non-sport-involved ones.

The research was aimed at the determination of the relations between self-esteem, aggression, smoking and alcohol consumption, sport activities

and gender. They were analyzed according to the Spearman's correlation coefficient (T_s) (Tab. 3).

Table 3

Relationships (Spearman's) between adolescents' self-esteem, aggression, tobacco and alcohol consumption, gender and sport Achievements

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1.PA	1												
2.VA	0.51**	1											
3.A	0.61**	0.58**	1										
4.H	0.45**	0.44**	0.62**	1									
5.SE	-0.09*	0.00	-0.16*	-0.29**	1								
6.G	-0.29**	0.07	-0.04	0.06	-0.05	1							
7.SF	0.2**	0.13**	0.16**	0.11**	0.05	0.02	1						
8.AIF	0.34**	0.22**	0.23**	0.05	-0.01	-0.16**	0.45**	1					
9.BDF	0.27**	0.17**	0.2**	0.05	-0.04	-0.21**	0.34**	0.66**	1				
10.WDF	0.12**	0.14**	0.14**	0.03	-0.05	-0.01	0.17**	0.34**	0.55**	1			
11.CHDF	0.15**	0.18**	0.16**	0.09*	-0.02	0.05	0.27*	0.37**	0.48**	0.66**	1		
12.FDF	0.20**	0.12**	0.18**	0.1*	-0.07	0.03	0.33**	0.41**	0.51**	0.55**	0.53**	1	
13.VDF	0.29**	0.19**	0.24**	0.08	0.02	-0.22**	0.35**	0.61**	0.66**	0.56**	0.54**	0.53**	1

Notes. PA – Physical aggression, VA – Verbal aggression, A – Anger, H – Hostility, SE – Self-esteem, G – Gender, SF – Smoking frequency, AIF – Alcohol intoxication frequency, BDF – Beer drinking frequency, WDF – Wine drinking frequency, CHDF – Champagne drinking frequency, FDF – Fizz drinking frequency, VDF – Vodka drinking frequency. *— $p < 0.05$, **— $p < 0.01$.

Statistically highly reliable relations ($p < 0.01$) of medium strength were determined among all the types of aggression: physical and verbal aggression ($T_s = 0.51$), physical aggression and anger ($T_s = 0.61$), physical aggression and hostility ($T_s = 0.45$), verbal aggression and anger ($T_s = 0.58$), verbal aggression and hostility ($T_s = 0.44$), and anger and hostility ($T_s = 0.62$). Another medium strength highly reliable relationship was determined between the frequency of alcohol drinking that reached the level of intoxication and smoking frequency ($T_s = 0.45$). Alcohol intoxication was on the average related with the frequency of weak alcoholic drinks usage, such as Fizz, etc. ($T_s = 0.41$), wine ($T_s = 0.34$), champagne ($T_s = 0.37$), stronger drinks, such as beer ($T_s = 0.66$), and strong beverages, such as vodka ($T_s = 0.61$). Significant relations were distinguished between a number of factors: smoking and beer ($T_s = 0.34$), champagne ($T_s = 0.27$), weak alcoholic drinks ($T_s = 0.33$) and vodka ($T_s = 0.35$) drinking frequency. Significant relations had also been found between smoking and physical aggression ($T_s = 0.2$). It is worth stressing that self-esteem was inconsiderably negatively related only with hostility ($T_s = -0.29$). The analysis of the relations between aggression and gender revealed an inconsiderable relation between physical aggression and male gender ($T_s = 0.29$).

Discussion

In this study, we surveyed the following issues: what were the adolescent self-esteem, aggression and bad habits, whether they differed among boys and girls and in the groups of different physical activity and which relationship existed between adolescent self-esteem, aggression, tobacco and alcohol consumption, gender and sport activities.

K. C. Kling, J. S. Hyde, C. J. Shower, B. N. Buswell (1999) analyses provide evidence that males score higher on standard measures of global self-esteem than females, but the difference is small. They take the assumption that potential reasons for the small yet consistent effect size are discussed. In our study the statistically reliable differences between gender and self-esteem were not determined.

Our findings in adolescent aggression regard those reported in the literature in which male adolescents reportedly have significantly higher estimates of physical aggression (Buss, Perry, 1992; Sullivan, 2005; Willemsse, Smith, van Wyk, 2011). L. Leoschut and P. Burton (2006) proposed that increased exposure to violence may enable adolescent males to learn physical aggression through modeling, vicarious observation and social sanctioning. This study agrees with reported findings in the literature where female adolescents were shown to have significantly higher estimates of hostility (Bjorkvist et al., 1992; Buss, Perry, 1992). It might be deduced that girls tend to show their aggression in a more socially appropriate and indirect manner to avoid possible social sanctions being imposed on them. On the other hand, boys may be more physically aggressive because the context demands it and it becomes necessary for them to defend themselves physically.

Dunn and co-authors (2011) found that over 40% of males and females adolescents had tried alcohol in their lifetime and over 34% of both gender had tried cigarettes. We established a similar trend in our research over 40% adolescents, among them 52% boys and 44% girls had tried cigarettes in their lifetime and about 40% adolescents claimed that they had tried alcohol in their lifetime, among them 50% male and 37 % female.

A. Bielskutė and J. Zaborskis (2005) revealed in their research that the alcohol addiction of schoolchildren at higher grades is very prevalent and correlates with smoking. Our results are consistent to their opinion. The relationship was determined between the frequency of alcohol drinking that reached the level of intoxication and smoking frequency.

The analysis of alcohol drinking habits showed that sport involved boys drank beer, champagne and vodka more frequently than non-sport-involved ones. Sport involved girls drank Fizz more frequently than non-

sport-involved ones. Such trends were also determined in previous studies (Martens, Dams-O'Connor, Beck, 2006). They found that participating on sports teams were correlated with the higher rates of alcohol use, supporting the negative stereotypes between athletics and alcohol consumption.

Conclusion and perspectives

The comparison of the indexes of self-esteem, smoking, physical and verbal aggression and anger among sport involved adolescents and the non-sport-involved ones did not reveal the statistically significant differences between the tested groups. Sport involved female demonstrated lower hostility than non-sport-involved peers. Sport involved male used alcoholic drinks more frequently than non-sport-involved peers. Our research results suggest that sports activities may decrease one type of aggression – hostility, especially among girls.

M. Dunn et al. (2011) had found that the more risk factors an adolescent has (e.g., poor family communication, peer pressure, lack of family support) the likelihood increases of being involved in risk behaviors such as substance abuse. Future studies on adolescent aggression, substance abuse and involvement in sport activities should use multivariate designs in an effort to better identify this research area.

References

1. Aaron, D. J., Dearwater, S. R., Anderson, R., Olsen, T., Kriska, A. M., & Laporte, R. E. (1995). Physical Activity and the Initiation of High-risk Health Behaviours in Adolescents. *Medicine and Science in Sports and Exercise*, 27, 1639–1645.
2. Bielskutė, J., & Zaborskis, A. (2005). Paauglių polinkis vartoti alkoholinius gėrimus ir šį poelgį skatinantys veiksniai. *Medicina*; 41(5) 409-416
3. Bjorkqvist, K., Lagerspetz, K. M. J., & Kaukiainen, A. (1992). Do Girls Manipulate and Boys Fight? Developmental Trends in Regard to Direct and Indirect Aggression. *Aggressive Behaviour*, 18, 117-127.
4. Black, D., Lawson, J., & Fleishman, S. (1999). Excessive Alcohol Use by Non-elite Sportsmen. *Drug and Alcohol Review*, 18, 201-205.
5. Buss, A. H., & Perry, M. (1992). The Aggression Questionnaire *Journal of Personality and Social Psychology*, Vol 63(3), 452-459
6. Choquet, M., & Hassler, C. (1997). Sports and Alcohol Consumption During Adolescence. *Alcoolologie*, 19, 21–27.
7. Chow, G. M., Murray, K. E., & Feltz, D. L. (2009). Individual, Team, and Coach Predictors of Players' Likelihood to Aggression in Youth Soccer. *Journal of Sport and Exercise Psychology*, 31, 425-443.

8. Donato, F., Assanelli, D., Chiesa, R., Poeta, M. L., Tomasoni, M., & Turla, C. (1997). Cigarette Smoking and Sports Participation in Adolescents: A Cross-sectional Survey Among High School Students in Italy. *Substance Use and Misuse*, 32, 1555–1572.
9. Dunn M., Kitts C., Lewis S., Goodrow B., & Scherzer G. (2011). Effects of Youth Assets on Adolescent Alcohol, Tobacco, Marijuana Use, and Sexual Behavior. *Journal Of Alcohol , Drug Education*55(3), 23-40.
10. Guilbert, P., & Baudier, F. (1998). Sport and Physical Activity. In: Baudier, F., Janvrin, M. P., Arenes, J., eds. *Baromètre Santé Jeunes 97/98*, 101–115. Vanves: CFES.
11. Faulkner, R. A., & Slaterry, C. M. (1990). The Relationship of Physical Activity to Alcohol Consumption in Youth, 15–16 Years Old. *Canadian Journal of Public Health*, 100, 172–180.
12. Kavussanu, M., Stamp, R., Slade, G., & Ring, C. (2009). Observed Prosocial and Antisocial Behaviors in Male and Female Soccer Players. *Journal of Applied Sport Psychology* , 21, 62-76
13. Kling, K. C., Hyde, J. S., Showers, C. J., & Buswell, B. N. (1999). Gender Differences in Self-esteem: A Meta-analysis. *Psychological Bulletin*, 125(4), 470-500.
14. Wild, L. G., Flisher, A. J., Bhana, A., & Lombard, C. (2004), Associations Among Adolescent Risk Behaviours and Self-esteem in Six Domains. *Journal of Child Psychology and Psychiatry*. 45,1454–1467.
15. Leoschut, L., Burton, P. (2006). *How Rich the Rewards? Results of the 2005 National Youth Victimization Study* (Centre for Justice and Crime Prevention Monograph series No.1) Cape Town, South Africa: Centre for Justice and Crime Prevention
16. Martens, P. M., Dams-O'Connor, K., Beck, M.C. (2006). A Systematic Review of College Student Athlete Drinking: Prevalence Rates, Sport-related Factors, and Interventions. *Journal of Substance Abuse Treatment*, 31, 305-316.
17. Michaud, P.A., Jeannin, A., Suris, J.C. (2006). Correlates of Extracurricular Sport Participation Among Swiss Adolescents. *European Journal of Pediatrics*, 165, 546-555.
18. Nishi, N., Jenicek, M., Tatara, K. (1998) A Meta-analytic Review of the Effect of Exercise on Smoking Cessation. *Journal of Epidemiology*, 8, 79–84.

19. Nucci, C., Young-Shim, K. (2005). Improving Socialization Through Sport: Ananalytic Review of Literature on Aggression and Sportsmanship. *Physical Educator*.
20. Overman, S. J. & Terry, T. (1991) Alcohol Use and Attitudes: A Comparison of College Athletes and Nonathletes. *Journal of Drug Education*, 21, 107–117.
21. Peretti-Watel, P. (2001). Sociological Hypotheses on Risks in Sport Consumption Behaviour Based on a Preliminary Clinical Study. In: Billet, D., ed. *Sports Played by Young People and Dangerous Behaviour*, 46–50. Paris: Ministère de la Jeunesse et des Sports.
22. Romand, P., Pantaléon, N., Cabagno, G. (2009). Age Differences in Individuals' Cognitive and Behavioral Moral Functioning Responses in Male Soccer Teams. *Journal of Applied Sport Psychology*, 21, 49–63.
23. Rosenberg, M. (1965). *Society and the Adolescent Self-image*. Princeton, NJ: Princeton University Press.
24. Schmitt, P., Allik, J. (2005). Simultaneous Administration of the Rosenberg Self-Esteem Scale in 53 Nations: Exploring the Universal and Culture-Specific Features of Global Self-Esteem. *Journal of Personality and Social Psychology*, 89, 4, 623–642
25. Sullivan, D.L. (2005). Exposure to Violence and Self-reported Aggression Amongst a Sample of High School Learners in eth Stellenbosch District. Unpublished Masters' Thesis, University of Stellenbosch, Stellenbosch, South Africa.
26. Usher, M. H., Taylor, A. H., West, R., McEwen, A. (2000). Does Exercise aid Smoking Cessation? A Systematic Review. *Addiction*, 95, 199–208.
27. WHO. Health Behaviour in School-aged Children. A WHO Cross-National Survey: Research protocol for the 1997–1998 study. Bergen; 1998, 91.
28. Willemse M., Smith M., van Wyk S. (2011). The Relationship Between Self-efficacy and Aggression in a Group of Adolescents in the Pre-urban Town of Worcester, South Africa: Implications for Sport Participation. *African Journal of Physical, Health Education, Recreation, Dance*, 1, 17, 90-102.

Submitted: June 15, 2013

Accepted: November 27, 2013

ORIGINAL RESEARCH PAPER

**THE PHYSICAL EDUCATION TEACHERS' PROFESSIONAL
ACTIVITY MOTIVATION AND PLANNING COMPETENCE**

Andra Fernāte

Latvian Academy of Sport Education
Address: 333 Brivibas Street, Riga LV-1006, Latvia
Phone: +371 67543373, Fax: +371 67543480
E-mail: Andra.Fernate@lspa.lv

Abstract

Physical education teacher will need to understand him/herself, including values, beliefs or “philosophies”, and be able to reflect on how these influence teaching and students` learning. The main aim of the study is to investigate the relationship between physical education teacher`s professional activity motivation and planning competence. Material and methods: 276 physical education teachers (118 males; 158 females) from all regions of Latvia were interviewed during the study. Semi-structured interviews were conducted. The questions were as follows: 1) Why do you teach physical education? 2) What are the advantages and disadvantages of a physical education teacher`s work? 3) What do you want to achieve as a result of teaching? 4) What objectives have you put for yourself? The results based on the linkages between meta-codes and sub-codes were constructed and analyzed with AQUAD 6 software and validated with SPSS 17 software. Results have shown that most of the people who have chosen physical education as a career mostly have positive experience in sports, they like sports (60%) or they like sports and work together with children (17%). 33% consider that the career choice was determined by combination of different factors. Physical education teachers have put such objectives for themselves: to work creatively and use different methods (22%), to maintain their physical condition (16%), to improve their knowledge and skills (20%). There is a relationship between physical education teachers` (female) beliefs about disadvantages and expectations to achievements as a result of teaching.

Key words: *physical education teachers, professional activity motivation, planning competence.*

Introduction

Changes in contemporary situation are common and stable part of our lives. In Latvia the implementation of innovative philosophy in pedagogy is rooted in physical education (PE) teacher personality characteristics, motivations and changes in competence. Physical education teacher motivation to be active in the situation of change and take advantage of the use of new approaches in the pedagogical process depends on the PE teacher internal readiness to change and the level of professional competences. For PE teacher it should be necessary to understand themselves, their values, their beliefs or "philosophy" and it should be necessary to consider how these aspects affect the study process and student learning.

Studies on the PE teacher education clearly show that researchers have only begun to explore this issue or the issues related to PE teacher psychology (Graber, 2001; Kirk, Macdonald & O'Sullivan, 2006; Carson & Chase, 2009, etc.). Little attention is paid to the motivation of PE teachers (Moreira, Fox, and Sparkes 2002, etc). PE teachers are driven by other motivation sources, not by intrinsic interest in teaching; therefore intrinsic motivation is not of main importance (Lapeniene, Bruneckiene, 2010). The principle of intrinsic motivation (Amabile, 1996) is defined as correspondence between people interests and the requirements of the work.

Empirical investigations have shown that PE teacher profession mostly is chosen by people, who have been successful in PE lessons or in sport (Stroot, 1996; Edmonds, Lee, 2002; Younger et al., 2004), because they have positive experience in sport, which, in turn influences their understanding of the image of PE teacher. The reasons why people are willing to become PE teachers mostly are connected with loving or liking sport or PE classes; PE teacher positive influence, willingness to transfer their knowledge, enthusiasm and love of others; and willingness to work with youngsters (Evans, Williams, 1989; Mawer, 1995; Capel, 2005).

Competence becomes the main weapon, produced and sold by new market of education (Jarvis, 2007). Competence can be viewed as an ability to act successfully in authentic and complicated context, integrating and using adequate knowledge, abilities, skills and attitudes (Gento, Medina & Domínguez, 2008). Such competences can be tested in their real expressions, working in the given position and practically implementing values, attitudes, motivation and abilities.

Already Englund (1997) has emphasized the importance of teacher didactic competence, i.e., an ability to reflect on the aspects of how to choose the content and methods of learning in connection with state study program. Didactic competence is an ability to choose the correct solution in

the variety of situations in the general system of differentiated and integrated solutions (Cartelli, 2006). Didactically competent teachers will carefully consider and substantiate the choice of the contents, methods and study literature. Pušnik and Zorman (2004) indicate eight main teacher competences (1) knowledge about study program, (2) knowledge about the branch of study subject, (3) planning, (4) resourcefulness in class organization, (5) student progress monitoring, (6) assessment, (7) personal professional development and (8) the use of information technologies.

In Slovenia the investigators have defined 34 different PE teacher competences, which are topical nowadays. All competences are divided into three groups (Kovac, Sloan, Starc, 2008): disciplinary (analysis and planning; assessment, evaluation and grading; classroom management; cross-curricular teaching; demonstration of curricular sports; demonstration of non-curricular sports; didactics of curricular sports; didactics of non-curricular sports; general PE didactics; organizing sport activities; physical and motor development; use general pedagogic strategies; use of educational technologies; work with students with special needs; work with talented students), sub-disciplinary (biomechanics of sport; developmental psychology; educational research; financing in sport; functioning of educational system; informational literacy; kinesiological foundations of sport; medical aspects of sport; organizational and managerial skills; philosophy and history of sport; physiology of sport; school legislation; sociology of sport and PE; sport and media, sport training theory) and general competencies (mentoring; teamwork; use of foreign language; use of theory in practice)

In the Standard of Teacher profession in Latvia as mutual skills in the branch are outlined the skills to plan teacher and student work, to organize study and upbringing work in compliance with the objectives and tasks, set forward, the skill to evaluate and promote student development and study achievements, as well as the efficiency of teacher work. These skills refer also to PE teacher didactic competences, which include three essential aspects of PE teacher activity: planning, organization and assessment.

Planning competence is ability to model behavior in longer time period. Planning is a complicated process (Lauder, 2001) and in PE lesson it is based on the answers to three questions: 1. What children expect from physical education experience? 2. How children learn the best? 3. What competences children need in physical education? Good PE teacher planning competence is manifested in different ways (Lauder, 2001). PE teachers plan and implement different study strategies corresponding to

child development in order to promote the development of physically educated students, as it is foreseen in state standards.

Daniel Pink (Pink, 2011) in his book "Drive" characterizes three features, driving people in the 21st century: autonomy – willingness to direct one's life; mastery - willingness to achieve progress to make things better; and goals – desire to do something in order to serve something greater than us. But in the 21st century the opinion about motivation is in contrast with the way how we organize things we do, how we think about things we do, and how we do what we do. We need innovations (Pink, 2011, 205).

The contribution of this paper to the existent PE literature is to fill the theoretical gap regarding how a PE teacher beliefs influence their judgments which affect their teaching practice, because teachers hold many untested beliefs which influence their response to particular PE teaching and learning situation.

In order to promote PE teacher professional growth through improving teacher professional and continuing education programs, it is essential to understand PE teacher professional motivation and their beliefs about the purposes of the PE and nature of their work.

The goal of the research is to investigate the realm of problems, connected with PE teacher professional motivation and their planning competence, as well as to consider the possible ways of overcoming them.

Material and Methods

To achieve the goal of the research was performed explanatory case investigation, embracing the schools of all Latvian regions. With the help of structured interviews were obtained data from 276 PE teachers (118 men, 158 women) from all Latvian regions (Riga (8.6%); Kurzeme (21.2%), Latgale (34.6%), Vidzeme (25.7%) and Zemgale (9.9%)) in the form of statements suitable for data processing. Respondents answered the following questions: 1. Why do you teach PE? 2. What are the advantages and restrictions in PE teacher work? 3) What are learning outcomes, which you want to achieve in the result of teaching? 4) What are the objectives you set for yourself?

In the research were used the following methods: 1) the analysis of scientific literature, 2) semi structured interviews, 3) open and axial coding, 4) methods of mathematical statistics (*One-Sample Kolmogorov-Smirnov Test, Spearman rank correlation, Mann-Whitney U, Kruskal-Wallis H, etc.*). Considering data obtaining and processing methods, was performed qualitatively-quantitative investigation, which was carried out in three phases: 1) semi structured interviews for obtaining qualitative data

(statements); 2) data qualitative and quantitative primary and secondary processing; 3) data analysis and interpretation.

Statements are coded, considering respondent gender, age and work experience. Considering that teachers obtain experience in their teaching practice, they professionally develop in different ways. Huberman (1993) describes these experience stages, calling them time periods in teacher work: 1) 1-3 years of work: period of entering career; 2) 4-6 years of work: stabilization period; 3) 7-18 years of work: period of experimenting and active position; 4) 19-30 years of work: period of conservatism; 5) 31 and more years of work: retirement from work. The range of respondent work experience was very wide: from one to even fifty-two years. PE teacher distribution according to their periods of professional career: period of entering career: 1-3 years of work (5.5%), period of stabilization: 4-6 years of work (6.2%), experimenting and active position: 7-18 years of work (40.9%), conservatism: 19-30 years of work (27%), retirement: 30-40 years of work (19.4%).

Qualitative data processing – coding, meta coding and interpretation – were carried out with AQUAD 6 program. Statements about PE teacher professional motivation were coded in relation with individual motivation theoretical model – self-determination theory (SDT) (Ryan and Deci, 2002), in which dominate three different directions: intrinsic motivation, extrinsic motivation and amotivation, extending them from the standpoint of teacher professional motivation. Data quantitative processing was performed in SPSS 17 environment. For data primary processing was used descriptive statistics, but for secondary processing were employed methods of non-parametric statistics, considering non-parametric character of research sample.

Results

Respondent opinion on the reasons why they teach physical education

PE teacher survey about the reasons why they teach physical education found the main reasons for choosing PE teacher career (Fig. 1). The reasons why people were willing to be PE teachers were liking sports (60%), liking sports and willingness to work with youth (17%), obtained education (13%), situation when there was no one to teach PE, (5%), or situation when „something must be done for living” (5%), as well as willingness to teach all subjects (0.5%).

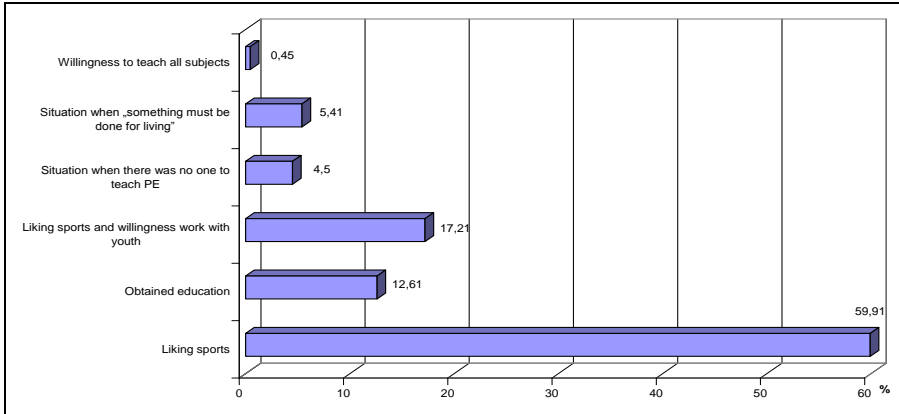


Figure 1. The reasons for choosing PE teacher career (%)

In different periods of PE teacher career there exist differences as to the reasons why they had started to teach PE ($p=.049$). Respondents, who have worked only from no 1 to 3 years, most frequently had embarked on their careers rather due to different coincidences, than because they like sports or work with children.

Advantages and disadvantages in PE teacher work

PE teachers consider that most essential advantage in their work (Fig. 2) is the opportunity to keep themselves in physical condition and to be in movement (45%), work in positive environment in friendly atmosphere (11%), work in fresh air (7%), work with children (6%), advantages regarding workload (6%), for example, long vacation and not having to correct homework (5%).

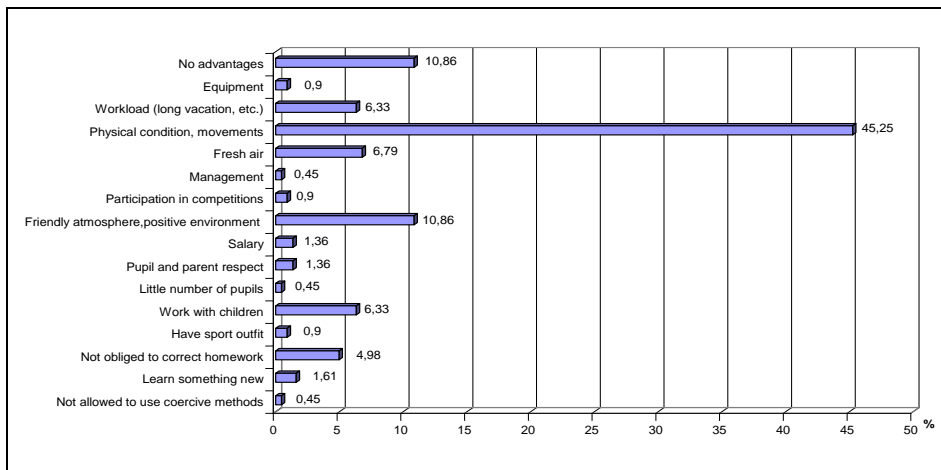


Figure 2. Respondent views on advantages in PE teacher work (%)

However, 11% of respondents consider that in PE teacher profession there are no advantages.

PE teachers (men) more often think that there are no advantages in PE teacher work ($r_s = -.18$, $p = .009$).

As one of the most essential disadvantage (Fig. 3) in PE teacher work is mentioned lack of equipment (10%) and workload (8%). PE teachers, for who it is difficult to be in good physical condition and be able to demonstrate to students the movements to be taught, consider physical condition (9%) as a disadvantage.

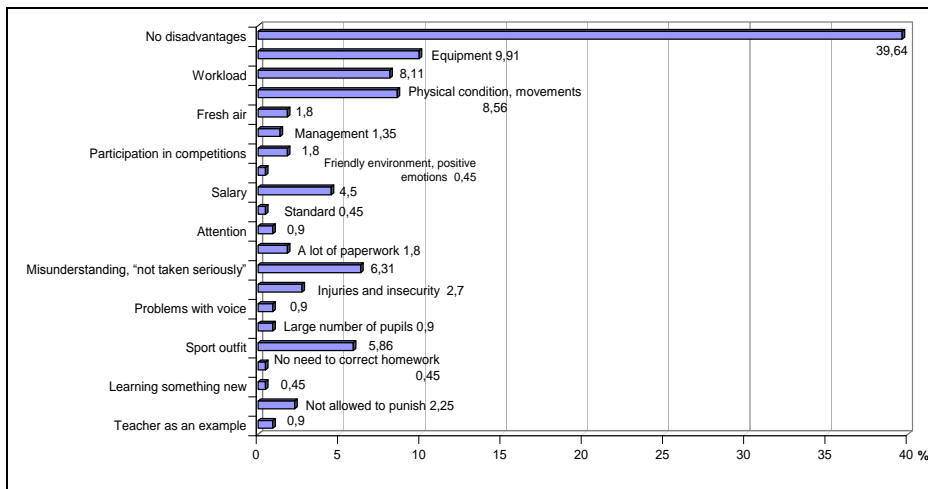


Figure 3. Respondent views on disadvantages of PE teacher work

As disadvantages PE teachers consider also other colleague misunderstanding of the essence of PE lessons and their importance (6%), for example, there is expressed a view that colleagues “do not take PE lessons seriously or take them light”. However, 40% of respondents, in their turn, consider that there are no disadvantages in PE teacher work.

PE teacher view on learning outcomes to be achieved

Answering the question, what PE teachers are willing to achieve as learning outcomes (Fig. 4), most frequently was mentioned student understanding of the importance of physical activities in their lives (23%). PE teachers consider that important goal is the promotion of the formation of student healthy lifestyle habits: healthy students (18%) with active lifestyle (21%), who need physical activities, students perform physical activities themselves and involve others (7%).

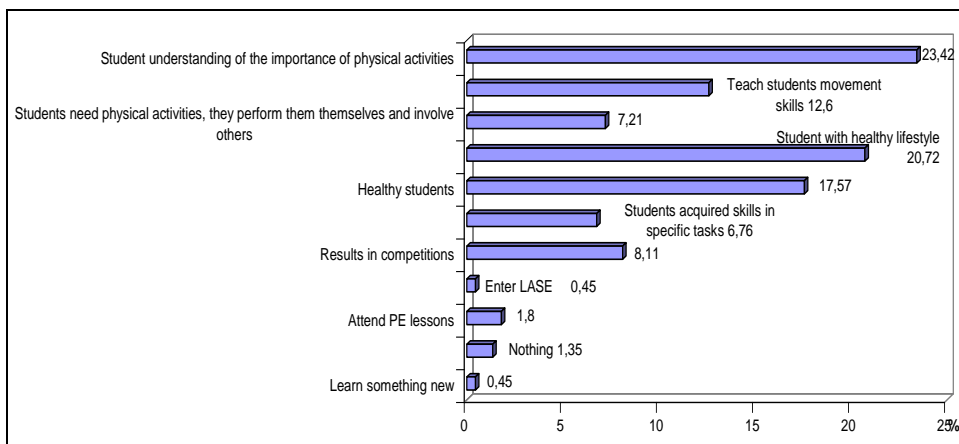


Figure 4. Respondent view on learning outcomes to be achieved

Goal is to teach students movement skills (12%) and promote student skill acquisition in specific tasks (7%). In their turn, 8% of respondents consider that teaching aim is gaining high results in competitions, which, in turn, is a goal in competitive sports, not in physical education.

There exists mutual correlation between PE teacher (female) views on disadvantages (*lack of colleague understanding, injuries, problems with voice, large number of students, necessity to retire faster*) in PE teacher work and views, what they are willing to achieve as learning outcomes (*students have acquired movement skills in specific tasks*) ($r_s=.35$, $p=.04$). The more disadvantages respondents find in PE teacher work, the narrower PE goal they put forward.

Personal goals set by PE teachers

Answering the question, what goals do you set for yourself (Fig. 5), dominates PE teacher willingness to improve their knowledge and skills (20%), improve their physical form (16%) and involve children in sport and increase their interest (16%), so that children are cheerful. 14% of PE teachers are willing to work creatively and use different methods, as well as improve teaching methods (2%). 5% of PE teachers are willing to be in harmony with themselves, bet 3%: be active and needed by school.

11% of PE teachers, in turn, do not want to change anything, 6% want to retire as soon as possible, but 4% do not set any goals. There is a mutual relationship between what teachers want to achieve as teaching outcome and objectives put forward by themselves ($r_s = .12$, $p = .04$).

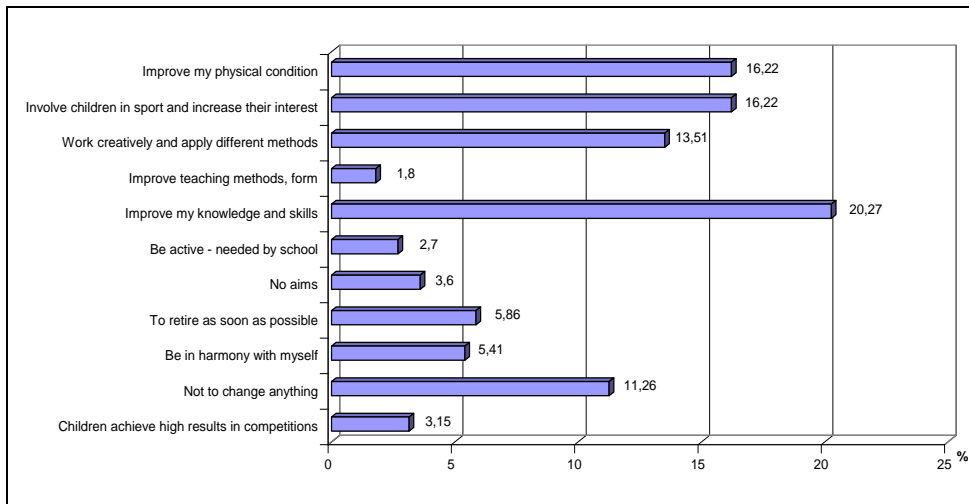


Figure 5. Goals set by PE teachers

Physical education teachers who as teaching outcome aim to enhance and improve student health by encouraging the desire to engage in routine physical activity, set for themselves the objective to improve their knowledge, skills and ability to work creatively.

Discussion

In this research are confirmed the reasons why people want to be physical education teachers, which have been found in other investigations (Evans, Williams, 1989; Mawer, 1995; Capel, 2005). In Latvia the main reason is: respondents like sports (60%). Only for 17% of PE teachers the reason for choosing the profession was willingness to transfer their knowledge, working with youth; this finding confirms Lithuanian scientist investigations (Lapeniene, Bruneckiene, 2010), that teachers are rather driven by other sources of motivation than by intrinsic interest in teaching. Sport teacher choice of profession mostly (77%) is determined by intrinsic motivation, i.e., liking sports and willingness to work with youth. The fulfillment of basic need – autonomy – is evident in the obtained experience in self-determined and enjoyable profession. Therefore 77% of PE teachers are willing to direct their lives. In turn, investigations about extrinsically determined motivation (Ryan, Deci, 2002) in the choice of the profession confirm the views expressed by 23% of respondents: choice of profession was determined by the necessity to make use of the acquired education; there was no one else who could teach PE, „one has to do something for

living". This is an introjection, when respondents have incorporated the views or motives of other people, they do not direct their lives.

PE teacher extrinsic or intrinsic motivation in the choice of profession influences their satisfaction with work and teaching strategies. Respondents, whose choice of profession is intrinsically motivated (40%), consider that there are no disadvantages in PE teacher work. Respondents, whose choice of profession is extrinsically motivated, find a lot of more disadvantages in PE teacher work. As a disadvantage PE teachers consider lack of colleague understanding (6%). This fact gives evidence of PE teacher integration problems: they do not possess the sense of belonging to school collective. PE teacher sense of belonging to school collective is determined by skillful interpersonal relations. To promote PE teacher sense of belonging to school collective it is necessary to develop communicative competence. In turn, the disadvantage – too large number of students – could be associated with the necessity to improve PE teacher didactic competence. The investigation provides evidence: the more disadvantages respondents find in PE teacher work, the narrower is the goal of PE, which they set, for example, the following: students will have acquired movement skills in specific tasks. Therefore the improvement of PE teacher planning competence promotes the sense of professional competence and satisfaction with work, which positively affects the achievement of goals, set for study subject "Sports" in the Standard. For example, Latvian Cabinet of Ministers Regulation No.141 (Appendix 19) of March 3, 2008 reflects the Standard in study subject of "Sports" for Grades 1-9. The goal of study subject "Sports" is to strengthen and improve student health, promote the acquisition of knowledge, develop physical abilities and basic skills in systematic physical activities, not only the acquisition of movement skills in specific tasks.

Intrinsically motivated physical education teachers are more interested in teaching students, but extrinsically motivated sports teachers are affected by external pressure, they think of student competition results (8%), and they more tend to control their students rather than teach them. Intrinsically motivated sports teachers can be described by mastery: desire to achieve progress in order to make something better, they set for themselves the goal to improve their knowledge, skills and ability to work creatively. The study shows that intrinsic motivation is stable during PE teacher's career.

Conclusions

In the choice of PE teacher profession dominates intrinsic motivation (77%), but for others the choice of profession is determined by extrinsic motivation. PE teachers` intrinsic motivation in the choice of profession

positively affects job satisfaction, enjoyment of teaching, further professional competence development and usefulness to the community. Such relationships enabled teachers to concentrate on their work and be capable to perform their tasks well. Results show that in planning competent PE teachers set learning outcomes, which correspond to children development based on standards in the subject of PE.

Respondents who have just started their PE teacher career and work only from 1 to 3 years do not have a sense of autonomy and they lack interest in teaching students, the consequences are related to problems with planning competence. Such a relationship means that practice without analysis and reflection does not lead to professional growth. PE teacher professional growth can be achieved by mentoring of reflective practice which is needed for the PE teacher in the period of starting the career.

There is a gender difference in views on the advantages of PE teacher work ($U = 4053.5$, $p = .01$). PE teachers (males) more frequently think that there are no advantages in PE teacher work ($r_s = -.18$, $p = .009$). Extrinsically determined motivation in the choice of profession involves distinguishing a lot more disadvantages in PE teacher work, which in turn indicates problems with communicative and didactic competence.

The barrier is PE teacher extrinsically determined motivation in the choice of profession and their beliefs about teaching, which do not change over time; this is an obstacle to shift PE teacher further professional development program orientation to PE teacher capability development through reflection and analytical processes in meaningful educational practice.

Physical education teacher professional development can be achieved by reconstructing PE teacher professional further education programs, which are more grounded in school life, through offering a choice in the development of professional competences, thus creating a learning environment, in which PE teachers motivate themselves, thus promoting the development of a sense of professional autonomy. The support of PE teacher sense of autonomy is the key in increasing their interest in teaching students and in choosing appropriate teaching strategies, which is a cornerstone of the development of teacher ability to provide an excellent education to students. Future research is needed to explore how new generation PE teacher professional further education programs can have a greater influence on teacher beliefs, practice and student learning outcomes.

References

1. Amabile, T. (1996). *Creativity in Context*. Westview Press.

2. Capel, S. (2005). *Learning To Teach In The Secondary School: A Companion To School Experience*. Taylor & Francis.
3. Carson, R., & Chase, M. (2009). An Examination of Physical Education Teacher Motivation from a Self-determination Theoretical Framework. *Physical Education and Sport Pedagogy*, 14 (4), 335-353.
4. Cartelli, A. (2006). *Teaching in the Knowledge Society: New Skills and Instruments for Teachers*. Information Science Pub.
5. Edmonds, S., & Lee, B. (2002). Teacher Feelings about Continuing Professional Development. *Education Journal*, 61, 28-29.
6. Englund, T. (1997). Towards a Dynamic Analysis of the Content of Schooling: Narrow and Broad Didactics in Sweden: *Journal of Curriculum Studies*, 29(3), 267–287.
7. Evans, J. Williams, T. (1989). Moving up and Getting out: the Classed and Gendered Opportunities of Physical Education Teachers. In T. Templin and P. G. Schempp (Eds.) *Socialization into Physical education: learning to teach*. Indianapolis, IN, Benchmark Press, 235-251.
8. Gento, S., Medina, A., & Domínguez, C. (2008). Empirical Justification of the Interuniversity Joint Master Degree on “Educational Treatment of Diversity”. *Qualitative Psychology in the Changing Academic Context* (pp.148-166). In I. Maslo, M. Kiegelmann, & G. L. Huber (Eds.), *Qualitative Psychology, Nexus VI*. Retrieved November 9, 2011, from http://www.qualitative-psychologie.de/files/nexus_6.pdf
9. Graber, K. (2001). Research on Teaching in Physical Education. In Richardson, V. (Eds). *Handbook of Research on Teaching* (4th ed.). Washington, D.C.: American Education Research Association.
10. Huberman, M.A. (1993). *The Lives of Teachers*. New York: Teachers College Press.
11. Jarvis, P., Parker, S. (2007). *Human Learning: An Holistic Approach*. London: Routledge.
12. Kirk, D., Macdonald, D. & O’Sullivan, M. (2006). *Handbook of Physical Education*. London: Sage.
13. Kovac, M., Sloan, S., & Starc G. (2008). Competencies in Physical Education Teaching: Slovenian Teachers' Views and Future Perspectives. *European Physical Education Review*, 14(3), 299–323.
14. Lapeniene, D., Bruneckiene, J. (2010). Teachers’ Creativity in the Domain of Professional Activity. Analysis of Individual Factors. *Economics & Management*. 15, 642.
15. Launder, A. (2001). *Play Practice: The Games Approach to Teaching and Coaching Sports*. Champaign, IL: Human Kinetics.

16. Mawer, M. (1995). *The Effective Teaching of Physical Education*. London: Longman.
17. Moreira, H., Fox, K., & Sparkes, A.C. (2002). Job Motivation Profiles of Physical Educators: Theoretical Background and Instrument Development. *British Educational Research Journal*, 28, 6, 845-862.
18. Pink, D. H. (2011). *Drive: The Surprising Truth about what Motivates us*. NY: Penguin Group (USA) Incorporated.
19. Pušnik, M. and Zorman, M. (2004). Od znanja h kompetencam. *Vzgoja in izobraževanje* [From Knowledge to Competencies. *Education*], 3, 9-18.
20. Ryan, R. M., & Deci, E. L. (2002). Overview of Self-determination Theory: An Organismic Dialectical Perspective. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 3–33). Rochester, NY: University of Rochester Press.
21. Skolotāja profesijas standarts. [Standard of teacher profession]. Apstiprināts ar Izglītības un zinātnes ministrijas 2004. gada 27.februāra rīkojumu Nr.116. Retrieved November 16, 2011, from <http://visc.gov.lv/profizglitiba/dokumenti/standarti/ps0238.pdf>
22. Stroot, S. A. (1996). Organizational Socialization: Factors Impacting Beginning Teachers. In S. J. Silverman & C. D. Ennis (Eds.) *Student learning in physical education* (pp. 339-365). Champaign, IL: Human Kinetics.
23. Younger, M., Brindley, S., Pedder, D., & Hagger, H. (2004). Starting Points: Student Teachers' Reasons for Becoming Teachers and their Preconceptions of what this will mean. *European Journal of Teacher Education*, 27, 3, 243-264.

Submitted: October 4, 2013
Accepted: November 27, 2013

ORIGINAL RESEARCH PAPER

ANALYSIS OF PRECOMPETITIVE PREPARATION OF THE ELITE ROWERS TOWARDS EUROPEAN CHAMPIONSHIP**Einius Petkus, Rūta Dadelienė, Algirdas Raslanas**

Lithuanian University of Educational Sciences
Address: Studentų st. 39, Vilnius, LT-08106, Lithuania
Phone: +37068222817
E-mail: ruta.dadeliene@gmail.com

Abstract

The goal of the research was to analyze the content of double scull elite rowers' pre-competition mesocycle and to assess the efficiency of aerobic capacity training. The training content of European champions of double scull during pre-competition mesocycle was analyzed. The mesocycle was composed of four microcycles: introductory microcycle of aerobic and creatine-phosphate power and endurance training, microcycle of aerobic critical power, endurance training, and pre-competition parts. In the introductory part, the intensity of aerobic training work was very close to anaerobic threshold limit (ATL), i.e. $La=2-3\text{mmol/l}$ and combined with muscle mass training exercises. In the second microcycle, aerobic training intensity was at $ATL\pm 5\%$, $La=3-6\text{mmol/l}$ and combined with creatine-phosphate power training exercises. In the third microcycle, work intensity between ATL and critical intensity limit (CIL), $La=4-9\text{mmol/l}$, was dominating. In the fourth pre-competition microcycle, working volume was reduced by 30% with different intensity, $La=3-14\text{mmol/l}$, and with improvement of rowing pace from start and technique. Researches were performed with gas analyzer „Oxycon Mobile“ and concept „Concept 2“. We have revealed that aerobic capacity was growing during study period. $VO_2\text{max}$ in athlete M. was growing from 62.3 up to 65.3ml/min/kg, in athlete R. – from 61.3 up to 65.2ml/min/kg. This research of ours has revealed that elite rowers, during pre-competition mesocycle when working close to ATL and between ATL and CIL and less working on glycolytic zone, have significantly increased their aerobic capacity that compose approximately 80% of sport performance.

Key words: rowers, aerobic capacity, training.

Introduction

Sport result in rowing is determined by many external and internal factors. Distance passing duration takes for 6 – 8 min. Work intensity of such duration on maximum exertion significantly exceeds the intensity of anaerobic threshold limit (ATL) and comes to the critical intensity limit (CIL) ($\text{VO}_2 \text{ max}$) of work intensity (Skernevičius, 1997; Astrand et al., 2003; Wilmore, Costill, Kenney, 2008). In rowers of 2000 m event approximately 75 – 80% of energy is produced in aerobic reactions (Secher, Volianitis, 2009; Steinacker et al., 1998). The capacity of aerobic reactions is determined by two main factors: muscles ability to consume oxygen and organism systems ability to deliver oxygen, energetic materials, and nutrients into muscles (Milašius, 2005).

Loads in rowers' trainings, when working on aerobic capacity increase, are oriented towards ATL increase and aerobic reactions activeness at CIL. Those cells that are fatigued during trainings do strengthen during recovery because of supercompensation phenomena and other unburdened cells may weaken or even vanish (Merson, 1986). This influences specificity of training loads. Thus, it is very relevant to study training process of elite rowers as well as intensity and duration of applied physical loads aimed to improve aerobic capacity. During distance passing, work intensity changes and at the end of event glycolytic reactions become considerably active. This activity is also very important (De Compos Mello et al., 2009; Smith, Hopkins, 2011).

The goal of the research was to analyze the content of double scull elite rowers' pre-competition mezocycle and to assess the efficiency of aerobic capacity training.

Material and methods

The analysis was executed in competition period in 2012, the fourth year of four-year Olympic cycle, and one mezocycle where the main task was to develop $\text{VO}_2 \text{ max}$ aerobic capacity had been studied. The training process of double scull European champions had been researched. Rowers' aerobic capacity was established with gas analyzer Oxycon Mobile 781023-052-5.2 and on rowing ergometer „Concept II“ before the beginning of mezocycle and after its ending. Indices at critical intensity limit (CIL) ($\text{VO}_2 \text{ max}$) and at ATL were recorded. Indices of lung ventilation (PL) (l/min), hard rate (HR bt/min), executed work power (W), and O_2 economical consumption were established either. ATL was calculated under O_2 consumption percentage from $\text{VO}_2 \text{ max}$.

Mezocycle was formed of four microcycles that lasted for seven days each. During the first microcycle (week), six trainings were executed (one training per day) and one day was given for recovery. During the second microcycle, ten trainings were executed. During the third microcycle – ten trainings, as well. And during the fourth microcycle, nine trainings were given and two days were left for recovery.

Lactate blood concentration was established during trainings and after tests with concept and gas analyzer.

Work intensity zones were divided under lactate (La) blood concentration indices that indicated work intensity limits: aerobic threshold La=2mmol/l, anaerobic threshold La=4mmol/l, and O₂ critical intensity limit, when consuming at maximum, La concentration is 10 – 16mmol/l and is individual to each athlete. Zone 1 – La up to 2mmol/l, Zone 2 – La 2,1 – 4 mmol/l, Zone 3 – La 4.1 – 8 mmol/l, Zone 4 – La 8.1 and more.

Table 1

Distribution of executed physical loads under zones in separate microcycles

Zones	1	2	3	4	In total
FIRST MICROCYCLE					
Duration min.	80	270	60	-	410
Km	10	36	9	-	55
%	17.85	64.43	17.28	-	
SECOND MICROCYCLE					
Duration min.	110	360	90	-	560
Km	20	84	12	-	116
%	17.24	72.41	10.34	-	
THIRD MICROCYCLE					
Duration min.	200	160	110	60	510
Km	38	37	20	12	107
%	32.20	31.37	20.33	16.15	
FOURTH MICROCYCLE					
Duration min.	200	140	120	50	510
Km	37	25	20	10	92
%	40.22	27.17	21.74	10.87	
IN TOTAL					
Duration min.	590	930	360	110	1990
Km	105	182	61	22	370
%	28.38	49.19	16.49	5.95	

Results

When analyzing during mezocycle executed physical load in the training process of aerobic capacity, we can see that for this purpose 1990 minutes and 370km were given. The most work was performed in Zone 2, the amount 49.19% of kilometers and La blood concentration had not exceed ATL. Rowers also did work hard in Zone 1 as La concentration did not exceed 2mmol/l. In Zone 3, when glycolytic reactions became very active, 360min was work for rowing 61km and this formed 16.49%. In Zone 4, when work intensity became very close to CIL and O₂ consumption was close to maximal powers, organism environment became acidic and so rowers made 22km and this formed 5.95% of executed work. Such load intensity appeared neither in the first, nor in the second microcycle. If taking into account these two microcycles, they had Zone 2 dominating where 64.43% and 72.41% took the part of in totally executed work. Work volume had doubled in size in Zone 3 of the third and fourth microcycles and work was combined in Zone 4 up to 10.87 and 16.15%.

Tests with gas analyzer executed beforehand mezocycle revealed that indices of O₂ consumption at CIL and ATL were very similar in both rowers (Tab. 2) but HR indices differed significantly. HR data survey helped to individualize work intensity.

Table 2

Indices of rowers' aerobic capacity at critical intensity and anaerobic threshold limits

Research	Athlete	Critical intensity limit							Anaerobic threshold limit							La mmol/l	
		LV l/min	HR bt/min	VO ₂ l/min	VO ₂ ml/min/kg	OP ml/bt	W	O ₂ lW/m	LV l/min	HR bt/min	VO ₂ l/min	VO ₂ ml/min/kg	OP ml/bt	O ₂ % of VO ₂ max	W		O ₂ lW/ml
1	R. M	198	192	6.10	62.3	31.8	500	12.20	133	177	5.10	51.8	28.7	83.6	380	13.42	10.8
	S. R.	214	186	6.62	61.3	35.4	520	12.26	146	161	5.34	49.5	33.2	80.6	400	12.71	9.8
2	R. M	179	197	6.94	65.3	32.5	520	12.30	148	174	5.90	60.0	33.9	92.1	410	14.05	14.0
	S. R.	211	180	7.10	65.2	39.4	540	13.10	140	166	6.14	56.3	37.0	86.4	420	14.62	16.1

Captions: LV - (VE) – lung ventilation; HR – hard rate; OP - (O₂ HR) – oxygen pulse; La - lactate

Data of the second research indicated that VO₂ max and power of executed work at CIL increased significantly in both rowers during mezocycle. ATL as well as VO₂ and work power increased significantly; H

indices varied but continued growing under both intensity limits. La blood concentration tested after the second research was significantly higher and this shows activeness of increased glycolytic reactions.

Discussion

The presumption can be formulated that, if rowing competition format distances, aerobic reactions form 75 – 80% of energy (Hagerman, 1984; Steinacker et al., 1998) so, during trainings, the same percentage of time should be given for activation of these reaction without considerable organism acidizing. Considering the fact that glycolytic reactions at the end of distance became very active (Smith, Hopkins, 2011), approximately 20% of total work during mezcycle should be appointed during competition period. The research revealed that such separate-zone planning of work intensity under the basis of La blood concentration leads to individualize physical loads for double scull rowers (Volker, 2011). Tests with gas analyzer as well lead individually to go by HR indices when assessing work intensiveness.

The study revealed that rational distribution of physical loads in separate zones when executing conditionally small physical loads has positive influence on elite rowers' aerobic capacity training.

Conclusions

1. When planning training process for elite rowers of double scull event, physical load should be divided into zones under lactate blood concentration, CIL, and ATL and HR indices should be adapted individually to each athlete.

2. The research has revealed that, during mezcycle of rowers' competition period, when training aerobic capacity, it is effective for a half of time (49.19%) to spend on working between the limits of aerobic and anaerobic thresholds, in hybrid aerobic-glycolytic zone and, if La 4 – 8 mol/l, to spend considerably less time (16.49%) and when working closely to CIL and La exceeds 8mmol/l – approximately 6% (5.95) of time.

References

1. Astrand, P-O., Rodahl, K., Dahl, H., & Stromme, S. (2003). *Textbook of work physiology: Physiological bases of exercise*. Champaign IL: Human Kinetics, 614 p.
2. De Campos Mello, F., De Moraes Bertuzzi, R., Grangeiro, P., et al. (2009). Energy Systems Contributions in 2,000m Race Simulation: a

- Comparison Among Rowing Ergometers and Water. *European Journal of Applied Physiology*, 107, pp 615-619.
3. Milašius, K. (2005). *Sporto fiziologija*. Vilnius, VPU, 184 p.
 4. Secher, N. H., & Volianitis, S. (2009). *Handbook of Sports Medicine and Science*, Rowing, ed. Wiley J. and Sons, 184 p.
 5. Skernevičius, J. (1997). *Sporto treniruotės fiziologija*. Vilnius, LTOK, 85 p.
 6. Smith T., & Hopkins, W. (2011). Variability and Predictability of Finals Times of Elite Rowers, *Medicine and Science in Sports and Exercise*, 43 (11), pp. 2155-2160.
 7. Steinacker, J.M., Lormes, W., Lehmann, M., & Altenburg, D. (1998). Training of Rowers Before World Championships. *Medicine & Science in Sports & Exercise*, 30 (7), 1158-1163.
 8. Wilmore, J., Costill, D., & Kenney, W. (2008). *Physiology of Sport and Exercise* (4^{ed}), Champaign, IL.: Human Kinetics, 574 p.
 9. Volker N. (2011) *Rowing faster*. Human Kinetics, 321 p.
 10. Меерсон, Ф.З. (1986). *Основные закономерности индивидуальной адаптации. Физиология адаптационных процессов*. Москва, pp. 10-76.

Submitted: June 10, 2013
Accepted: November 27, 2013

ORIGINAL RESEARCH PAPER

FUNCTIONAL CHANGES OF THE MUSCULAR-SKELETAL SYSTEM OF ATHLETES**Jeļena Solovjova¹, Imants Upītis¹, Juris Grants¹, Joy Jarvie Kalmikovs²**

¹Latvian Academy of Sports Education
Address: 333 Brīvības Street, Rīga LV-1006, Latvia
Phone: + 371 67799537

²Aqualification & Fitness, Rockhampton Australia
Phone: +371 67799539
E-mail: solovjova.elena@gmail.com

Abstract

Athletes across all sports face sporting injuries stemming from overuse of specific muscle groups for that particular sport. Overuse of specific muscle groups causes functional muscle imbalance leading to postural changes. It was hypothesized that athletes from each sport would show similar muscular-skeletal changes allowing the formation of a postural stereotype for each sport. The aim of this study was to determine the postural changes of 92 athletes aged 14 to 17 years old in Latvia; 20 Swimmers, 20 ice-hockey players, 19 basketball players, 17 handball players, and 16 cyclists. The previously tested express diagnostic program (Solovjova & Upītis, 2008), was employed to evaluate muscular-skeletal changes. Results indicate specific sporting stereotypes exist. The presence of a postural stereotype indicates these muscular-skeletal changes are of benefit to the athlete. How much benefit athletes gain from these postural changes before injury occurs is open to debate among coaches, athletes, support staff and sporting officials.

Key words: *sporting postural stereotypes, postural stereotypes, functional postural changes,*

Introduction

Athletes across all sports face sporting injuries stemming from overuse of specific muscle groups for that particular sport. Overuse of specific muscle groups causes functional muscle imbalance leading to postural changes. These postural changes can provide benefits and advantages to athletes making them better adapted to their sport, therefore these changes

are functional for athletes. Just as species have evolved through a series of adaptations over time, sporting exercises, drills, and strengthening programs drive to adapt and evolve the athletes that participate in them. Despite the fact that in certain studies and literature we may find results that speak of changes in the spinal cord in athletes of different sports that involve large rotations, such as gymnastics, ballet, swimming, wrestling, javelin throwing, etc., it has not yet been determined that these activities lead to a direct acceleration or worsening of postural disorders (Slawinska, Rožek, & Ignasiak, 2006),(Tanchev, Dzherov, Parushev, Dikov, & Todorov, 2000), (Wood, 2002).

The problem professional/elite athletes face today is finding the balance between sporting advantage and injury: functionality versus detrimental change. This study is the first step in solving the problem of ensuring balance of functional muscular-skeletal changes and its advantages. It is hotly debated between coaches, athletes and support staff how, and where that balance point is to be found, and applied.

The aim of this study was to determine the postural changes of 92 athletes aged 14 to 17 years old in Latvia (20 Swimmers, 20 ice-hockey players, 19 basketball players, 17 handball players, and 16 cyclists) to see if sporting stereotypes occur across the five sports. It was hypothesized that athletes from each sport would show similar muscular-skeletal changes allowing a postural stereotype for each sport to be allocated.

Methods

92 athletes in Latvia; 20 swimmers, 20 ice-hockey players and 19 basketball players, 17 handball players and 16 cyclists aged 14 – 17 and having different preparation level were examined. Tests were completed using methods by (Vasiljeva, 1996) for visual diagnostics and by (Janda, 1994, Kendall & Kendall, 1982), for muscular functional testing. From these methods a diagnostic program was developed, (Solovjova, & Uptis, 2008) which included measuring the changes of 8 sagittal points from the vertical plane along with functional testing of 11 muscle groups.

Express-diagnostics of posture statics. The following points were marked on the athlete: the external ear opening, acromion, radial point, outer points of the palm, the highest point of the iliac crest, the trochanter, the upper end of the fibula bone and outer ankle. The subject stood at a vertical wall. The distance from the marked point to the vertical wall on the right and left side was measured.

Muscle functional testing. To state the postural tone and phasic contraction muscle functional condition, the major body and leg muscles

that are involved in posture forming were tested according to (Kendall & Kendall, 1982). To indicate muscle shortening and weakening, muscles were tested at rest condition. Ten muscle groups were examined all together: the phasic muscles such as the blade fixators, *m. rectus abdominis*, *m.m. medius*, and the postural muscles such as *m.m. erector cervicis*, *m. pectoralis major*, *m. iliopsoas*, *m. quadriceps femoris*, hamstring muscles and *m. triceps surae*. The functional condition of the postural muscles was assessed according to 3 point system: 1 point was considered to be the norm, points 2 and 3 were considered to be changes.

Results

Results indicate that all athletes showed functional muscular-skeletal changes at various skeletal points. Asymmetry of the point distance from the vertical line between the left and right sides were observed in two swimmers, one ice-hockey player and one basketball player. These measurements were averaged for ease of profiling.

The following peculiarities of posture statics can be marked in the athletes' individual posture profile: the body deviation forward, so-called "body falling" forward was observed in athletes of all groups; the distance from the vertical line between the outer ankle and the auricle of the ear in group A was 9.1 cm, in group B – 5.5 cm, in group C – 10.7 cm; the hip rotation forward was observed in all athletes. It can be concluded that the difference between the highest point of the iliac crest (point 5 on Fig.1) and the trochanter, (point 6 on Fig.1) – in the ice-hockey players is 5.5 cm, swimmers – 2.0 cm and basketball players – 3.5 cm. The greatest distance from the vertical line in the swimmers is in the shoulder girdle (11cm), ice-hockey players – the highest point of the iliac crest (8 cm), basketball players – the auricle of the ear point (10.7 cm).

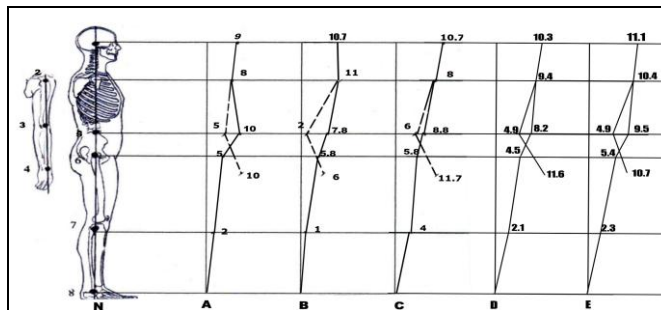


Figure 1. Deviations of the body vertical line from the side, vertical line parameters, cm. N-optimal position; A-ice-hockey players (n=20), B-swimmers (n=20), C basketball players (n=19), D- handball players (n=17) and E-cyclists (n=16) average data, cm

In general the following peculiarities of posture statics can be marked in the athletes' individual posture profile. All sporting profiles were found to fall forward; cyclists being the most pronounced. Swimmers have a round back and a slight forward rotation of the pelvis. Ice-hockey and handball players along with cyclists have explicit forward rotation of the pelvis.

Muscle functional condition (Groups: A – ice-hockey, B - swimmers, C – basketball players, D – cyclists, E – handball players)

Muscle testing results indicate that the greatest changes were found in the postural muscles *m. rectus femoris* – in all 20 ice-hockey players and cyclists (100%), in handball players (91.2%), in basketball players (84.2%) and swimmers (41%).

Changes in the hamstring muscles were recorded in hockey (64%) and handball players (64.7%), swimmers (60%), basketball players (57.9%) and cyclists (55.6%). The greatest changes of *m. triceps surae* were in the swimmers group (41%), and handball players 35.3%. Ice-hockey players and cyclists both recorded 22.3% change and basketball players 21.1%.

Athletes in all groups have short pelvic muscles (A – 77.2%, B – 84%, C – 73%, D – 82.4%, E – 83.4%) and hamstring muscles. The changes of the shoulder girdle muscle tone were as follows: *m. pectoralis major* 21% in 4 swimmers, 5% in 2 basketball players, the ice-hockey players, handball players and cyclists do not have any changes. Handball players have the greatest number of changes in *m. pectoralis major* – 70.6%, swimmers have the smallest – 49%, but cyclists, basketball players and hockey players have respectively 66.7%, 63.2% and 54.4%.

Having the results of the muscle testing we can see the changes in the phasic muscles when their effectiveness decreases, that is, they extend and are not able to contract effectively: *m. rectus abdominis* – 47% of swimmers and 77% of ice-hockey players, 47% of basketball players, 70.6% of handball players and 44.5% of cyclists. Swimmers have the lowest tone of the shoulder blade fixators – 70%, basketball players – 42%, cyclists – 61.2%, hockey riders – 54.4% and handball players – 41.2% .

Conclusions

All athletes showed individual changes from a neutral posture (deviation from the vertical line in the sagittal plane) characteristic to their sport due to overloaded muscle groups.

Analysis of muscles according to their tone development, they can be divided into two groups: posturally and phasically contracting muscles. The

postural muscles that form posture have rather high tone, but if these muscles are overloaded, the tone pathologically increases and the muscle cannot contract nor relax effectively enough to allow the antagonist to work. Phasically contracting muscles that provide movements have lower tone than postural muscles. If they are overloaded, their efficiency decreases, they lengthen and cannot contract effectively.

Balanced work of the phasic and postural muscles is one of the preconditions to form a correct posture. The muscles are in definite strength relations providing typical or correct stereotype, thus every movement is executed with optimal strength.

Athletes in all groups have short pelvic (A – 77.2%, B – 84%, C – 73%, D – 82.4%, E – 83.4%) and hamstring muscles. If the leg and pelvic muscles are shorter, the lordosis of the lower back increases the function of the spine amortization decreases, as well as equal load division. If the body adaptation ability is low, it can cause pain in the lower back and knee joints. Basketball players' hamstring muscles have significantly higher tone than those of swimmers.

The shortened muscles of the shoulder girdle in group B – *m.m. erector cervicis*, *m. pectoralis major* and *m. pectoralis minor* indicate these muscles are overloaded. The upper cross syndrome is characteristic for athletes of repetitive shoulder sports such as swimming and rowing Коган et al.(1986); ИВАНИЧЕВ (1999). Loading of the sport on the shoulder girdle, we have shown that the spine hyper-kiphozis of the chest part and the shortening of the small chest and upper trapezius muscles (Solovjov, 2004).

The lower cross syndrome is characteristic for athletes of the sports requiring complicated coordination (eg. Ice-hockey, basketball) at high load on lower extremities: “body falling” forward, hyper-lordosis of the chest-pelvis area and the shortening of the pelvic muscles at weakened major hip muscles and *m. rectus abdominis* (Travell & Simons 1992).

Correction and Prophylaxis

The measurements shown on the athlete profiles indicate that these changes occur at a young age during the training process as these athletes are aged between 14 and 17 years of age. For superior athletic performance, athlete posture profiles should be monitored throughout an athlete's development to indicate the speed that these changes occur. With monitoring of the athletes profiles early intervention can be made to keep a more neutral posture and eliminate the chance of injury.

However, participation in any sport should not affect an athlete's posture to the extent that joint/muscle pain occurs due to muscle imbalance. If the correct training program is adopted (one that incorporates

strengthening of antagonistic muscles) a more neutral balanced posture should be maintained throughout the course of an athlete's career. This should allow the athlete to maintain superior athletic performances with minimal injuries due to posture changes. Yet, in order to achieve a neutral posture, athletes must spend equal time working on the antagonist muscle groups. This may not be feasible due to time and physical limitations.

Where, when and how do coaches draw the line of balance between functional and detrimental musculoskeletal changes? When an athlete sees a physiotherapist to start correcting muscle imbalance may already be too late. How do we educate coaches that the antagonist muscle groups need to be incorporated into their training schedules? How much of these exercises/activities do coaches need to enforce upon their athletes?

Without long term studies across all sports, following the individual athletes, these questions cannot be answered.

References

1. Janda, V. (1994). *Manuelle Muskelfunktion Diagnostik*. Berlin, Ullstein, Moscow.
2. Kendall, H. O., & Kendall, F. P. (1982). *Muscles Testing and Function*. The Williams and Wilkins Company.
3. Solovjova, J. (2004). Jauno peldētāju balsta kustību aparāta agrīno traucējumu analīze. In: *Teorija un prakse skolotāju izglītībā II*. Starptautiskā zinātniskā konference, Rīga, 5.
4. Solovjova, J. (2004). Muscular Imbalance in Young Swimmers: Reasons, Prevention of Damages. In: *Scientific management of high performance athletes training. 7th International Sport Science Conf*. Viļņus, (12 - 13)
5. Solovjova, J., & Upītis, I. (2008). Jauno sportistu morfofunkcionālā adaptācija fiziskām slodzēm. *LSPA zinātniskie raksti: 2007*, 166-175.
6. Slawinska, T., Rožek, K., & Ignasiak, A. (2006). Body Asymmetry within Trunk at Children of Early Sports Specialization. *Medycyna Sportowa*, 22 (161), 97-100.
7. Tanchev, P.I., Dzeherov, A.D., Parushev, A.D., Dikov, D.M., & Todorov, M.B. (2000). Scoliosis in Rhythmic Gymnasts Spine, 25 (11), 1367-1372.
8. Travell, J., & Simons, D. (1992). *Myofascial Pain and Dysfunction the Trigger Points*. Manual. Williams and Wilkins, 154-165.
9. Wood, K.B. (2002). Spinal Deformity in the Adolescent Athlete. *Clinical Journal of Sports Medicine*, 21, 77-92.

10. Васильева, Л. Ф. (1996). Визуальная диагностика нарушений статики и динамики опорно-двигательного аппарата человека. Иваново: МИК. 19-39.
11. Иваничев, Г. А. (1999). Мануальная медицина. Москва: Медицина, 48-56.
12. Коган, О. Г., Шмидт, И. Р., Васильева, Л. Ф. (1986). Визуальная диагностика неоптимальности статики и динамики. *Мануальная медицина*: 3, 85- 92.

Submitted: October 7, 2013

Accepted: November 27, 2013

REVIEW PAPER

GYMS' SERVICE QUALITY EVALUATION IN KAUNAS CITY

Viktorija Grigaliūnaitė, Lina Pilelienė

Marketing Department, Faculty of Economics and Management
Vytautas Magnus University

Address: 28 Street S.Daukanto, LT44246, Kaunas, Lithuania

Phone: +37037327856, Fax: +37037327857

E-mail: viktorija.grigaliunaite@fc.vdu.lt, l.pileliene@evf.vdu.lt

Abstract

The aim of the research is to evaluate gyms' service quality in Kaunas city. Research methods: comparative literature analysis and synthesis, questionnaire research, descriptive statistical analysis, inferential statistical analysis and logical analysis. The SERVQUAL methodology was applied for respondents' evaluations towards gyms' service quality in Kaunas city. The results of the research revealed that service quality of gyms in Kaunas city is low. Customer expectations are high with respect to reliability, responsiveness, assurance and empathy, while customer expectations with aspects of tangibility are quite low in comparison with the other dimensions. Despite this, the quality of services regarding personnel competences, capacities, desire with providing services, and willingness to help do not match the expectations of customers. In contradistinction, service quality regarding the aspects of tangibility satisfies customer needs. The results of the research indicated that most important aspects of gym's service quality for customers are disregarded by the owners and managers of the gyms. Considering gyms' purposes, it is comprehensible that the personnel's competencies, knowledge and the ability to use it efficiently make more influence on the desired customers' results than the brand or the modernity of the equipment and other material tools used in the gym. Hence, the suggestion could be made that the owners and the managers of the gyms' in Kaunas city should pay more attention and investments on the choice, education, behavior and training of their personnel in order to provide higher quality services.

Key words: *expectations, gyms, service quality, SERVQUAL methodology.*

Introduction

In recent decades, people saw the negative aspects of the fast pace of life, fast food, air pollution, and many other consequences of the prevailing changes of life in the twentieth century; a trend of healthy lifestyle support has emerged.

Common healthy lifestyle support measures – a healthy diet and sport. Consequently, the trend of healthy lifestyle was not iced in a business world. In 2012, fitness and recreational sports industry's sales in the United States accounted for more than 20 billion U.S. dollars, provided jobs for more than 500,000 people (United States Fitness & Recreational Sports Centers Industry Capital & Expenses Report, 2013). This trend has also affected Lithuania. There were 1,091 gyms in Lithuania in the year 2011 (Lithuania Sports Statistical Yearbook, 2011).

Considering fact that society has become a consumerist, in recent decades the growing number of organizations are focusing on product and service quality. Product and service quality is important for both: consumers and organizations. According to Golder, Mitra and Moorman (2012) high-quality products and services fascinate consumers, increase organizations' profit and promote specific country's economic growth. It is also argued that service quality is a decisive factor for the organization's competitive capability (Benazic & Došen, 2012). Of course, larger organization's competitive advantages can lead to higher organization's profit and increase the shareholder's economic benefits, as well as implement one of the key profit-making organizations' goals. Consequently, the measurement of provided product or service quality enables identification of the defects of quality, improve them and provide the quality that meets customer's needs. Despite this, the same service which is provided with the same level of quality could be perceived at a diverse level of quality by different customers. Kaura, Datta and Vyas (2012) summarized that the overall most acceptable definition of service quality refers to the extent to which services meet customers' needs and expectations.

Hence, the object of this research is gyms' service quality. The *aim of the research* is to evaluate gyms' service quality in Kaunas city.

Material and methods

Methods of data collection and analysis

Based on various theories there are created many models for the evaluation of service quality. The most known and widely used models are generalized in Table 1.

Table 1

Generalized main models for the evaluation of service quality

Model	Authors and Years	Measurement covers	Main features
Kano model	Kano et al. (1984)	Based on two axis (horizontal shows the amount of quality elements, vertical – satisfaction), the quality is classified into five categories.	Does not assess the importance of quality criteria, which is crucial from a consumer perspective when considering the level of quality (Ching-Chow, 2005).
Technical and functional quality model	C. Gronroos (1984)	Identified three components of service quality: technical quality; functional quality; and image.	Quality of service is measured as the difference between customer's expected and perceived quality of service, but there was no methodology for evaluating this difference (Parasuraman, Zeithaml, & Berry, 1985).
GAP model	Parasuraman, Zeithaml, and Berry (1985)	Service quality is a function of the differences between expectation and performance along the quality dimensions (. The developed model is based on gap analysis (Seth, Deshmukh, & Vrat, 2005) and the methodology for evaluation of the service quality gap is called SERVQUAL.	The model was revised in the year 1991 and 1994 and the final model contained 21 indicators that reflected 5 dimensions of service quality: tangibles, reliability, responsiveness, assurance and empathy.
P-C-P attributes model	Philip & Hazlett (1997)	Hierarchical structure model based on three main classes of attributes – pivotal, core and peripheral.	Assessed controversial due to dimensions and their elements (Seth, Deshmukh, & Vrat, 2005).
Antecedents and mediator model	Dabholkar, Shepherd, & Thorpe (2000)	Integrates two models into one: antecedents' model of service quality and mediator model of customer satisfaction.	Many researches (Bayol et al., 2000; Grigaliūnaitė & Pilelienė, 2013; Pilelienė & Grigaliūnaitė, 2013) showed that perceived quality is not the only variable that affects customer satisfaction.

Obviously, there are more models on the subject of service quality, but most of them are specified on the particular sector (e.g. “Internal service quality DEA model” assesses a bank branch performance (Soteriou & Stavrinides, 2000); “IT-based model” attempts to look into the relationship between IT-based services and customers’ perceived quality (Zhu, Wymer, & Chen, 2002, etc.).

Thus, each model has its drawbacks and advantages. Basically, there are a lot of service quality evaluation models; and none of them could be assessed as good or bad model. Each model, based on its weaknesses along with the characteristics of the research object and the aim of the analysis, could be applied. In addition, some of the limitations of the models can be adjusted after the analysis of a wider range of service types, besides some of the disadvantages of these models can be removed.

It could be stated that the selection of a service quality model depends on the specific model’s disadvantages, aim and object of the research, and finally on the possibilities to adjust the model to a particular case.

SERVQUAL methodology was considered to be the most suitable for the research. The methodology consists of five core dimensions, namely tangibility, reliability, responsiveness, assurance and empathy. After the correction of the indicators representing the dimensions based on the specifics of the gyms in Kaunas city, the final questionnaire was composed of 21 indicators corresponding to customers’ expectations and 21 indicators corresponding to customers’ perceived quality (Tab. 2).

Table 2

Indicators corresponding to customers’ expectations and perceived quality regarding gyms in Kaunas city

Name	Indicators corresponding to the expectations	Name	Indicators corresponding to the perceived quality
Tangibility			
EQ1	Equipment in the gym should be modern	PQ1	Equipment in the gym is modern
EQ2	Physical tools used in the gym should be visually attractive	PQ2	Physical tools used in the gym are visually attractive
EQ3	Area in the gym should be spacious	PQ3	Area in the gym is spacious
EQ4	Trainers should look attractive	PQ4	Trainers looks attractive
EQ5	The written material on exercise performance, muscle stretching techniques and programs in the gym should be visually attractive	PQ5	The written material on exercise performance, muscle stretching techniques and programs in the gym are visually attractive

Table 2 (continued)

Indicators corresponding to customers' expectations and perceived quality regarding gyms in Kaunas city

Reliability			
EQ6	Trainers should provide the promised services on time	PQ6	Trainers provides the promised services on time
EQ7	Trainers should sincerely care about the customers' problems	PQ7	Trainers sincerely cares about the customers' problems
EQ8	Trainers should provide services correctly at the first time	PQ8	Trainers provides services correctly at the first time
EQ9	The things and money left during the training time should be safe	PQ9	The things and money left during the training time are safe
EQ10	The information provided by trainers should be true and accurate	PQ10	The information provided by trainers is true and accurate
Responsiveness			
EQ11	Trainers should always want to help their customers	PQ11	Trainers always wants to help their customers
EQ12	Trainers should be never too busy to respond to customers' questions	PQ12	Trainers are never too busy to respond to customers' questions
EQ13	Trainers should provide services quickly	PQ13	Trainers provides services quickly
Assurance			
EQ14	Trainers behavior should cause trust for customers	PQ14	Trainers behavior causes trust for customers
EQ15	Trainers should be always helpful	PQ15	Trainers are always helpful
EQ16	Trainers should be proficient enough to be able to answer customers' questions	PQ16	Trainers are proficient enough to be able to answer customers' questions
EQ17	Because of the trainers customers should feel safe during the training	PQ17	Because of the trainers customers feels safe during the training
Empathy			
EQ18	Trainers should pay personal attention for the customers	PQ18	Trainers pays personal attention for the customers
EQ19	Trainers should look after the interests of their customers	PQ19	Trainers looks after the interests of their customers
EQ20	Gym working hours should be convenient for all customers	PQ20	Gym working hours are convenient for all customers
EQ21	Trainers should understand customers' specific needs	PQ21	Trainers understand customers' specific needs

The questionnaire was based on the requirements for the SERVQUAL methodology, opinions of various authors (Parasuraman, Zeithaml, & Berry, 1985; Ghasemi, Kazemi, & Esfahani, 2012; Aydin & Yildirim, 2012; Soita, 2012) and gym services' specifications. A 5-point evaluation scale was applied for respondents' evaluations of gym services' quality in Kaunas.

The statistical analysis using IBM SPSS Statistics v.20 software package was used for data analysis.

The Sample

The total sample was 150. The survey was conducted during the summer of 2013. Achieving to increase the diversity of the respondents, the survey was handled both in person and via Internet. The investigated group consisted of 51% males and 49% females. 52% of the respondents were aged 18 to 25.

Results

The Reliability Statistics in Table 3 shows that the measurement scale of expectations as well as measurement scale of perceived quality displays internal consistency reliability. Consequently both scales can be regarded as reliable (Cronbach's Alfa > 0.7).

Table 3

Reliability Statistics

<i>Expectation Scale</i>		<i>Perceived Quality Scale</i>	
Cronbach's Alpha	N of Items	Cronbach's Alpha	N of Items
,804	21	,950	21

The highest evaluated indicators corresponding to the expectations indicate the most important factors for the customers regarding perceived quality of the specific gym. As can be seen in Table 4, the most important indicators of perceived quality of the gym were found to be: EQ6, EQ7, EQ8, EQ9, EQ10 (represent the dimension of reliability), EQ11 (represents responsiveness), EQ14, EQ15, EQ16 (represent the dimension of assurance). None of the indicators representing the dimensions of tangibility or empathy were evaluated above the meaning of 4.5, indicating that these dimensions were less important for customers in comparison to reliability, assurance and responsiveness.

Table 4

The importance of the indicators corresponding to the customer expectations

Name of Expectations indicator	N	Min	Max	Mean	Std. Deviation	Variance	Dimension	Importance
EQ1	150	1	5	4,09	,938	,880	Tangibility	3,7
EQ2	150	1	5	3,51	,972	,944		
EQ3	150	2	5	4,12	,827	,683		
EQ4	150	1	5	3,26	1,097	1,203		
EQ5	150	1	5	3,75	1,128	1,272		
EQ6	150	3	5	4,71	,537	,289	Reliability	4,67
EQ7	150	1	5	4,52	,840	,706		
EQ8	150	2	5	4,59	,679	,461		
EQ9	150	1	5	4,73	,696	,485		
EQ10	150	2	5	4,82	,516	,267	Responsive-ness	4,43
EQ11	150	2	5	4,67	,662	,439		
EQ12	150	2	5	4,34	,761	,580		
EQ13	150	3	5	4,29	,720	,518	Assurance	4,59
EQ14	150	1	5	4,59	,775	,601		
EQ15	150	2	5	4,63	,653	,426		
EQ16	150	3	5	4,73	,557	,311		
EQ17	150	1	5	4,39	,912	,832	Empathy	4,13
EQ18	150	1	5	3,96	1,003	1,006		
EQ19	150	1	5	4,11	,935	,874		
EQ20	150	1	5	4,25	,808	,654		
EQ21	150	1	5	4,21	,806	,649		

The GAP analysis is presented at the Table 5. The number of GAP represents the GAP between indicators with the same numbers (e.g. GAP1 means the GAP between indicators EQ1 and PQ1, etc.). As can be seen in Table 5, the highest GAPs are formed at the dimensions of responsiveness, reliability and assurance; moreover, these GAPs are statistically significant ($p < 0.01$), the GAP of the dimension of empathy is statistically significant as well ($p < 0.01$), hence the GAP score is lower. The GAP score of the dimension of tangibility is low, statistically non-significant, although still negative. The overall SERVQUAL GAP is negative, moderate and statistically significant ($p < 0.01$).

Table 5

GAP analysis

GAP No.	Meaning	Sig.	Dimension	GAP Score	Sig.	SERVQUAL	Score	Sig.
GAP_1	-,12	,094	Tangibility	-,0443	,592	GAP	-,4876	,000*
GAP_2	,15	,124						
GAP_3	-,57	,000*						
GAP_4	,61	,000*						
GAP_5	-,29	,031**						
GAP_6	-,97	,000*	Reliability	-,7773	,000*			
GAP_7	-,78	,000*						
GAP_8	-,75	,000*						
GAP_9	-,66	,000*						
GAP_10	-,69	,000*						
GAP_11	-,99	,000*	Responsiveness	-,7833	,000*			
GAP_12	-,77	,000*						
GAP_13	-,59	,000*						
GAP_14	-,59	,000*	Assurance	-,5457	,000*			
GAP_15	-,62	,000*						
GAP_16	-,58	,000*						
GAP_17	-,39	,000*						
GAP_18	-,38	,001*	Empathy	-,2875	,001*			
GAP_19	-,34	,002*						
GAP_20	-,19	,069						
GAP_21	-,24	,013**						

** p<0,05; * p<0,01.

The data provided in Figure 1 indicate the relations between importance of dimensions and GAPs of service quality.

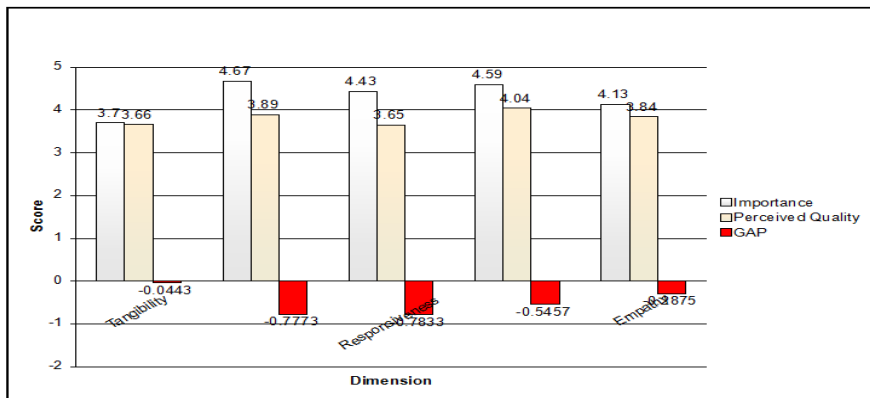


Figure 1. Relations among importance of dimensions and GAP's of service quality

It substantiates the fact that the most important dimensions of service quality for customers have the largest negative and statistically significant GAPS, while the least important dimension for customers have the lowest service quality GAPS.

More specifically, the reliability, assurance and responsiveness are the most important dimensions for customers regarding gyms in Kaunas city. Customers get the lowest perceived service quality regarding these mentioned dimensions.

Discussion

The results revealed that the most important dimensions of customers' perceived quality of gyms in Kaunas city are reliability, responsiveness and assurance. Despite this, these dimensions have the highest GAPS of service quality. It could be stated that customers' expectations regarding these dimensions are not satisfied. The indicators' scores of reliability dimension shows that trainers do not provide promised services on time, they do not sincerely care about the customers' problems. The results showed that trainers did not provide services correctly at the first time and information provided by trainers is not always true and accurate. Besides, customers do not feel that things and money left during the training time are safe. Furthermore, customers feel that trainers do not always want to help them and sometimes are too busy to respond to customers' questions. Moreover, services are not quickly provided. Regarding assurance, it could be stated that trainers' behavior do not cause trust for customers, trainers are not always helpful and they are not proficient enough to be able to answer customers' questions. It can be stated, that customers cannot feel safe during the training because of the trainers.

More concerns about the trainers work could be made after the evaluation of empathy: it is exposed that trainers do not pay personal attention for the customer, they do not look after the interests of their customers and they do not understand specific customers' needs.

The only two positively evaluated indicators are corresponding to the tangibility dimension, reflecting visual attractiveness of physical tools used in the gym and the attractiveness of the trainers. The rest indicators corresponding to the dimension of tangibility were evaluated negatively (they pertained to modern equipment used in the gym, spacious area in the gym, and attractiveness of written material used in the gym). Despite latter results, the service quality GAPS that are formed in this dimension are not so high in comparison with the other dimensions.

It is obvious that staff willingness to serve the consumer, to help him and the ability to provide the promised service properly, accurately and timely is at the lowest level. The assumption could be made that the managers of the gyms in Kaunas are investing in the physical attributes of the gyms, but the personnel management and selection are not managed sufficiently or the allocation of the investments is thoughtless.

Conclusions

Different service quality evaluation models were created over the last decades. The variety of the models is based on the adaptation of the object for the model, different methodologies. The choice of service quality model for the specific research depends on the analysis of drawbacks of the particular model, aim and object of the research, and the possibilities to modify the model to a precise analysis.

In accordance with research results, the main conclusion is that service quality of gyms in Kaunas city is below the average. Customer expectations are high with respect to personnel competences, capacities, desire with providing services and willingness to help. Despite this, the quality of services regarding reliability, responsiveness, assurance and empathy does not match the expectations of customers. In contradistinction, the expectations with the aspects of tangibility are low, but quality of services regarding tangibility satisfies customer needs. It could be stated that all the aspects of gym's service quality, that are very important for the customers, are ignored or not perceived as important by the owners and managers of the gyms. On the subject of the purpose of the gyms, it is understandable that the management of the processes, activities in this sport branch is more important than the brand or the modernity of the equipment and other material tools used in the gym.

Finally, the suggestion can be made that the owners and the managers of the gyms' in Kaunas city should pay more attention and investments on the choice, education, behavior and training of their personnel.

References

1. Aydin, K., & Yildirim, S. (2012). The Measurement of Service Quality with SERVQUAL for Different Domestic Airline Firms in Turkey. *Serbian Journal of Management*, 7(2), 219-230. doi: 10.5937/sjm7-1317
2. Bayol, M.-P., Foye, A., Tellier, C., & Tenenhaus, M. (2000). Use of PLS Path Modelling to Estimate the European Consumer Satisfaction Index (ECSI) Model. *Statistica Applicata*, 12(3), 361-375.

3. Benazic, D. & Došen, D. O. (2012). Service Quality Concept and Measurement in the Business Consulting Market. *Tržište / Market*, 24(1), 47-66. Retrieved from Business Source Complete, EBSCO. Retrieved from <http://search.ebscohost.com>
4. Ching-Chow, Y. (2005). The Refined Kano's Model and its Application. *Total Quality Management & Business Excellence*, 16(10), 1127-1137. doi:10.1080/14783360500235850
5. Dabholkar, P.A., Shepherd, C.D., & Thorpe, D. I. (2000). A Comprehensive Framework for Service Quality: an Investigation of Critical Conceptual and Measurement Issues Through a Longitudinal Study. *Journal of Retailing*, 76(2), 131-169. DOI:10.1016/S0022-4359(00)00029-4
6. Ghasemi, M., Kazemi, A., & Esfahani, A. N. (2012). Investigating and Evaluation of Service Quality Gaps by Revised Servqual Model. *Interdisciplinary Journal of Contemporary Research in Business*, 3(9), 1397-1408. Retrieved from <http://www.journal-archives14.webs.com/1397-1408.pdf>
7. Golder, P. N., Mitra, D., & Moorman, C. (2012). What is Quality? An Integrative Framework of Processes and States. *Journal of Marketing*, 76, 1-23. doi: <http://dx.doi.org/10.1509/jm.09.0416>.
8. Grigaliūnaitė, V., Pilelienė, L. (2013). Customer Satisfaction with Catering Services in Lithuania. *Regional Formation and Development Studies: journal of social sciences*, 3(11), 75-87. Retrieved from Business Source Complete, EBSCO. Retrieved from <http://search.ebscohost.com>
9. Gronroos, C. (1984). A Service Quality Model and its Marketing Implications. *European Journal of Marketing*, 18(4), 36-44. doi: 10.1108/EUM00000000004784
10. Kano, N., Seraku, N., Takahashi, F., & Tsuji, S. (1984). Attractive Quality and Must be Quality. *Quality. Journal of the Japanese Society for Quality Control*, 14(2), 39-48.
11. Kaura, V., Datta, S., & Vyas, V. (2012). Impact of Service Quality on Satisfaction and Loyalty: Case of Two Public Sector Banks. *Vilakshan: The XIMB Journal Of Management*, 9(2), 65-76. Retrieved from Business Source Complete, EBSCO. Retrieved from <http://search.ebscohost.com>
12. Lithuania Sports Statistical Yearbook. (2011). Retrieved from <http://www.kksd.lt>.
13. Parasuraman, A. A., Zeithaml, V. A., & Berry, L. L. (1985). A Conceptual Model of Service Quality and Its Implications for Future

- Research. *Journal of Marketing*, 49(4), 41-50. Retrieved from Business Source Complete, EBSCO. Retrieved from <http://search.ebscohost.com>
14. Philip, G. & Hazlett, S. A. (1997). The Measurement of Service Quality: A New P-C-P Attributes Model. *International Journal of Quality & Reliability Management*, 14(3), 260-286. doi: 10.1108/02656719710165482
 15. Pilelienė, L., Grigaliūnaitė, V. (2013). Determination of Customer Satisfaction with Supermarkets in Lithuania. *Management of Organizations: Systematic Research*, 66, 99-114. doi: 10.7720/MOSR.1392-1142.2013.66.7
 16. Seth, N., Deshmukh, S. G., & Vrat, P. (2005). Service Quality Models: A Review. *International Journal of Quality and Reliability Management*, 22(9), 913-949. doi: 10.1108/02656710510625211
 17. Soita, P. W. (2012). Measuring Perceived Service Quality Using Servqual: A Case Study of the Uganda Health and Fitness Sector. *International Journal of Business and Social Science*, 3(5), 261-271.
 18. Soteriou, A.C., & Stavrinides, Y. (2000). An Internal Customer Service Quality Data Envelope Analysis Model for Bank Branches. *International Journal of Bank Marketing*, 18(5), 246-252. doi: 10.1108/02652320010356799
 19. United States Fitness & Recreational Sports Centers Industry Capital & Expenses Report (2013). Retrieved from <http://www.reportlinker.com/p0748305-summary/U-S-Fitness-Recreational-Sports-Centers-Industry-Capital-Expenses-Report.html>
 20. Zhu, F.X., Wymer, W.J., & Chen, I. (2002). IT-based Services and Service Quality in Consumer Banking. *International Journal of Service Industry Management*, 13(1), 69-90.

Submitted: September 26, 2013

Accepted: November 27, 2013

REVIEW PAPER

THE EXISTENTIAL ASPECTS OF LEARNING IN PHYSICAL EDUCATION AND SPORTS ACTIVITY

Mārtiņš Veide

University of Latvia

Address: Jūrmalas gatve 74/76, Rīga, Latvia

E-mail: martinsw@inbox.lv

Abstract

This paper reviews the participation in sports activities and physical education as a learning process that provides not only the change in behavior, but also the development of skills and knowledge, formation and change of attitude through experience. This article analyzes the relationship between the attitude of students and the existential questions they have about themselves, their choice and meaning in the context of physical education and sports activity as well as existential aspects of the pedagogical effectiveness. Attitude towards life, which is closely related to the notions about the answer to the question “who am I?” emerges as one of the main factors that influences youngsters’ participation in physical activities. Students’ positive attitude towards physical activity requires learning environment that encourages finding personal meaning. Opportunities to develop their physical skills are linked to the opportunities encouraged by a more conscious learning. Meanwhile, the attitude of the coach or the physical education teacher stems from their personal view on the meaning of their work. In sports psychology the research on athletes’ emotional state could be promoted by paying more attention towards athletes’ subjective existential experience, personal attitude towards their own emotional states, such as, for example, anxiety.

Key words: *attitude, choice, existentialism, meaning, learning, physical education, sports activities.*

Introduction

Nowadays physical activity, health and quality of life are inextricably linked. The aim of sports policy in Latvia is formulated as "sports – for the quality of life". One of the sub-goals of the sports policy guidelines defined by the Ministry of Education and Science of the Republic of Latvia is „make it possible for every citizen to engage in regular physical activity and health-promoting sporting events, as well as raise public awareness of the impact

of physical activity in maintaining and strengthening health” (Sporta politikas pamatnostādnes, 2012). Quality of life includes a number of indicators: the increase in the level of education, the improvement in living conditions and health, increased life expectancy, increased availability of cultural values, a greener environment, etc. It could be concluded that good life requires many prerequisites; however, an important thing besides external circumstances and material conditions is one’s attitude, inner freedom, knowledge, practical skills to achieve goals and gain fulfillment. The formation of attitude and change, as well as the development of skills, knowledge, or understanding through personal experience, in essence, is learning. So, at least part of the quality of life is something that we learn during our lives. Potentially, any participation in physical activity and sports is also learning. Formally, it is reviewed from three different aspects in relation between education and physical activity: physical education at school, physical activity in the community (such as sports clubs), and the education and training of physical education teachers and coaches (Eiropas Savienības pamatnostādnes, 2008).

A common way of existence is to have or, in terms of education process, to obtain more and more information. There is abundance of information on the impact of physical activity on maintaining and strengthening health. However, awareness of the impact of physical activity apparently does not guarantee understanding and motivation to participate. Researchers in the field of physical education indicate that it is essential to better understand the factors associated with children and young people’s participation in physical activity in order to facilitate the participation in current and lifelong physical activities (Chung, Phillips, 2002; Ding et al, 2006).

Nowadays, when human existence is perceived as something final, the impetuous rush encircled individual is forced to constantly manage time and take care of its proper use. In addition, various advanced mechanisms, ICT development and the increasing avalanche of information to be processed do not encourage to choose regular physical activity. Human beliefs mix with doubts about the meaning of their actions and the meaning of their lives. Sometimes, even after many years of trainings and achievements an athlete leaves their sport with the disappointment of “lost time” and determination to protect their children from it. In general, it reveals the topicality of the learning to be (one of the UNESCO International Commission’s 21st century education pillars (UNESCO Task Force, 2013)) aspect in the physical education and sports.

The author sets a task to analyze the existential understanding of the participation in physical activity and sports, the accompanying anxiety and sense of loss, as well as the interpretations of the relationship between athlete and coach.

Research question: What is the role of existential questions about oneself, one's choice and meaning in the learning process of physical education and sports?

Research method: analysis of scientific literature and other sources.

Material and methods

Existential understanding of participation in physical activity and sports

Nowadays, one can easily access information on the impact of physical activity on maintaining and strengthening health. It is known that due to lack of exercise even young people may have cardiovascular disease and heart attack. Sedentary lifestyle causes spine problems for many people, including young ones. During muscle downtime the body cleaning processes are slowed down, while moving improves immunity, metabolism, blood circulation and increases vitality. I.Pavlov has noted that the movement can replace almost all drugs, but no drug can replace the movement. However, one of the most common diseases in the 20th century has been hypodynamia – excessive muscle relaxation related to lack of exercise and sedentary lifestyle. Every other citizen of the European Union (Eiropas Savienības pamatnostādnes, 2008, 4) has sedentary lifestyle. After a human being has sat for more than ten years at school and then a few more years – at higher education institution, he sits again at his workplace... Various mechanisms continuously release the modern human being from the physical activity and exercise.

During their spare time children and young people are always keen to engage in various physical activities, such as playing games or doing all kinds of sports. However, with the development of ICT, new leisure activities such as watching TV, playing video games, and, in particular, using the internet have gradually changed their daily habits. And there are serious concerns that this change in the children and youth physical activity and the replacement of physical activities by inactivity-enhancing activities can be associated with the increasing health problem of adults. As noted by the European Union Sports and Health working group, in the European Union Member States one can observe more and more children and young people who have sedentary lifestyle and who report to have metabolic problems, such as accumulation of the cardiovascular disease risk factors; however, access for these children can be complicated (ibid., 22). This can

be explained with the situations when these children and young people have had a bad experience in competitive sports or performing tasks in physical education classes and; hence, they do not want to re-experience this frustration. And it is particularly understandable in the absence of no alternatives to the traditional competitive sports disciplines. Nowadays, the educational innovation, including the case of physical education and sports, do not keep up with the technological innovations. Children and young people are very keen on using modern technology opportunities and often outperform adults, including teachers, in terms of using the technology. In the relationship with ICT one can gain much more predictability and security than in the competitive atmosphere. This reduces the likelihood of frustration. Moreover, not like the external activities, the virtual world provides for children and young people new opportunities for internal activities such as, for example, construction of new meanings, their comparison and evaluation.

From an existential point of view, one needs to look at an important issue appears of choosing a certain way of passing one's free time during the particular lifetime period and of using their inner freedom to make this choice. An individual, of course, cannot be free from biological, psychological or sociological conditions. However, as V. Frankl (1967) notes, a human being is always free to take a certain position in relation to these conditions, change one's own attitude towards them. An individual can take a certain position not only in terms of his attitude towards the world, but also in his attitude towards himself.

The attitude of pupils and students as one of the main factors that influence participation in physical activities is researched in several scientific studies (e.g., Chung, Phillips, 2002; Ding et al., 2006; Solmon, 2003). Everyday people express their views and attitudes through behavior and language. In the context of participatory intentions one can divide the student's attitude in two parts – towards his or her own behavior (personal positive or negative evaluation of behavior) and towards the views of the society (i.e., the evaluation of peers, teachers and parents on appropriate behavior). Researchers recognize that understanding of students' viewpoints helps to understand their attitude, interests, and involvement or non-involvement in physical activity and physical education programs (Rikard, Benville, 2006). It has been found that young people with a more positive attitude towards physical activities more often take part in physical activities also outside school compared to those who have less positive attitude (Chung, Phillips, 2002; McKenzie, 2003).

Formation of attitude is one of the main tasks of education; hence, it is interesting to look at the potential factors of educational environment that may have an impact on the students' attitude towards the physical activities. It has been found that if the physical education at school has marginal status, it has a negative impact on the attitude of students (Tannehill et al., 1994). In the meantime, a positive students' attitude is associated with joy, a sense of belongingness and perceived usefulness of the curriculum (Subramaniam, Silverman, 2002). In addition, the joy of participation diminishes when the teacher requires the pupils to repeat the same activity again and again (Carlson, 1995).

One can conclude that the formation of attitude is significantly affected by the learning environment and the fact whether search for meaning is taken into account during learning process. This in accordance with J.Rink (2006), who acknowledges that in physical education learning environment that promotes *personal meaning* is important for the development of positive attitude. Moreover, the individual choice is free and not limited to, for example, with easily observable gender differences, such as when young women emphasize aesthetics in the physical activities, while men choose more risk elements. The basic principles of V. Frankl Institute of Logotherapy show the close link between motivation and the aspirations to find meaning: „our main motivation for living is our willingness to find meaning of life” (Logotherapy, 2013). When replacing verb “to live” with “to do sports” in this postulate we obtain the following: the main motivation of students to do sports is their willingness to find meaning in this participation. Scrupulous tendency to use one narrow, globally prescribed syllabus (as it can often be observed at school) often does not provide an answer to the question: what is the significance of today's sports class activity in the current life of the student or in his personal future? If the task is to run a distance in defined time slot or to pull at the bar certain number of times, then the link to the well-being and improvement of health is not obvious. The impact of a sedentary lifestyle might not be noticeable in youth. Also the improvement in one's physical abilities does not take place quickly and prominently. When student explicitly or impliedly expresses a question about the meaning of the learning context, it does not mean lack of motivation as can sometimes be interpreted. Existential approach underlines that challenging meaning is not peculiar or wrong – it is just human.

The search for meaning can be broadened if during the physical education classes or training session students learn something about the relationship with the teacher and their own attitude towards the taught discipline. In other words, they not only learn to perform a certain task

(running a distance, jumping, etc.) and how to perform this task (how to do it better), but also learn to learn and learn to live. In this context a fundamental existential question arises for the physical education teacher: what exactly am I teaching?

Several studies in the field of physical education show that the attitude of students towards physical activities becomes less positive as they graduate the primary school and start studying at secondary school. This is due to the fact that young people become more educated; hence, their attitude towards physical activity worsens (Biddle, Mutrie, 2008; Xiang et al, 2004). Such changes can be observed also at university where students believe that “higher education is better without physical education classes”.

This fact is related to the contradiction, which has arisen during the 20th century, between the mental and physical development of children and young people due to the large flow of information (Grants, 1997). This contradiction between knowledge and abilities is based on the insurmountable dualism of body and mind. Widely prevalent is an idea that physical activities develop only the body, while reading, writing, and thinking develop the mind. This creates a false position of mind versus muscles.

If looking at M. Göhlich’s (2007) four learning concept dimensions – knowledge, abilities, living and learning - learning, one can observe that traditionally exactly knowledge-learning is the dimension that is most closely linked to the formal education institution and its mission. Obviously this is because, first of all, knowledge is something that can be separated from the individual, respectively, it can be taught at school as a study subject. Secondly, when using knowledge-learning it becomes easier to measure the learning outcomes – knowledge can be tested even out of context according to standardized criteria. On the other hand, during the physical education classes or sports trainings the capability oriented (body or social) abilities-learning dimension is brought to the foreground. Although abilities-learning is often linked to practical, technical knowledge, it does not become an objectified subject. Abilities cannot be separated from the doer. This can be achieved only by simulation, testing, practice, and other activities. In particular, this dimension focuses on practical learning through personal experience. Hence, the participant’s personal meaning is especially important.

Main learning throughout centuries for humanity has been to learn how to survive, which is linked to life assurance. In the modern technology era the significance of physical abilities in this context has significantly diminished. Nowadays, in physical education classes and sports trainings

living-learning is not as much related to the awareness, increase in physical abilities, or restructuring of one's own perception and activity, as with the unity with one's own body and the comprehension of one's own distinctiveness.

Mind-body dualism for a modern human being stems from the contradictory notions of oneself, respectively, of the answer to the existential question: who am I? It is significant that this question cannot be answered with the help of the natural science data or facts learned at school. Finding the answer to this question is done on the level of existence, rather than knowledge. The answer can be found in own personal experience.

Most people feed their body as something separable from themselves, from their "I". When drawing a line between the mind and body, people always identify themselves with the former. K. Wilber (2001) has stated: „As it turns out, few of us have lost our minds, but most of us have long ago lost our bodies, and I am afraid we must take that literally". For an average representative of the Western civilization his body is not his "who I am" but "something that I own", like clothes, a bag, or a car. Although during lifetime the body can serve as a source of pleasure and means for leaving an impression, it hides in itself the threat for disease and physical pain, it has to be taken care of, it has to be maintained. Since the body is not necessarily the subject to daily commands of mind, it creates a "headache". Already early in the childhood one can notice that the body not only gives pleasure, but also produces faeces and punk which become the cause for the tumultuous situations with parents. A situation which results with full pants does not stimulate the child to recognize his body as his own in the future. Also the later experienced unpleasant realization that the body is aging and dying is not consistent with the plans of "I" to live and continuously develop. As noted by K. Wilber (ibid., 110), people do not want to recover the unity with their body, due to the fears of its socially denied emotions and feelings, as well as fear of death.

Tendency to identifying oneself with the mind and seeing one's own mortal body as something "beyond oneself" or "underneath oneself" gives direction for the preferences also in the learning process – people as if develop themselves and their personality with intellectual pursuits and knowledge acquisition, while physical activities and sports are secondary option to pass the free time. Thus, it becomes obvious that the answer to the question "who am I?" is not only an issue that the philosophers have tried to resolve throughout history, but it is relevant also in the context of very practical activities – such as organizing and participating physical activities.

Distancing oneself from their body leads to a feeling of loss and emptiness. An individual tries to fill this emptiness with even newer and more complete information, thinking that he acquires knowledge and develops his personality. However, information as means of signs and signals that conveys messages or represents significance, is not yet comprehended information or subjective wisdom that can be used in different contexts. In fact, information acquired without personal, subjective experience creates only an illusion about the existence of knowledge or knowledge-learning. This illusion alienates people from themselves, from their self-realization, replaces the opportunities to acquire personal experience with the impersonal experience that is characterized as if to us all and, consequently, also is easier definable and measurable in the education system. At the same time, it does not help to get to know oneself. Individuals, for example, do not necessarily need to know the kinetic laws to know themselves that they are a good dancer or athlete.

To overcome the gap between mind and body it is not sufficient to only have knowledge of the somatic and psychic processes. In other words, it is not important to think about one's body, it is important to feel it. It usually feels very unusual and strange to try to feel the body, because it is more common to pay all the attention to the whole body or parts of it within one's mind. In this respect, physical activities can help. More than a century ago, W. James stated that if we want to overcome unwanted emotional expressions, we have to imitate the external features of those characteristics that we would like to have. Rather than wondering and thinking with one's mind, a person needs to physically act and explore new, uncharacteristic movements that will provide better chance to learn about oneself and change in the desired direction. While changing the nature and manners of one's movements, also the person's attitude changes towards himself, his body, and capabilities.

Attitude towards loss and anxiety in sports and in life

One can easily observe that the human inner emotional state appears in a natural way through the body movements. A. Lowen (1993) mentions the person's lust for power as one of the major reasons for the fragmentation of human mind and body. Human beings desire to control themselves and their world. This links in a complex way with their aspirations to gain more and more knowledge. To abdicate from control would mean to unleash the inadvertent aspect of the body. But that is linked to the personal concerns that the body will reveal its weakness, destroy its ambitions, disclose its hidden sadness and anger. As further noted by A. Lowen (*ibid.*, 307), it

would open the truth hidden from the world by oneself, would provide life a new existential depth, making it brighter and more fulfilled; however, fear and lack of belief in one's own body does not permit it to happen.

Both student's avoidance of physical education classes because of potential frustration and fear of death and collapse of self-image maintaining mind-body dualism are related to the sense of loss. By narrowing down the understanding of learning to certain, specially organized processes in the educational institutions loss is not always interpreted as a valuable experience that provides a great opportunity to learn something. Subjectively experienced loss when repeated in one's thoughts often creates the feeling of powerlessness, even chronic mental and physical fatigue. At the same time, long lasting depressive emotional state can cause problems with concentration to perform the set tasks and repeatedly reaffirms the person's inability to success carry out planned things. As a result, the main loss after emotionally experienced situations proves to be the loss in one's own faith and faith in one's abilities, respectively, the chance of self-actualization becomes less possible. A. H. Maslow (1972) in this context warns that „if you deliberately plan to be less than you are capable of being, then you will be deeply unhappy for the rest of your life”.

In the context of competition loss is an essential part of the athlete's life experience. This becomes especially eminent if one considers the winner only the athlete who is the first, while everyone else being losers. However, there are always variations in one's own attitude towards the loss.

Interest in the athletes' emotional state is often focused on the impact of this variable on their achievements in sports. In their research G. Jones, S. Hanton, and A. Swain (1994) for the first time showed what personal significance to anxiety individual athletes assign. However, for the most part, the significance is assigned to the levels of athletes' anxiety. Moreover, scientists who have studied athletes' anxiety and stress have always interpreted high level of these states as unwelcome. Anxiety is comparable to the loss of emotional control and is seen as something that has a devastating effect on the athlete's achievements. Interestingly, this is defined as a negative phenomenon and is studied in isolation, regardless the fact that often athletes do not experience these emotions in this way at all.

From existential perspective approach *meaning* that athletes attribute to anxiety or other emotional states can have more significance than the levels of affective states themselves. For example, it is possible that an athlete who experiences high level of anxiety before the race does not consider it to be a disruptive and potentially debilitating condition, because this is his normal

emotional state in such situations. Nevertheless, when studying the effects of anxiety on performance the personal attitude of the athlete towards his emotional state is often not taken into account. As a result, a lot of work is done to determine the effectiveness of various intervention strategies designed to control anxiety and manage stress. But G. Jones and L. Hardy (1990) have indicated that the results of such studies have not provided clear reasoning for the effectiveness of applying anxiety control and stress management in sports, explaining it with the deficiencies of these studies' methodologies such as inability to control the placebo effect. The desire to control again and again arises from the same perception of the superiority of mind over body and lack of own integrity, which in the end does not permit the possibility that not only intentional, but also accidental, uncontrolled mental processes could be one's own and that one does not have to overcome them.

This suggests an idea that a better approach to understand the relationship between emotional states and achievements in sports, one should pay more attention to meaning that individuals assign to anxiety. Following the existential approach one should examine anxiety in a constructive manner, instead of avoiding it at all costs. Moreover, in this way one could see the difference between neurotic anxiety as a response to unreasonable threat or challenge (test of strength) and anxiety that is related to the individual's personal growth. Individual's integrity and unlocking of the potential truth, which is an integral part of an individual's existence and is as natural a process as birth, physical growth, and death, can lead to a condition that requires so much strength that for some period of time a human being is not capable of acting properly. Christina and S. Grof (1992) define this with a term "spiritual emergency" and note that nowadays people who experience this condition are rarely perceived as ones who are experiencing internal growth. Most frequently it is interpreted as a disease that requires such curative methods that completely throttle the potential benefits that could be gained by experiencing the spiritual emergency.

A higher level of anxiety is usually expected just before the race. However, when paying closer attention to the athletes' subjective experience, one can observe that the athlete's mood changes based on the most significant events in his life, regardless of whether they are related to sports or not (Nesti, Sewell, 1999). It is difficult to understand the relationship between the emotional states and the achievements in sports when examining only sports and ignoring other life events. The threat of potential loss is not unequivocally linked to the achievement of goals in specific sports' competitions. Loss of personal resources, such as lack of sleep, less

the time allowed for social and family commitments or excessive work demands may have a greater impact on the athlete's emotional state than the upcoming sports events, even if they are very difficult, challenging and stressful (ibid., 265). Such loss description can be used to gain a deeper understanding of the relationship between sports achievements and anxiety by shifting attention from the emotional intensity to its personal meaning for the individual.

The existential aspects of the pedagogical effectiveness

The desire to be a good athlete, to make achievements in sports may be related to the illusion about the link between success and love, in other words, the most common hope formed in the childhood that by constantly making progress one can earn the lacking care and love of their important person (initially – one's parents). In this way, the threat of loss and anxiety can be reduced if a person gains experience, which destroys this illusion. On one hand, it may be a long-awaited non-receipt of awards, consistently achieving the best results. On the other hand, this experience can be provided by important people (including the coach) by showing understanding, care, and appreciation, if the results are not satisfactory or the competition is lost.

Given the relation between the emotional state, the body movements, and the significance of one's integrity, for a sports' teacher it is important to recognize and accept one's own and student's emotions in the environment of training or competition. The coach can be supportive by encouraging the student to be aware and express one's emotional state.

The relationship between athlete and coach is thought to be one of the key factors underpinning the achievements in sports. Unsatisfactory communication between athlete and coach, lack of trust, the ambiguity of the role of coach are factors that have been identified by the participants of the Olympic games as the ones that have a disruptive impact on their performance (Gould et al., 1999).

Often the relationship between athlete and coach is interpreted as mutual dependence: an athlete needs to acquire the knowledge, expertise and experience that the coach has to succeed and the coach needs to transform their knowledge and skills on the athlete's achievements. Consequently, the effectiveness of the coach as a teacher is linked to the results of the athlete during the competition. This view narrows the meaning of the work of the coach, as the effectiveness of the coach may be reflected not only by the improvement of the student's skills, i.e., obtaining a medal or outperforming one's personal record, but also by the development of the

personal and social qualities, such as student's satisfaction, sense of self-confidence or assertiveness.

Victory-loss relationship dimension does not allow differentiate between effective and ineffective coaches as it might seem at the first glance – neither from the behavioral, nor cognitive approach. The coaches of the winning and losing athletes have behavior of similar nature and frequency (Claxton, 1988). Moreover, any coach throughout his career has seen both wins and losses at different knowledge levels of methods and sports' tactics, as well as at different individual relationships with athletes that are measured in the cognitive approach studies of the coach effectiveness. (e.g., Gallimore, Tharp, 2004). B. T. Gearity (2010) research findings confirm that the athlete's win in the competition is insufficient measurement of the effectiveness of the coach, as it does not show the learning outcomes and development of the athlete. Similarly, the positive exam results at school do not guarantee a student's ability to apply the learned material in solving real life problems.

A human being experiences and feels only in one's own inner world that despite the existence of the objective reality is always subjective. Taking into account the significance of the subjective existential experience of an athlete, it is important to broaden the understanding on how he interprets his coach's behavior and knowledge. Athletes of the same team can interpret their coach's behavior differently (Smith et al., 2009). This is taken into account in the paradigm of constructivism where learning is not processing of information acquired from outside but rather creation of meaning and knowledge in the discovery process of one's personal world. Instead of determining the effectiveness of the coach in the processes of behavior or cognition, constructivist approach seeks to understand students construct their understanding of effective or ineffective coaching. When examining the athletes' individual experience one can conclude that the effectiveness of the coach's behavior is contingent upon the athlete building a relationship with their coach and understanding the coach's philosophy (Becker, 2009). Such an approach makes it possible to identify specific reasons that do not allow students to gain satisfactory, growth-enhancing experience in sports. It is remarkable that such reasons are not limited only to loss during competition and unsatisfactory teaching during training, but also reveal such features as not taking care (coach does not support emotionally, but just thinks about winning, about his own honor), biasness of the coach, having their own favorites ("you will not achieve anything!"), the suppression of the athlete's mental skills (the athlete needs to obey only to commands – without thinking that make one feel like an

idiot), as well as the coach competing himself with the athlete (Gearity, Murray, 2011). In such cases, the meaning of the coach as a teacher is lost, as they form certain athlete's attitude, that they do not learn anything from their coach. Athletes' motivation is affected in such a way that they still want to win, but not for their coach. This shows the ambiguity of the learning goals in sports' training, respectively, it is not limited to the skills, knowledge and success in competitions, but also provides satisfactory and meaningful personal experience.

Conclusion

Student attitude is one of the main factors that affects participation in physical activity. However, the formation of attitude is significantly affected by the learning environment and the inclusion of search for personal meaning in the learning process. The attitude of coach or physical education teacher stems from their personal views on the importance of their work, respectively, the meaning of their work. In an organized educational process the search for meaning can be limited by scrupulous focus on global fixed curriculum or narrowly defined learning objectives. The field for search of meaning can be extended subject to various dimensions of the learning process – not only in terms of the traditional knowledge-learning or abilities-learning that is brought to attention in physical education classes and sports trainings, but also in terms of learning-learning and living-learning, or learning to be. Unreasonably low priority is assigned to the search for meaning as the resulting self-knowledge and change in attitude contributes to the personal development on existential, rather than knowledge level.

Attitude towards physical activity is associated with the perceptions of the potential answer to the existential question: "Who am I?" The dualism of mind and body distances from getting to know oneself and makes this attitude renunciative. The tendency to identify oneself with one's mind and the loss of unity with one's body is related to the fears of the corresponding emotions and feelings, as well as death. But overcoming this dualism provides a new personal experience, making the learning of physical education and sports more conscious.

Focusing on the loss of the emotional control as something that has a devastating effect on the athletes' achievements hinders the integrity of the individual and unlocking the true potential. Personal attitude towards failure and regression phases can also be conscious and changed, provided that it is taken into account. Individual subjective experience has a role also in physical education and sports, just as in any other learning process.

Therefore, a better understanding of the relationship between sports' achievements and individual emotional states, such as, for example, anxiety, may be derived by shifting attention from the emotional intensity to its personal importance for the individual.

The requirements of the sports' productivity and educational assessment influence how the relationship between sports' teachers and students is defined. This has high impact on the training, respectively, the learning process and the results in student lives. Excessive concerns about the evaluation of the results dehumanize this relationship. Evaluation focuses on the evaluation part, gives a certain direction. Therefore, it is important to distinguish, whether only the result itself is evaluated or the whole process, namely, the student's effort, progress made and their attitude.

The existential questions about oneself, one's choice and meaning in the learning process of physical education and sports are closely linked to one's attitude, participation, the impact of emotional states, and the athlete-coach relationship.

References

1. Becker, A. J. (2009). It's not What They Do, it's How They Do it: Athlete Experiences of Great Coaching. *International Journal of Sports Science & Coaching*, 4(1), 93-119.
2. Biddle, S. J. H., & Mutrie, N. (2008). *Psychology of Physical Activity: Determinants, Well-Being and Interventions*. New York: Routledge.
3. Carlson, T. B. (1995). We hate gym: Student Alienation from Physical Education. *Journal of Teaching in Physical Education*, 4, 467-477.
4. Claxton, D. B. (1988). A Systematic Observation of More and Less Successful High School Tennis Coaches. *Journal of Teaching in Physical Education*, 7, 302-310.
5. Chung M., & Phillips, D. A. (2002). The Relationship Between Attitude Toward Physical Education and Leisure-time Exercise in High School Students. *Physical Educator*, Vol. 59, Is. 3, 126-138.
6. Ding, S., Wright, P. M., & Li, W. (2006). Exploring the Relationship Between a Caring Climate and Student Attitudes Toward Physical Education in an Urban High School. *Research Quarterly for Exercise & Sport* Vol. 77, Suppl.1.
7. *Eiropas Savienības pamatnostādnes fiziskās aktivitātes jomā*. (2008). Brisele.
8. Elko, K. P., & Ostrow, A. C. (1991). Effects of a Rational-emotive Education Program on Heightened Anxiety Levels of Female Collegiate Gymnasts. *Sport Psychologist*, 5, 235-255.

9. Frankl, V. E. (1967). *Psychotherapy and Existentialism*. Simon & Schuster.
10. Gallimore, R., & Tharp, R. G. (2004). What a Coach Can Teach a Teacher. *The Sport Psychologist*, 18, 119-137.
11. Garity, B. T. (2010). Effective Coaching: the Winning Discourse or Educational Foundations? *Journal of Coaching Education*, 3(1), 1-21.
12. Garity, B. T., & Murray, M. A. (2011). Athletes' Experiences of the Psychological Effects of Poor Coaching. *Psychology of Sport and Exercise*, 12, 213-221.
13. Gould, D., Guinan, D., Greenleaf, C., Medberry, R., & Peterson, K. (1999). Factors Affecting Olympic Performance: Perceptions of Athletes and Coaches from More and Less Successful Teams. *The Sport Psychologist*, 13, 371-394.
14. Göhlich, M., & Zirfas, J. (2007). *Lernen: Ein pädagogischer Grundbegriff*. W.Kohlhammer Verlag.
15. Grants, J. (1997). *Fiziskā audzināšana, sports un vesels bērns*. Rīga: Mācību grāmata.
16. Grof, C., & Grof, S. (1992). *The Stormy Search for the Self: A Guide to Personal Growth through Transformational Crisis*. Putnam's.
17. Jones, G., Hanton, S., & Swain, A. B. J. (1994). Intensity and Interpretation of Anxiety Symptoms in Elite and Non-elite Sports Performers. *Personality and Individual Differences*, 17, 657-663.
18. Jones, G., & Hardy, L. (1990). *Stress and performance in sport*. Chichester: Wiley.
19. *Logotherapy*. (2013). Retrieved from http://www.logotherapyinstitute.org/About_Logotherapy.html
20. Lowen, A. (1993). *Depression and the Body*. Penguin Books.
21. Maslow, A. H. (1972). *The Farther Reaches of Human Nature*. Maurice Bassett.
22. McKenzie, T. L. (2003). Health-related Physical Education: Physical, Activity Fitness and Wellness. In Silverman S.J., Ennis C.D. (Eds.) *Student Learning in Physical Education: Applying Research to Enhance Instruction* (pp. 207-226). Human Kinetics.
23. Nesti, M., & Sewell, D. (1999). Losing it: the Importance of Anxiety and Mood Stability in Sport. *Journal of Loss & Trauma* Vol. 14, No. 3, 257 - 268.
24. Rikard, G. L., & Banville, D. (2006). High School Student Attitudes about Physical Education. *Sport, Education and Society*, 11, 385-400.

25. Rink, J. (2009). *Teaching Physical Education for Learning*. New York: McGraw-Hill.
26. Smith, R. E., Shoda, Y., Cumming, S. P., & Smoll, F. L. (2009). Behavioral Signatures at the Ballpark: Intraindividual Consistency of Adults' Situation-behavior Patterns and their Interpersonal Consequences. *Journal of Research in Personality*, 43, 187-195.
27. Solmon, M. A. (2003). Student Issues in Physical Education: Attitudes, Cognition and Motivation. In Silverman S.J., Ennis C.D. (Eds.) *Student Learning in Physical Education: Applying Research to Enhance Instruction*. (pp. 147-162). Human Kinetics.
28. *Sporta politikas pamatnostādnes 2013. – 2020. gadam*. (2012). Rīga: IZM.
29. Subramanian, P. R., & Silverman, S. (2002). Using Complimentary Data: An Investigation of Student Attitude in Physical Education. *Journal of Sport Pedagogy*, 8, 74-91.
30. Tannehill, D., Romar, J., O'Sullivan, M., England, K., & Rosenberg, D. (1994). Attitudes Toward Physical Education: Their Impact on how Physical Educators Make Sense of their Work. *Journal of Teaching in Physical Education*, 13, 406-420.
31. *UNESCO Task Force on Education for the Twenty-first Century*. (2013). Retrieved from <http://www.unesco.org/delors/>
32. Wilber, K. (2001). *No Boundary: Eastern and Western Approaches to Personal Growth*. Shambhala.
33. Xiang, P., McBride, R., & Guan, J. (2004). Children's Motivation in Elementary Physical Education: A longitudinal Study. *Research Quarterly for Exercise and Sport*, 75, 71-78.

Submitted: September 5, 2013

Accepted: November 27, 2013

SHORT COMMUNICATION

THE LIFELONG LEARNING STRATEGY FOR THE SPORT AND ACTIVE LEISURE SECTOR AT NATIONAL AND EUROPEAN LEVEL

Juris Grants, Iveta Boge, Inta Budviķe, Imants Upītis

Latvian Academy of Sport Education

Address: 333 Brīvības Street, Riga, LV 1006, Latvia

Phone: +371-67543412

E-mail: Juris.Grants@lspa.lv, Iveta.Boge@lspa.lv, Inta.Budvike@lspa.lv,
Imants.Upits@lspa.lv

Abstract

The Lifelong Learning Strategy for Sport and Active Leisure provides a framework for the development of a strategic approach to ensure that vocational education, training and qualifications (VET system) exist to support the development of this workforce. The publication unite information from three different topics in the framework of the VSport+ Project „ A Cross-Sectoral Valorisation Framework For The Lifelong Learning Strategy In Sport”, which key aims are to ensure a successful dissemination of the Lifelong Learning Strategy (LLS) at the International, European, national, regional and local levels, encourage and support the transfer and implementation of the Strategy at all levels, stimulate changes within vocational education to ensure that it is fit for purpose and aids employability and mobility. Full articles are available on LASE website (www.lspa.lv) both in English and Latvian. The authors of the topic now are involved in the dissemination process of the LLS at the International and national levels.

Key words: *Sport and Active Leisure Sector, Lifelong Learning (LLL) Strategy, Seven Steps of the LLL Sport Strategy.*

Introduction

THE NEED FOR CHANGE

The Sport and Active Leisure sector has the potential to make a huge impact on the economy, the health of a nation and social cohesion. The sector is growing fast across the European Union and is currently facing significant challenges in the field of education and employment which need

to be considered if the sector is to achieve its potential and impact on individuals and communities. There are a number of key issues in the field of education and employment which need to be considered if the sector is to achieve its potential and positive impact on individuals and communities: employers need well-trained employees, able to match the requirements; courses and qualifications are often not regarded as appropriate by employers and sport federations; the sector lacks a clear career structure. This is needed in order to attract the best people and particularly to give graduates the opportunity to find employment in the sector. There is often poor communication and co-operation between stakeholders because of the fragmentation of the sector and the lack of organized contact between employers and the providers of vocational education training.

A RESPONSE TO THE EDUCATION AND TRAINING CHALLENGES INTRODUCING THE LLL SPORT STRATEGY

The European Observatoire of Sport and Employment (EOSE) has developed a coordinated response to education and training entitled the Lifelong Learning Strategy for the Sport and Active Leisure Sector (LLL Sport Strategy). The LLL Sport Strategy has been mainly produced in order to: understand and anticipate realities, changes and future skills needs of the labor market; organize the sector in support of the European policies and strategic initiatives, especially the European Qualification Framework (EQF), the European Credit System for Vocational Education and Training (ECVET) and the European Quality Assurance in Vocational Education and Training (EQAVET); promote a transparent and flexible education and training system with clear learning and career pathways; engage main stakeholders from the sector; facilitate the link between the worlds of education and employment; match education and training to the needs of the labor market; equip the workforce with the right skills and competences through fit for purpose qualifications and courses; facilitate the economic growth and social impact of the sector; improve the recognition of competences and qualifications; and support mobility, transparency and mutual trust of qualifications.

SEVEN STEPS OF THE LLL SPORT STRATEGY

The LLL Sport Strategy has been designed to be flexible so that it can be used by a wide range of stakeholders and to achieve a variety of education or employment objectives in the sector. The strategy offers a common and consistent approach, but its implementation will be different

depending on the national systems and the roles and needs of the stakeholders in each European country.

It is important to note that the 7 steps model (Figure 1) can be applied to the Sport and Active Leisure Sector as a whole, to a sub-sector such as Fitness or Outdoors, or to an individual sport such as Golf or Basketball etc. Also, the work can be carried out at the regional, national, European or International level.

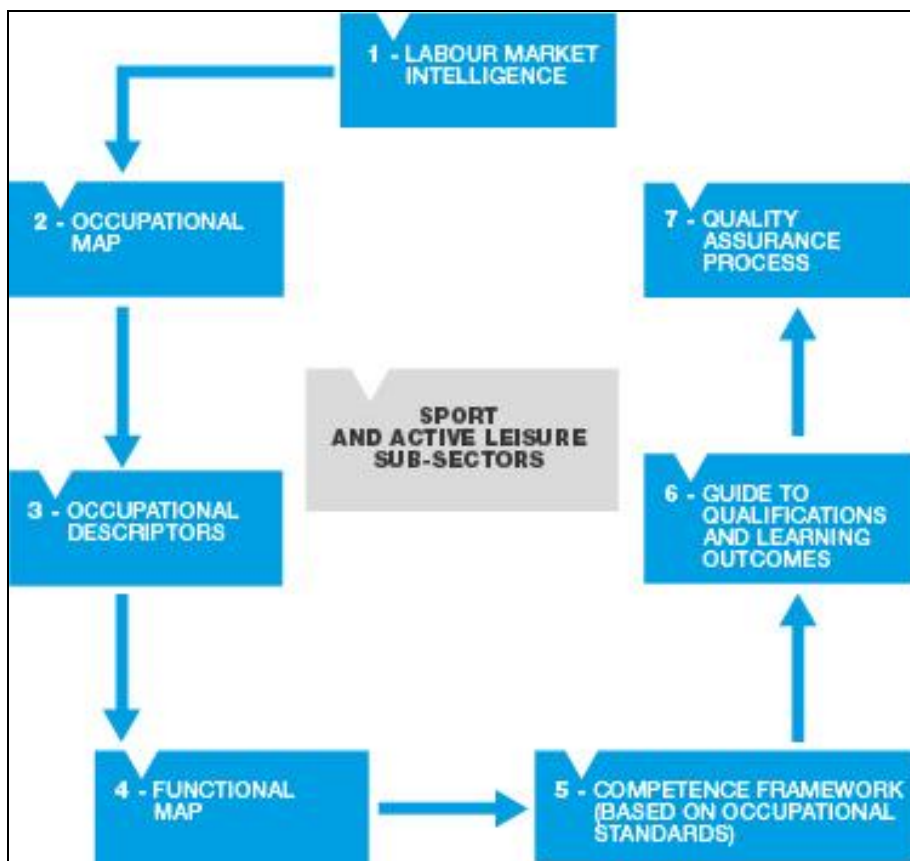


Figure1. The Lifelong Learning Strategy for the Sport and Active Leisure Sector.

STEP 1: LABOUR MARKET INTELLIGENCE

The first step consists of conducting Labor Market Intelligence (LMI) to collect data from various sources using a range of techniques to be able to understand the characteristics of the sector and its current labor market (paid and unpaid), to assess the potential for growth and change and to identify the priority areas. The main use of this information is to describe the

relationship between employers and occupations, and to assess how well the labor market is functioning, the existing and emerging skill shortages and training requirements, the appropriateness of the existing VET system, and the prediction of current and future skill priorities.

STEP 2: OCCUPATIONAL MAP

Step 2 is a natural progression from Step1, and all data collected about the labor market can be used to inform the Occupational Map. Both Steps can be combined to provide a comprehensive and concise overview of the sector, the employment related issues and the common job roles and key occupational areas. The Occupational Map contributes to the context and background for the development of Occupational Standards and Education and Training strategies for a sector, a sub-sector or an occupation.

STEP 3: OCCUPATIONAL DESCRIPTORS

Step 3 of the LLL Sport Strategy consists of developing occupational descriptors for the main occupations and job roles in the sector/sub-sector or individual sport identified within the Occupational Map. Organizations often use different job titles for roles that are essentially similar. The aim of this step is to identify this commonality. The Occupational descriptors identify key tasks, skills and attributes which relate to a specific occupation as well as knowledge, qualifications and career routes, and therefore become a useful reference point for the development of occupational standards and qualifications and identifying career routes.

STEP 4: FUNCTIONAL MAP

The Functional Map is a graphic representation that describes the work activities taking place across an occupational sector or a specific sport. Functional maps set out a framework from which occupational standards can be drawn and developed but they are not the occupational standards themselves.

STEP 5: COMPETENCE FRAMEWORK (BASED ON OCCUPATIONAL STANDARDS)

The Competence Framework is made up of Occupational Standards which are units of competence which describe the skills and knowledge necessary to work in a sector. Occupational standards describe what needs to be achieved in the workplace and they are specifically related to employment whether this is in a paid or voluntary capacity. The standards outline the minimum core competences, skills and knowledge required to carry out specific roles and should be flexible enough to allow individual European countries and training organizations to interpret and apply the model to their own national systems.

STEP 6: GUIDE TO QUALIFICATIONS AND LEARNING OUTCOMES

Step 6 is the point in the Strategy where there is cross over from the area of employment to the area of education. The guide to Qualifications and Learning Outcomes describes the guidance from the sector to education and training providers and national qualifications authorities concerning the development of learning programs which help people reach the competence required for employment in the sector (matching the requirements in the occupational standards). The guide to Qualifications and Learning Outcomes should not only focus on qualifications within the VET system, there should also be an emphasis on guidance for Continuing Professional Development (CPD), which is a vital part of the learning portfolio in a sector, often aimed at individuals already in work. Learning outcomes and qualifications which support the sport sector can be from the vocational or higher education area.

STEP 7: QUALITY ASSURANCE PROCESS

When looking at a sector as a whole, it is essential that there is trust and confidence from all stakeholders in the education and skills development system. Quality assurance systems are being developed throughout Europe at the national level. This is often in conjunction with national qualification framework developments and is the responsibility of national qualifications agencies. It is also possible and desirable to put in place quality assurance and accreditation systems within the sport and active leisure sector itself at the national or European level.

Quality assurance is the final step of the LLL Sport Strategy and ensures that there is confidence and trust that the other steps within the model are delivered in a consistent and quality way to produce a competent and qualified workforce.

Conclusions

The success of the LLL Sport Strategy strongly depends on the involvement of the main stakeholders in the sector's national and European education and employment process. The different categories of stakeholders listed will have a key role to play in addressing the challenges that the Sport and Active Leisure sector is facing.

European Observatoire of Sport & Employment (EOSE), with the support of its network of National Ambassadors throughout Europe and two third country partners from Australia and New-Zealand, is delighted to have been given the opportunity to deliver such an ambitious project which has the potential to facilitate the changes the sector needs to become more

organized and successful in taking its place as a sector of significance at the European level. The project, managed by EOSE, runs between November 2011 – March 2014 and is funded with support from the European Commission. See. further information about the Project on www.vsportplus.eu.

Submitted: September 5, 2013

Accepted: November 27, 2013



Latvian Academy of Sport Education

*LASE 6th PhD and Master Student Scientific Conference
"Theory and Practice in Sport Science"*
March 27, 2014 Riga, Latvia

LASE International Scientific Conference in Sport Science
April 10, 2014 Riga, Latvia

LASE 66th Student Scientific Conference
June 5, 2014 Riga, Latvia

The official languages of the Conferences for oral and poster presentations are Latvian and English. The information is placed on the website: www.lspa.lv



OSRESS 2014

Outdoor Sports and Recreation Education Summer School 2014
Outdoor Games from the Historical Perspective in Latvia

September 4 -11, 2014 Madona, Latvia

Organizers: Latvian Academy of Sport Education and Latvian Association of Outdoor Education and Recreation **in collaboration with** Jozef Pilsudski University of Physical Education in Warsaw, Faculty of PE in Biala Podlaska, Poland, State College of Computer Science and Business Administration in Lomza, Poland, Swedish School of Sport and Health Science, Sweden and University of Malaga, Spain.

GUIDELINES FOR CONTRIBUTORS

Instruction to Authors

The **LASE Journal of Sport Science** is a journal of published manuscripts in English from various fields of sport science. It covers the following types of papers:

- ✓ *original research papers* (maximum 12 standard pages of typescript, including tables, figures, references and abstract),
- ✓ *review papers* commissioned by the Editor (maximum 20 standard pages of typescript, including documentation),
- ✓ *short communications* (maximum 3 standard pages of typescript plus two table or figure and up to 5 references),
- ✓ *letters to the Editor* delivering an opinion or a comment to published manuscripts (maximum 2 standard pages of typescripts),
- ✓ *current news* (information on conference, abstracts of PhD. theses and Post-Doc. theses, book reviews, biographical notes),
- ✓ *advertisements* that may be covered on separate pages of the journal (prices are subjects to individual negotiations).

Papers must be accompanied by the following submission letter (form available at journal's website), signed by all Authors: "The undersigned Authors transfer the ownership of copyright to the **LASE Journal of Sport Science** should their work be published in this journal. Authors state that the article is original, has not been submitted for publication in other journals and has not already been published except in abstract form, preliminary report or thesis. Authors state that they are responsible for the research that they have carried out and designed; that they have participated in drafting and revising the manuscript submitted, which they approve in its contents. Authors also state that the reported article (if it involves human experiments) has been approved by the appropriate ethical committee and was undertaken in compliance with The Helsinki Declaration."

Research papers and short communications will be sent anonymously to two reviewers. Depending on the reviewers' opinion, the Editors will make a decision on their acceptance or rejection. The Editors' decision is ultimate.

Manuscript specification

Articles must be submitted in English and only to the **LASE Journal of Sport Science**.

Authors should observe the ethics of manuscript preparation (avoiding duplicate publication, inaccuracy of citations, fraudulent publication, plagiarism and self-plagiarism).

Copyright will be owned by the publisher: **LASE Journal of Sport Science**. A properly completed Transfer of Copyright Agreement must be provided for each submitted manuscript. A form is available at journal website.

Authors are responsible for the factual accuracy of their papers, for obtaining permission to reproduce text or illustrations from other publications and for an ethical attitude regarding the persons mentioned in the manuscript.

Format

Document format – Microsoft Word 97-2003 or 2007.

Page format – 210x297 mm (A4). Text – single column (font Times New Roman, letter size 12 pt), line spacing – Single, paragraph alignment – Justified, left margin – 20mm, right margin – 20mm, bottom margin – 25mm.

Style

Papers must be written in a clear, concise style appropriate to an international readership. Familiar technical terms may be used without explanation. Acronyms and abbreviations are likely to need full presentation at least once.

Content

Research or project reports, case studies of practice, action research reports, and reports on teaching practice or techniques will be accepted.

Research reports should include a description of the practical application(s) of the ideas tested, while reports of teaching practice or techniques should contain an explanation of the theoretical foundation underlying the practice or technique in question.

Material in the form of illustrations or photos is welcomed. This material should be accompanied by text clearly setting out its philosophical or practical origins or implications. All material should be clearly referenced to its sources.

The manuscripts should be arranged as follows: title page, abstract and body text

Title page should contain: title of the paper, first and last names of authors with affiliation, first and last name of corresponding authors with postal address, telephone, fax and e-mail.

Abstract (up to 250 words) consisting of the following sections: justification and aim of the study, material and methods, results, conclusions, as well as 3-6 key words, should be provided before the body text.

Body text should be sectioned into: Introduction, Material and Methods, Results, Discussion, Conclusions, Acknowledgements (If necessary) and References. In articles of others types, the text should follow in a logical sequence and headings of its particular sections should reflect issues discussed therein.

Introduction – should be short and concise; it should introduce readers into research problems addressed in the study as well justify undertaking the research and specify its aim.

Material and methods – should describe the subject of the study (in the case of human subjects data should include their number, age, sex and any other typical characteristics) and methods applied in a sufficiently exhaustive way to enable readers to repeat the experiments or observations. For generally known methods only references should be given, whereas detailed descriptions are to be provided for new or substantially modified methods.

Results – should be presented in a logical sequence in the text, tables and figures. Data collated in table and figures should not be repeated in the text which should summarize the most important observations.

Discussion – should emphasize new or important aspects of experimental results and discuss their implications. Results of own studies are to be compared with findings described in the respective domestic and international references used by the Authors.

Conclusions – should be started in points or descriptively and should be logically connected with objectives stated in the *Introduction*. Statements and conclusions not derived from own observations should be avoided.

References – following instructions for Authors on References (APA style).

Citing in-text

Following artificial text shows different types of in-text citation:

Claessens (2010) found evidence that attention will be given to multi-compartment models, such as the 3-water, 3-mineral and 4-compartment models, to assess percentage of body fat. However, Raslanas, Petkus and Griškonis (2010) noted that Aerobic physical load of low intensity got 35.1 % of total trainings time. Research on physical loading also focused on

identifying the basis of many years' research of physical activity (Bytniewski et al. 2010). According to Ezerskis (2010), "... heavy physical loads had the undulating character depending on the dynamics of workloads..." (p. 71) yet girls are more ascertained that the Track & Field training helps to develop courage.

Instructions for Authors on References (APA style)

This document describes standards for preparing the references in the APA style. The following sections give detailed instructions on citing books, journal articles, newspaper articles, conference papers, theses, web pages and others.

Please provide all the required elements in the references to your paper. Please pay particular attention to spelling, capitalization and punctuation. Accuracy and completeness of references are the responsibilities of the author. Before submitting your article, please ensure you have checked your paper for any relevant references you may have missed.

A complete reference should give the reader enough information to find the relevant article. If the article/book has DOI number, the author should include it in the references. And most importantly, complete and correct references may allow automatic creation of active links by the MetaPress technology that we use for making the electronic version of our journal. Active reference linking is regarded as the greatest benefit of electronic publishing and it adds a lot of value to your publication.

Additional information about APA style writing is found on LASE web page: <http://www.lspa.lv/>.

Tables – should be prepared on separate pages (saved in separate files) and numbered using subsequent Arabic letters. They should be provided with titles (above). Every column in a table should have a brief heading and more extensive explanation should be given under the table, e.g. statistical measures of variability.

Figures – should be prepared in an electronic form and saved in separate files. A separate page should be provided with legends to figures, authors' names, manuscript's title, and consecutive number of figure with "bottom" or "top" identification. Photographs or other illustrative materials may be submitted in an electronic form (*.tif, *.jpg, image resolution: 300 or 600 dpi) or any other form suitable for final technical typesetting by the Editorial Office. In the appropriate places in the text consecutive numbers of tables or figures should be provided in parentheses, e.g. (Tab. 1) or (Fig. 1). Places of insertion of the illustrative material should be marked with pencil on the margin of the typescript.

General principles – the Editorial Office reserves for itself the right to correct stylistic errors and to make necessary changes (abridgements) in the text without Author's knowledge. Articles not accepted for publication are not returned. Manuscripts not prepared following *Instruction to Authors* will be sent back to Authors for revision. Galley proofs of manuscripts will be sent to Authors for proofreading. It is the Author's responsibility to return the proof within one week. Each Author will receive free-of-charge one copy of the issue in which their work appears.

Manuscripts are liable to copyright resulting from the Berne Convention for the Protection of Literary and Artistic Works and from the Universal Copyright Convention. Any part of the manuscript may be reproduced, or transferred in any form without consent of the copyright owner.

Submission of manuscripts

The articles should be sent to:

Ilze Spike

E-mail: ilze.spike@lspa.lv

Reviewers of the articles on 2013

Agita Ābele (Latvia) PhD, Professor, Latvian Academy of Sport Education
Rolf Carlson (Sweden) PhD, Professor, Swedish School of Sport and Health Sciences
Dmitriy Cherenkov (Russia) PhD, Assoc. Professor, Russian State University of Physical Education, Sport Youth and Tourism
Leonīds Čupriks (Latvia) PhD, Professor, Latvian Academy of Sport Education
Andra Fernāte (Latvia) PhD, Assoc. Professor, Latvian Academy of Sport Education
Juris Grants (Latvia) PhD, Professor, Latvian Academy of Sport Education
Uldis Grāvītis (Latvia) PhD, Professor, Latvian Academy of Sport Education
Vello Hein (Estonia) PhD, Assoc. Professor, University of Tartu
Vladimir Issurin (Israel) PhD, Professor, Wingate Institute for Physical Education and Sport
Rasma Jansone (Latvia) PhD, Professor, Latvian Academy of Sport Education
Jānis Lanka (Latvia) PhD, Professor, Latvian Academy of Sport Education
Artur Litviniuk (Poland) PhD, Assoc. Professor, Jozef Pilsudski Academy of Physical Education
Kazys Milasius (Lithuania) PhD, Professor, Vilnius Pedagogical University
Krzysztof Piech (Poland) PhD, Assoc. Professor, Jozef Pilsudski Academy of Physical Education
Inese Pontaga (Latvia) PhD, Professor, Latvian Academy of Sport Education
Inta Māra Rubana (Latvia) PhD, Professor, Latvian Academy of Sport Education
Juozas Skernevičius (Lithuania) PhD, Professor, Lithuanian University of Educational Sciences
Jānis Židens (Latvia) PhD, Professor, Latvian Academy of Sport Education
Ivars Kravalis (Latvia) PhD, Assoc. Professor, Latvian Academy of Sport Education
Viesturs Lāriņš (Latvia) PhD, Professor, Latvian Academy of Sport Education
Imants Upītis (Latvia) PhD, Assoc. Professor, Latvian Academy of Sport Education
Žermēna Vazne (Latvia) PhD, Assoc. Professor, Latvian Academy of Sport Education
Signe Luika (Latvia) PhD, Latvian Academy of Sport Education
Zbigniew Bujak (Poland) PhD, Assoc. Professor, Jozef Pilsudski Academy of Physical Education
Andre Koka (Estonia) PhD, Assoc. Professor, University of Tartu

LASE JOURNAL OF SPORT SCIENCE
is a Scientific Journal published two times per year in Sport Science
LASE Journal for sport scientists and sport experts/specialists

Published and financially supported by
the Latvian Academy of Sport Education in Riga, Latvia

p-ISSN: 1691-7669
e-ISSN: 1691-9912
ISO 3297

Language: English
Indexed in IndexCopernicus

Printed in 100 copies

Executive Editor:
Inta Bula – Biteniece
Ilze Spīķe
Language Editor:
Ieva Rudzinska

Printed and bound: "Printspot" Ltd.
Cover projects: Uve Švāģers - Griezis
Address: 14-36 Salnas Street
Riga, LV1021, Latvia
Phone: +371 26365500
e-mail: info@printspot.lv
website: www.printspot.lv

Editorial Contact Information.

Publisher Contact Information:

Inta Bula-Biteniece
Latvian Academy of Sport Education
Address: 333 Brivibas Street
Riga, LV1006, Latvia
Phone.: +371 67543410
Fax: +371 67543480
E-mail: akademija@lspa.lv

The annual subscription (2 issues) is 35 EUR
(20 EUR for one issues).

Order form of LASE Journal of Sport
Science Exemplary order form of
subscription is accessible
in our website: www.lspa.lv/research

Please send the order to:
LASE Journal of Sport Science
Latvijas Sporta pedagoģijas akadēmija
Address; 333 Brivibas Street
Riga, LV1006, Latvia
Phone: +371 67543410
Fax: +371 67543480
E-mail: akademija@lspa.lv

Method of payment:

Please send payments to the account of
Latvijas Sporta pedagoģijas akadēmija
Nr. 90000055243
Account number: LV97TREL9150123000000
Bank: State Treasury
BIC: TREL LV22
Postscript: subscription LASE Journal
of Sport Science

Full-text available free of charge at <http://journal.lspa.lv/>

All papers are reviewed

This task is created in the cooperation with Latvian Olympic Committee (LOK)
and with the support of the Foundation for Solidarity



CONTENTS.....	138
---------------	-----

Original research papers

BODY HYDRATION DEGREE CHANGES DURING TRAINING IN FOOTBALL PLAYERS IN WINTER CONDITIONS Ozoliņa L., Pontaga I., Strēle M.	139
COMPARISON OF LOWER LIMB ISOKINETIC MUSCLE PERFORMANCE BETWEEN ROAD CYCLISTS AND MIDDLE DISTANCE RUNNERS Rannama I., Baskin K., Roosalu M., Port K., Kunitson V.	147
RELATIONSHIP BETWEEN LOWER LIMB ISOKINETIC STRENGTH AND 60m SPRINT RUNNING TIME Misjuk ¹ M., Rannama I., Niglas E.	159
MUSCLE ACTIVATION LEVEL IN GENERIC AND SPECIFIC STRENGTH TRAINING EXERCISES FOR ORIENTEERS Nilsson J., Johansen E., Gjerset A., Lund M.	168
CHANGES IN PHYSICAL FITNESS OF 9–10 YEAR-OLD SPORTS DANCERS DURING A TEN-MONTH TRAINING CYCLE Ušpurienė A., Čepulėnas A.	175
THE INFLUENCE OF SERVICE CLOSING SETS ON THE WORKING CAPACITY Lāriņš V., Rudzītis A., Pavāre Z.	185
NON-FORMAL PHYSICAL EDUCATION IN SCHOOL AS FACTOR FOR INNATE PHYSICAL POWERS TRAINING Šarkauskienė A.	193
PSYCHOMETRIC INDICATORS OF GENERAL HEALTH QUESTIONNAIRE IN LATVIA Zelča I., Vazne Ž., Čuprika A., Amantova I., Galeja Z., Ozoliņa L., Vaisjūns O., Ozola L.	207
ANAEROBIC POWER AND MUSCLE WORK CAPACITY OF LITHUANIAN BASKETBALL PLAYERS Paulauskas R.	217
AEROBIC AND ANAEROBIC CHARACTERISTICS IN FEMALE AMATEUR LACROSSE PLAYERS IN COMPARISON WITH UNTRAINED FEMALES Kursīte A., Pontaga I.	228
CURRENT NEWS.....	237
GUIDELINES FOR CONTRIBUTORS.....	238

ORIGINAL RESEARCH PAPER

BODY HYDRATION DEGREE CHANGES DURING TRAINING IN FOOTBALL PLAYERS IN WINTER CONDITIONS**Lilita Ozoliņa¹, Inese Pontaga¹, Madara Strēle²**¹Latvian Academy of Sports Education²University of Latvia

Address: 333 Brivibas Street, Riga LV-1006, Latvia

Phone: + 371 67799537

E-mail: lilita.ozolina@lspa.lv, inese.pontaga@lspa.lv

Abstract

Body hypohydration degree significantly influences the athletes' performance, which is especially important for sport game players. The hydration degree of athlete's body determines his aerobic endurance and the ability to perform psychomotor tests. Thirst sensation cannot be plausible indicator to regulate water uptake, because plain water suppresses thirst (thus further drinking) therefore the water uptake will be twice smaller than necessary. The aim of our investigation is to determine the effect of 1.5 hours football training on urine specific gravity and hydration degree of athlete in winter conditions. Forty football players from the first league teams participated in the investigation voluntarily. Their mean age was 20.5 ± 3.5 years; height – 180.7 ± 6.2 cm and mean body mass – 76.4 ± 8.2 kg. The players are weighed using precise scales. Urine samples were collected before and after the training. Urine specific gravity was measured by urine refractometer. Results show that before training 14 (35%) athletes were euhydrated, 24 athletes (60%) were hypohydrated and two athletes (5%) were seriously hypohydrated. After training 4 (10%) athletes were euhydrated, 22 athletes (55%) were hypohydrated and 14 (35%) were seriously hypohydrated. The mean weight loss during the training was 0.80 ± 0.55 kg, but the mean water loss – 0.53 l/h. Even 1.5 hours prolonged training changes urine specific gravity. Results show that more than half of players were hypohydrated even before the training and body hydration degree worsens after the training. The recommendation is to uptake greater amount of mineral water before, during and after training.

Keywords: *hydration status, urine specific gravity, urine refractometry, football players, winter.*

Introduction

Body hypohydration degree significantly effects the athletes performance, which is especially important for sport games players – male football players during the game in summer lose 0.99 – 1.93l of water per hour, the mean loss of water is 1.46l/h, but during training in winter – 0.71– 1.77l/h, the mean loss – 1.13l/h (Sawka et al., 2007). The hydration degree of athlete's body determines his aerobic endurance and the ability to perform psychomotor tests (Mendez-Villanueva et al., 2007). Small degree of the body hypohydration (loss of 1.5 – 2.0% of the body weight caused by water loss) causes significant decrease of the performance of football players and their psychological state (Edwards et al., 2007). A loss of 2% body weight causes an increase in perceived effort and is claimed to reduce performance by 10 – 20%. A fluid loss exceeding 3 – 5% body weight reduces aerobic exercise performance noticeably and impairs reaction times, judgement, concentration and decision making – vital elements in all sports, from pole-vaulting to football (Wright, 2004).

One universal method to determine the body hydration degree is not elaborated. It is not possible to do it by only one characteristic measurement, for example, from the body water content or from urine osmolarity (Armstrong, 2007).

Three methods are available to measure the urine specific gravity: hydrometry, refractometry and reagent strips. The German authors (Stuempfle & Drury, 2003) compared the precision of these three methods by testing wrestlers before and during the competitions. It was concluded that only urine refractometry is a precise method to measure urine specific gravity. Using hydrometry – 28% of results were false positive and 2% – false negative, but by strips of reagents – 15% of results were false positive and 9% – false negative.

According to the data of National Collegiate Athletic Association the hydration degree of the body is in norm if the urine specific weight is below 1020 (Stover et al., 2006). Athletes trained in different sports differ in their body mass composition (mass of skeletal muscles), uptake of water and food or restriction of water and food uptake. Therefore the body hydration degree and loss of mineral salts before competitions, during competitions and after sports loads differs in wide range in different sport specialization athletes (Maughan & Shirreffs, 2008).

The aim of our investigation is to determine the effect of 1.5 hours football training on urine specific gravity and hydration degree of athlete in winter conditions.

Material and methods

Subjects. Forty male football players from two first league teams participated in our investigation voluntarily. They trained regularly five times per week and participated in the competitions on weekends. Their mean age was 20.5 ± 3.5 years, height – 180.7 ± 6.2 cm and the mean body mass at rest – 76.7 ± 8.4 kg.

Methods. The anthropometric data were measured before training: height and body mass. The football players were weighed using special scales Midrics1 (Sartorius, Germany) with precision 10g and maximal weight of measurement of 150kg. The weighting of the athletes was repeated after 1.5 hours duration training.

Every athlete collected mid – stream specimens of urine before and after the training. Urine samples were collected in 15ml sterile tubes (Sarsted Aktiengesellschaft & Co, Germany). Urine specific gravity was measured by urine refractometer PAL - 10S (Atago, USA) with precision ± 0.001 , at $\pm 0.1^\circ\text{C}$.

Evaluation of athlete's hydration degree is performed by using National Athletic Trainers' Association and American College of Sports Medicine used scale, were USG (urine specific gravity) under 1.020 means euhydration, USG in range 1.020 – 1.029 means hypohydration and USG equal or higher than 1.030 means serious hypohydration (Armstrong, 2007). All football players could uptake mineral water or sports drinks during the training without any limitation. The SPSS version 20 programs were used for statistical analysis of the data.

Results

The specific gravity of athletes' urine samples was greater after the training than before it in the greatest number of cases (Fig. 1)

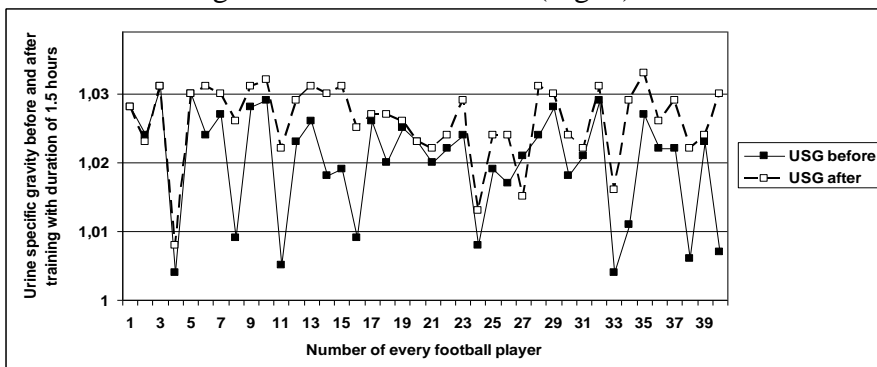


Figure 1. Comparison of urine specific gravity (USG) before and after training for each football player

The urine specific gravity did not change for four football players and decreased in two players. The mean changes of the urine specific gravity were + 0,006 units.

Alteration of the body mass of players varied – from decrease after the training for 1.89kg in comparison with their mass before training – to increase of the body mass for 0.51kg after training in comparison with the rest mass, see Table 1.

Table 1

The body mass (BM) and urine specific gravity (USG) before and after the training for football players

BM (kg) before training	BM changes, kg	BM (kg) after training	BM changes, %	USG before training	USG after training
78.14	- 0.28	77.86	- 0.36	1.028*	1.028*
73.48	- 0.80	72.68	- 1.09	1.024*	1.023*
79.05	- 0.63	78.42	- 0.80	1.031**	1.031**
70.91	- 0.54	70.37	- 0.76	1.004	1.008
73.00	- 1.59	71.41	- 2.18	1.030**	1.030**
92.11	- 0.33	91.78	- 0.36	1.024*	1.031**
68.51	- 0.65	67.86	- 0.95	1.027*	1.030**
89.21	- 0.62	88.59	- 0.69	1.009	1.026*
78.98	+ 0.45	79.43	+ 0.57	1.028*	1.031**
72.59	+ 0.51	73.10	+ 0.70	1.029*	1.032**
65.60	- 0.60	65.00	- 0.91	1.005	1.022*
75.01	- 0.57	74.44	- 0.76	1.023*	1.029*
71.64	- 0.36	71.28	- 0.50	1.026*	1.031**
80.55	- 0.95	79.6	- 1.18	1.018	1.030**
72.47	- 0.82	71.65	- 1.13	1.019	1.031**
79.85	- 1.14	78.71	- 1.43	1.009	1.025*
84.11	- 0.39	83.72	- 0.46	1.026*	1.027*
85.15	- 1.51	83.64	- 1.77	1.020*	1.027*
77.06	- 0.14	76.92	- 0.18	1.025*	1.026*
73.27	- 0.58	72.69	- 0.79	1.023*	1.023*
71.19	- 0.61	70.58	- 0.86	1.020*	1.022*
81.95	- 1.37	80.58	- 1.67	1.022*	1.024*
81.12	- 0.57	80.55	- 0.70	1.024*	1.029*
67.62	- 1.37	66.25	- 2.03	1.008	1.013
85.67	- 1.76	83.91	- 2.05	1.019	1.024*
83.46	- 1.50	81.96	- 1.80	1.017	1.024*
85.40	- 1.53	83.87	- 1.79	1.021*	1.015
73.78	- 0.84	72.94	- 1.14	1.024*	1.031**
70.97	- 0.93	70.04	- 1.31	1.028*	1.030**
82.45	- 1.89	80.56	- 2.29	1.018*	1.024*

Table 1 continuation

The body mass (BM) and urine specific gravity (USG) before and after the training for football players

BM (kg) before training	BM changes, kg	BM (kg) after training	BM changes, %	USG before training	USG after training
92.39	- 0.47	91.92	- 0.51	1.021*	1.022*
89.92	- 0.46	89.46	- 0.51	1.029*	1.031**
83.35	- 1.24	82.11	- 1.49	1.004	1.016
70.36	- 1.56	68.80	- 2.22	1.011	1.029*
84.03	- 0.33	83.7	- 0.39	1.027*	1.033**
71.79	- 0.53	71.26	- 0.74	1.022*	1.026*
69.35	- 0.88	68.47	- 1.27	1.022*	1.029*
58.82	- 0.51	58.31	- 0.87	1.006	1.022*
64.80	- 0.93	63.87	- 1.44	1.023*	1.024*
59.04	- 1.27	57.77	- 2.15	1.007	1.030**
76.7 ± 8.4	0.80 ± 0.55	75.9 ± 8.4	1.06 ± 0.71	1.020 ± 0.008	1.026 ± 0.006

From the data of USG: * - hypohydration, ** - seriously hypohydration of the body; **bold – the mean values ± SD**

These changes in body mass indicated that greatest number of football players did not consumed enough fluid before and during the training because their body mass diminished. The largest water loss by sweating was approximately 1.8l per 1.5 hours. The mean body mass decrease was 0.80 ± 0.55 kg. This means that the mean water loss by sweating in winter conditions in all players was close to 0.8l per 1.5 hours. This means that average water loss by sweating was 0.53l per hour.

The mean body mass decrease was $1.06 \pm 0.71\%$. This proved that football players' body hypohydration degree worsened after training in comparison with the body hydration degree before the training, Table 1. The variation of body mass changes is shown in the Fig.2.

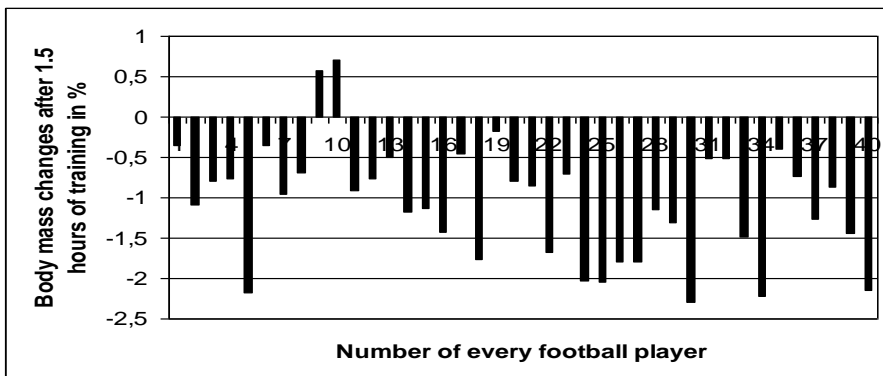


Figure 2. The body mass changes after the training in percentage for every football player

The players' body mass changes in percentages and increase of urine specific gravity after training are dependent on the body hydration degree changes.

Before the training 14 (35%) athletes were euhydrated, 24 athletes (60%) were hypohydrated and two athletes (5%) – seriously hypohydrated. After the training four (10%) athletes were euhydrated, 22 athletes (55 %) were hypohydrated and 14 (35 %) were seriously hypohydrated (Fig.3.).

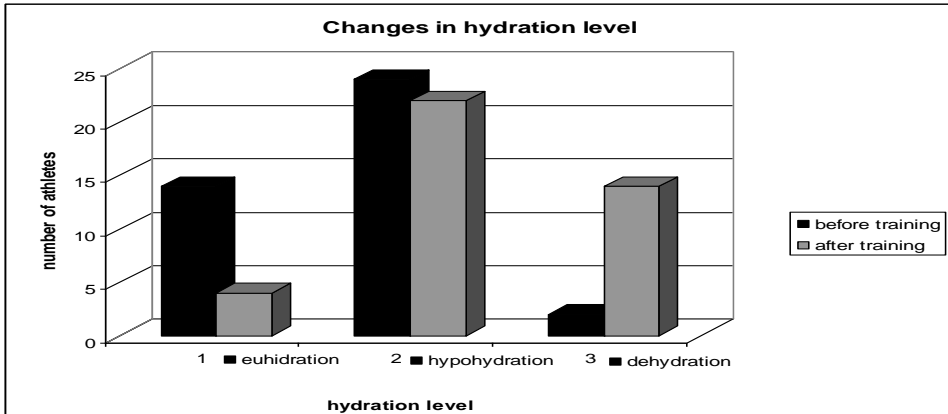


Figure 3. Changes of football players' body hydration degree using USG values.

If determining the athletes' body hydration degree from the urine specific gravity values, then the body hydration degree did not change after training in 19 football players, the body hydration level of nine players from hypohydrated became seriously hypohydrated, but the body hydration level of eight euhydrated athletes before the training became hypohydrated after it. Three players were euhydrated before the training and became seriously hypohydrated after the training. One player, who was hypohydrated before the training consumed large amount of water and became euhydrated after the training. Evaluation of athlete's hydration status was made by using National Athletic Trainers' Association and American College of Sports Medicine used scale, where USG (urine specific gravity) under 1020 means euhydration, USG in range 1020-1029 means hypohydration and USG equal or higher than 1030 means serious hypohydration (Volpe et al, 2009)

Discussion

In our investigation we chose to use urine refractometry and precise scale weighing to determine changes of body hydration level in football

players. Our results of football players' hydration degree before the training are in good agreement with the data of S.L. Volpe et al (2009), who determined that 66% of collegiate athletes appeared hypohydrated before training, but from our investigation – 60% of football players were hypohydrated before training. Stover et al (2006) assessed the urine specific gravity of recreational athletes before exercises. They examined 329 women and men from 2 fitness centres: one in Los Angeles, California, and another – in Chicago, Illinois. Similar to our results, they reported that 46% of the recreational athletes were hypohydrated before the training. It is obvious that professional and recreational athletes are not properly informed about correct fluid uptake before, during and after the training.

Male football players during the game in summer lose 0.99 – 1.93l of water per hour, the mean loss of water is 1.46l/h, but during training in winter – 0.71 – 1.77l/h, the mean loss – 1.13l/h (Sawka et al., 2007). From our investigation: the mean water loss by sweating was 0.53 l per hour, which is at least twice less than measured by M.N. Sawka et al (2007). This can be explained by less intensity of exercises during training in our players in comparison with the load intensity during the game in the athletes investigated by Sawka et al. (2007).

Conclusions

Only 14 (35%) of the first league football team players were euhydrated before the training. Twenty – four players (60%) were hypohydrated and two athletes (5%) were seriously hypohydrated before training. This proves that daily water uptake of players is not enough.

After the training four (10%) athletes were euhydrated, 22 athletes (55%) were hypohydrated and 14 (35%) were seriously hypohydrated. The mean weight loss during the training was 0.80 ± 0.55 kg, but the mean water loss – 0.53l/h. This proves that the body hydration degree of athletes worsened after training.

The water and mineral salts consumption strategy and education of coaches and football players about uptake of liquids before, during and after training is very important.

References

1. Armstrong, L. (2007). Assessing Hydration Status: The Elusive Gold Standard. *Journal of the American College of Nutrition*, Vol. 26, 575S–584S. PMID: 17921468
2. Edwards, A.M., Mann, M.E., Marfell-Jones, M.J., Rankin, D.M., Noakes, T.D., & Shillington, D.P. (2007). Influence of Moderate

- Dehydration on Soccer Performance: Physiological Responses to 45 Min of Outdoor Match-play and the Immediate Subsequent Performance of Sport-specific and Mental Concentration Tests. *British Journal of Sports Medicine*, Vol. 41, 385–391 PMID: 17272311
3. Maughan, R.J., & Shirreffs, S.M. (2008). Development of Individual Hydration Strategies for Athletes. *International Journal of Sport Nutrition and Exercise Metabolism*, Vol.18, 457-472 PMID:17454547
 4. Mendez-Villanueva, A., Fernandez-Fernandez, J., & Bishop, D. (2007). Exercise-induced Homeostatic Perturbations Provoked by Singles Tennis Match Play with Reference to Development of Fatigue. *British Journal of Sports Medicine*, Vol.41, 717–722. DOI [10.1136/bjism.2007.037259](https://doi.org/10.1136/bjism.2007.037259)
 5. Sawka, M.N., Burke, L.M., Eichner, E.R., Maughan, R.J., Montain S.J., & Stachenfeld, N.S. (2007). Exercise and Fluid Replacement. *Medicine and science in sports and exercise*. Vol.39, 377-390 PMID: 17277604
 6. Stover, E.A., Heather, J.P., Horswill, C.P.D., Murray, B., & Wildman, R. (2006). Urine Specific Gravity in Exercisers Prior to Physical Training. *Applied Physiology, Nutrition, and Metabolism*, Vol. 31, 320–327. DOI: [10.1139/h06-004](https://doi.org/10.1139/h06-004)
 7. Stuempfle, K.J., & Drury, D.G. (2003). Comparison of 3 Methods to Assess Urine Specific Gravity in Collegiate Wrestlers. *Journal of Athletic Training*, Vol. 38, 315–319 PMID:14737213
 8. Volpe, S.L., Poule, K.A., & Bland, E.G. (2009). Estimation of Prepractice Hydration Status of National Collegiate Athletic Association Division I Athletes. *Journal of Athletic Training*, Vol.44(6):624–629. DOI [10.4085/1062-6050-44.6.624](https://doi.org/10.4085/1062-6050-44.6.624)
 9. Wright, C. (2004). Dehydration in Sport: Why It is Vital an Athlete Maintains Hydration Levels During Exercise. Retrieved April 5, 2013, from: <http://www.pponline.co.uk/encyc/dehydration-in-sport-why-it-is-vital-an-athlete-maintains-hydration-levels-during-exercise-316>

Acknowledgements

This research was supported by the European Social Fund within the project “**Support for Sport Science**” No. 2009/0155/1DP/1.1.2.1.2/09/IPIA/VIAA/010 action programme „Human resources and Employment” 1.1.2.1.2. sub-activity „**Support for Doctoral Study Programme Implementation**”

INVESTING IN YOUR FUTURE



Submitted: April 4, 2013

Accepted: October 31, 2013

ORIGINAL RESEARCH PAPER

COMPARISON OF LOWER LIMB ISOKINETIC MUSCLE PERFORMANCE BETWEEN ROAD CYCLISTS AND MIDDLE DISTANCE RUNNERS**Indrek Rannama, Karin Baskin, Meeli Roosalu, Kristjan Port, Vladimir Kunitson**

Tallinn University
Address: 55 Tondi Street, 11316 Tallinn, Estonia
Phone: +372 6996544
E-mail: rannama@tlu.ee

Abstract

The purpose of this study was to compare the isokinetic muscle performance of lower limbs in middle distance runners and road cyclists. Subjects: 10 competitive Estonian middle distance runners (age 23.8 ± 3.8 yrs., height 181.8 ± 2.8 cm, mass 73.6 ± 7.4 kg) and 16 road cyclists (21.1 ± 3.5 yrs., 181.5 ± 5.0 cm, 74.8 ± 7.0 kg) volunteered in this study. Methods: Isokinetic strength of ankle plantar flexors (A-pf), ankle dorsal flexors (A-df), knee (K) and hip (H) extensors (ex) and flexors (fl) were measured with Humac NORM isokinetic dynamometer in angular speeds 60, 180 and 240 °/s. Isokinetic peak torque (PT), and power (P) values of best repetition and total work (ToW) of 15 repetitions in angular speed 240°/s were expressed as a mean of dominant and non-dominant leg. The absolute and relative isokinetic values were compared between runners and cyclists. Results: The comparison of PT values shows that cyclists have significantly ($p < 0.05$) higher results in A-pf and K-fl in all testing speeds. No significant differences between A-df, K-ex, H-fl and H-ex PT values at any speed were found. Cyclists had also significantly higher P results in A-pf, K-fl and K-ex in all testing speeds and tendency ($p = 0.08$) in H-ex 60°/s. ToW values of A-pf, K-ex and K-fl were significantly higher in cyclists group, but runners had higher values in H-fl. Conclusion: Cyclists have higher isokinetic muscle performance values in A-pf, K-fl, and K-ex and runners have higher total work ability in H-fl. No significant differences in A-df and H-ex performance between cyclists and runners were found. Runners and cyclists have also different power-velocity curves of A-df, H-ex, K-ex and K-fl

Keywords: *power, peak torque, isokinetic dynamometry.*

Introduction

Cycling and running are most common sports for development of endurance abilities. The differences in physiological adaptations between endurance cyclists and runners are well reported (Millet et al., 2009). Although endurance running and cycling places high demands on aerobic characteristics, runners also have to produce force rapidly and repeatedly (Paavolainen et al., 1999) and cyclists need to perform many high power spurts during the road race competitions (Jeukendrup et al., 2000; Ebert et al., 2006). Running and cycling activity is mainly performed by muscle contraction of the lower limbs, but they have different movement, kinetic and muscle activation patterns. In running (Kyröläinen et al., 2000) the knee and hip joints are more extended during the power production phase than in cycling (Bini and Diefenthaler, 2010). The peak force applied in one cycle in submaximal conditions is more than 5 times higher during running, measured as a ground reaction force (Kyröläinen et al., 1999) than in cycling, measured as a pedal force (Farrell et al., 2003). Also the peak joint moments and power patterns in ankle, knee and hip joints are different during running stance phase than in pedal cycle at steady-state submaximal (Schache et al., 2011; Bini & Diefenthaler, 2010; Elmer et al., 2011; William et al., 2012) and at sprinting conditions (Bezodis et al., 2012; Martin & Brown, 2009; Vrints et al., 2011; Elmer et al., 2011). The main muscle groups that are involved in cycling and running are the knee extensors and ankle plantar flexors, respectively, but in contrast to cycling, which includes mainly concentric contractions, during running the eccentric muscle actions play an important role (Bijker et al 2002; William et al., 2012).

It is known that sprint and endurance training adapt local (single joint) and global (multi joint) muscle strength patterns in different way (Harrisson et al., 2004; Lattier et al., 2003), but how can different types of endurance activities influence muscle strength adaptation? Farup et al. (2012) find that 10 weeks endurance cycling training did not change isokinetic strength and force-velocity curve of knee extensors and flexors. In opposite way, Buško et al. (2008) conclude that the four week intensive endurance training with different cadences, carried out on the cycle ergometer, caused the increase of the isometric torque of hip extensors, knee extensors and ankle plantar flexors, but lowered the torque of hip flexors and knee flexors. No analogous researches about a local strength adaptation in endurance running training were found, but Lattier et al. (2003) compared competitive level endurance runners with sedentary population and did not find significant differences in knee extensors and ankle plantar flexors isometric strength

and counter-movement jump performance. Another studies of Kanehisa et al. (1997) and Sleivert et al. (1995) found similar maximal strength and force-velocity values between middle-distance runners and age-matched untrained subjects. Izquierdo et al. (2002) compared half-squat results between high level athletes of different sports and conclude that middle distance runners have lower maximal concentric one repetition maximum (RM) strength and average power output at the load of 30% of 1RM compared with cyclists. Also maximal power output was achieved with load of 60% by runners and with 45% of 1RM by cyclists (Izquierdo et al., 2002). But local strength differences between cyclists and runners are not known. Only So et al. (1994) have been declared that running and jumping athletes (soccer players and gymnasts) had significantly higher dorsiflexion/plantar-flexion peak torque ratio than the cyclists, but no significant strength differences were demonstrated. The differences of lower limb extensors and flexor muscle performance, strength ratios and power-velocity curves between competitive middle distance runners and road cyclists are not known.

The aim of this study was to compare the local isokinetic muscle performance of lower limbs in middle distance runners and road cyclists.

Material and methods

Participants. The study participants were 10 competitive male middle distance runners of age ranging from 18 to 28 (mean age \pm SD: 23.8 ± 3.8 years, height 181.8 ± 2.8 cm, mass 73.6 ± 7.4 kg) and 16 competitive male road cyclists of age ranging from 18 to 32 (21.1 ± 3.5 years, 181.5 ± 5.0 cm, 74.8 ± 7.0 kg). The age, height and body mass did not differ statistically ($p < 0.05$) between runners and cyclists group. All athletes had at least 6 years focused endurance running or cycling training and competition experience. 4 Road cyclists were Estonian national junior (U18) and 7 cyclists U23 team members, 3 were national elite level amateur and 2 professional road cyclists from Pro Tour and Pro continental level teams. Middle distance runners mean 800m and 1500m track running outdoor season personal best results were 117.1 ± 4.6 and 242.7 ± 8.5 seconds respectively.

All participants were informed about the research procedures, requirements, benefits and risks before the testing. All participants were asked not to do a heavy or intensive training at least two days before the testing. The study was performed in November 2011 after the end of competitive season and before the start of new preparation period for cyclists and runners.

Procedures. A HUMAC 2009 NORM (Computer Sports Medicine, Inc. Stoughton, MA, USA) isokinetic dynamometer was used for the strength testing. Testing was made by one investigator and one assistant. All participants had familiarisation session with the testing equipment before testing and had before and during testing instructions how to make exercise correctly.

The ankle plantar flexors, ankle dorsi flexors, knee and hip extensors and flexors of both legs were tested accordingly. All tests procedures, dynamometer settings and securing of subjects to seat and measurement arms were carried out in accordance with the HUMAC NORM user manual. Ankle plantar and dorsi flexion tests were performed in the “Modified Seated” (supine) position, knee extension and flexion tests in seated position and hip extension and flexion tests in lying position.

The axis of rotation of the dynamometer lever arm was aligned with the anatomical axis of the joint being tested, as described in the HUMAC NORM test manual. The “gravity correction” features were used in all tests to avoid gravity effect of limb weight.

Before testing, all participants warmed up for 10 to 15min on a cycle ergometer. All tests were performed concentrically at three different velocities (60°/sec, 180°/sec and 240°/sec). For familiarization purposes, each velocity had 4 trials before the five (at 60°/sec and 180°/sec velocity) or fifteen (at 240°/sec velocity) repetitions of maximal joint flexion-extension. A recovery period of 20s between trail and test repetitions, 60 s between test velocities, 5min between body sides and 10min between different joint actions was used.

Measures. Measurement and initial analysis of isokinetic strength test variables were carried out in “HUMAC2009 NORM Application Program”. The highest peak torque (expressed in Nm) and power (W) values of best repetition from all joint actions and testing speeds and total work (J) of 15 repetitions in angular speed 240°/s were analyzed. Because the lower limb strength is depending on body weight, the relative torque (Nm/kg), power (W/kg) and total work (J/kg) were also analyzed. The deficit variables (torque difference in per cent) between body sides, muscle group strength ratios between antagonists and rate of strength maintenance in per cent between testing velocities for all muscle groups were computed. Isokinetic strength values were expressed as mean of dominant and nondominant leg.

Analysis. Microsoft Excel add-on „Statistics” were used for data analysis. Descriptive data were computed for both groups separately and expressed as mean \pm standard deviation (SD). All the data was tested for their normal distribution (Kolmogorov - Smirnov test) and the differences

between dispersion of compared groups were tested with F-test. Two tails Student's t-tests were used to assess the differences of absolute and relative isokinetic performance variables between runners and cyclists groups. A Student's t-test for paired data was applied to compare muscle groups power values of different testing velocities in cyclists and runners groups separately. Significance level was set at $p < 0.05$ for all analyses.

Results

The isokinetic muscle peak torque and relative peak torque average results of runners and cyclists are shown in Table 1. Cyclists had significantly ($p < 0.05$) higher ankle plantar flexors relative peak torque values in testing speeds 60 and 240°/s, but had similar tendency ($p = 0.08$) in speed 180°/s. The knee flexors relative strength was significantly higher in cyclists group in all tested velocities and absolute strength in testing speeds 180 and 240°/s, but had similar tendency ($p = 0.08$) in 60°/s. No significant differences in ankle dorsi flexors, knee extensors and hip extensors and flexors peak torque values at any speed were found between runners and cyclists.

Table 1

Absolute (Nm) and relative (Nm/kg) peak torque values of all tested muscle groups and testing velocities in middle distance runners (n=10) and road cyclists (n=16) group (mean \pm SD)

Joint	Velocity	Absolute peak torque values (Nm)			Relative peak torque values (Nm/kg)		
		Runners (n=10)	Cyclists (n=16)	p-value	Runners (n=10)	Cyclists (n=16)	p-value
Ankle PF	60 °/s	87.5 \pm 32.5	107.6 \pm 22.4	0.09	1.17 \pm 0.36	1.43 \pm 0.22	0.04*
	180 °/s	58.2 \pm 15.9	68.6 \pm 16.6	0.16	0.79 \pm 0.17	0.91 \pm 0.16	0.08
	240 °/s	55.5 \pm 14.0	66.8 \pm 14.8	0.09	0.75 \pm 0.14	0.89 \pm 0.15	0.04*
Ankle DF	60 °/s	30.1 \pm 6.4	27.8 \pm 4.8	0.33	0.41 \pm 0.07	0.38 \pm 0.06	0.17
	180°/s	27.6 \pm 7.2	28.2 \pm 6.2	0.84	0.37 \pm 0.07	0.38 \pm 0.07	0.86
	240 °/s	27.0 \pm 6.3	26.7 \pm 6.3	0.90	0.37 \pm 0.06	0.36 \pm 0.06	0.74
Knee EX	60°/s	199.3 \pm 26.8	222.7 \pm 35.4	0.11	2.72 \pm 0.35	2.98 \pm 0.41	0.14
	180°/s	148.7 \pm 16.0	158.6 \pm 24.6	0.32	2.03 \pm 0.19	2.13 \pm 0.31	0.40
	240 °/s	127.1 \pm 11.5	135.7 \pm 21.3	0.30	1.74 \pm 0.16	1.82 \pm 0.26	0.42
Knee FL	60°/s	110.8 \pm 22.3	128.8 \pm 22.6	0.08	1.50 \pm 0.22	1.72 \pm 0.24	0.04*
	180°/s	81.8 \pm 11.6	95.2 \pm 13.7	0.03*	1.11 \pm 0.14	1.28 \pm 0.17	0.03*
	240°/s	67.2 \pm 13.5	84.2 \pm 13.1	0.01*	0.92 \pm 0.18	1.13 \pm 0.15	0.01*
Hip EX	60 °/s	282.3 \pm 58.7	316.5 \pm 71.3	0.25	3.83 \pm 0.61	4.21 \pm 0.68	0.20
	180 °/s	223.2 \pm 50.0	246.5 \pm 49.1	0.29	3.02 \pm 0.49	3.29 \pm 0.46	0.21
	240°/s	207.0 \pm 39.1	220.0 \pm 37.3	0.44	2.81 \pm 0.39	2.94 \pm 0.33	0.41
Hip FL	60°/s	175.9 \pm 31.0	170.9 \pm 21.8	0.65	2.39 \pm 0.33	2.30 \pm 0.27	0.46
	180 °/s	138.1 \pm 26.0	131.0 \pm 16.5	0.42	1.88 \pm 0.32	1.76 \pm 0.22	0.31
	240 °/s	122.6 \pm 24.1	115.4 \pm 15.3	0.38	1.67 \pm 0.30	1.55 \pm 0.22	0.29

DF - dorsi flexors; PF – plantar flexors; EX – extensors; FL - flexors

*- significantly different between cyclists and runners ($p < 0.05$)

The comparison of average power values (Table 2) of best repetitions gave almost similar differences between cyclists and runners – cyclists had higher relative and absolute average power in knee flexors at all speeds and higher relative values of ankle plantar flexors in 60°/s and 240°/s. But in power values the cyclists had significantly higher relative and absolute results of knee extensors at 60°/s and had also tendency (p=0.08) for higher relative hip extensors power in testing speed of 60°/s and knee extensors power (p=0.08) in velocity of 240°/s.

Table 2

Absolute (W) and relative (W/kg) average power values of all tested muscle groups and testing velocities in middle distance runners (n=10) and road cyclists (n=16) group (mean ± SD)

Joint	Velocity	Absolute power values (W)			Relative power values (W/kg)		
		Runners (n=10)	Cyclists (n=16)	p-value	Runners (n=10)	Cyclists (n=16)	p-value
Ankle PF	60 °/s	50.3 ± 19.0	64.8 ± 15.2	0.05	0.67 ± 0.21	0.86 ± 0.15	0.02*
	180 °/s	81.8 ± 25.9	99.5 ± 27.7	0.15	1.10 ± 0.29	1.32 ± 0.29	0.10
	240 °/s	89.8 ± 26.6	112.8 ± 29.2	0.07	1.21 ± 0.29	1.50 ± 0.31	0.04*
Ankle DF	60 °/s	19.8 ± 4.1	18.5 ± 3.3	0.44	0.27 ± 0.05	0.25 ± 0.04	0.30
	180 °/s	26.4 ± 7.7	26.9 ± 5.5	0.86	0.36 ± 0.09	0.36 ± 0.06	0.91
	240 °/s	25.1 ± 7.0	26.7 ± 6.3	0.57	0.34 ± 0.08	0.35 ± 0.07	0.65
Knee EX	60 °/s	140.3 ± 12.7	160.3 ± 25.8	0.05*	1.92 ± 0.20	2.15 ± 0.27	0.05*
	180 °/s	269.9 ± 29.4	296.0 ± 42.7	0.14	3.68 ± 0.33	3.97 ± 0.49	0.15
	240 °/s	270.7 ± 31.8	302.5 ± 46.3	0.10	3.70 ± 0.36	4.05 ± 0.49	0.09
Knee FL	60 °/s	79.5 ± 15.3	99.2 ± 16.1	0.01*	1.08 ± 0.16	1.32 ± 0.16	0.00*
	180 °/s	148.3 ± 21.8	182.9 ± 25.7	0.00*	2.02 ± 0.26	2.45 ± 0.31	0.00*
	240 °/s	145.1 ± 30.5	189.1 ± 32.8	0.00*	1.98 ± 0.42	2.53 ± 0.39	0.00*
Hip EX	60 °/s	193.9 ± 36.8	226.0 ± 50.9	0.13	2.63 ± 0.37	3.01 ± 0.51	0.08
	180 °/s	400.3 ± 93.3	445.3 ± 91.2	0.27	5.42 ± 0.97	5.93 ± 0.89	0.21
	240 °/s	415.8 ± 89.3	443.3 ± 78.0	0.45	5.65 ± 0.99	5.92 ± 0.77	0.46
Hip FL	60 °/s	110.0 ± 16.3	111.3 ± 16.6	0.86	1.50 ± 0.21	1.49 ± 0.19	0.91
	180 °/s	218.2 ± 34.3	211.8 ± 31.7	0.65	2.98 ± 0.42	2.84 ± 0.40	0.44
	240 °/s	227.8 ± 43.2	218.3 ± 33.1	0.55	3.11 ± 0.55	2.93 ± 0.40	0.37

DF - dorsi flexors; PF – plantar flexors; EX – extensors; FL - flexors

*- significantly different between cyclists and runners (p<0.05)

No significant differences in ankle dorsi flexors and hip flexors average power values at any speed were found. Also the significance of differences between runners and cyclists in hip extensors power values lowered with increase of testing velocities.

In Table 3 are expressed the total work values of 15 repetitions in testing velocity 240°/s, this data is expressing the local muscular speed endurance abilities of tested muscle groups. Cyclists had significantly higher total work abilities of ankle plantar flexors (relative values) and knee extensors and flexors (absolute and relative values), but runners had significantly better relative results of hip flexors. No statistical differences

between runners and cyclists were observed in the local speed endurance of ankle dorsi flexors and hip extensors.

Table 3

Absolute (J) and relative (J/kg) total work values of 15 repetitions in testing velocities 240°/s at all tested muscle groups in middle distance runners (n=10) and road cyclists (n=16) group (mean ± SD)

Joint	Absolute total work of 15 repetition (J)			Relative total work of 15 repetition (J/kg)		
	Runners (n=10)	Cyclists (n=16)	p - value	Runners (n=10)	Cyclists (n=16)	p - value
Ankle PF	452.4 ± 155.0	571.3 ± 139.5	0.07	6.12 ± 1.80	7.61 ± 1.54	0.05*
Ankle DF	139.0 ± 35.8	147.9 ± 27.6	0.51	1.88 ± 0.41	1.99 ± 0.35	0.52
Knee EX	1991.1 ± 246.6	2294.4 ± 372.1	0.05*	27.16 ± 2.79	30.76 ± 4.40	0.05*
Knee FL	944.5 ± 217.6	1342.5 ± 229.0	0.00*	12.95 ± 3.18	18.02 ± 2.95	0.00*
Hip EX	3232.5 ± 840.0	3307.8 ± 688.8	0.82	43.82 ± 9.30	44.24 ± 7.80	0.91
Hip FL	1719.4 ± 354.0	1496.2 ± 199.6	0.06	23.51 ± 4.69	20.14 ± 2.80	0.04*

DF - dorsi flexors; PF – plantar flexors; EX – extensors; FL - flexors

*- significantly different between cyclists and runners (p<0.05)

The comparison of antagonistic muscle group ratios (Table 4) show that runners have significantly more balanced ankle dorsi flexors-plantar flexors ratio (in velocities 60°/s and 240°/s) and cyclists have more equally balanced knee flexors-extensors ratio in velocity of 240°/s, but same tendency (p=0.06) is also in velocity of 180°/s. No statistical differences in hip extensors-flexors ratios between runners and cyclists were found, but there is a tendency (p=0.08) for higher ratios in cyclists group at low (60°/s) velocity.

Table 4

Antagonistic muscle group ratios of all tested joints and testing velocities in middle distance runners (n=10) and road cyclists (n=16) group (mean ± SD)

Joint	Velocity	Peak torque ratio (%)		
		Runners (n=10)	Cyclists (n=16)	p-value
Ankle DF/PF	60 °/s	37.6 ± 9.3	26.4 ± 3.9	0.00*
	180 °/s	49.7 ± 13.9	42.3 ± 10.7	0.16
	240 °/s	50.2 ± 9.7	40.8 ± 7.2	0.01*
Knee FL/EX	60 °/s	55.6 ± 6.9	57.9 ± 4.2	0.32
	180 °/s	55.1 ± 5.9	60.5 ± 6.4	0.06
	240°/s	53.0 ± 8.8	62.5 ± 7.2	0.01*
Hip EX/FL	60°/s	161.1 ± 18.5	185.5 ± 34.9	0.08
	180 °/s	164.3 ± 35.1	189.7 ± 38.2	0.13
	240°/s	173.1 ± 37.1	192.3 ± 30.3	0.19

*- significantly different between cyclists and runners (p<0.05)

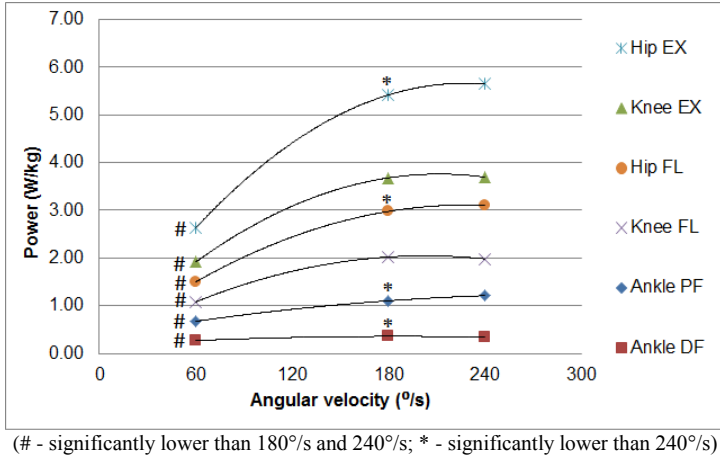


Figure 1. Power-velocity curves of tested muscle groups in runners group (n=10)

The power-velocity curves of middle distance runners (Figure 1) and road cyclists (Figure 2) are showing that power achieved at velocity of 60°/s is in all cases and in both groups significantly lower than power achieved at higher velocities. Ankle plantar flexors and hip flexors power is significantly highest at velocity of 240°/s in both groups. At hip extensors and ankle dorsi flexors have runners significantly stronger power values also at velocity of 240°/s, but cyclists have no significant differences (p=0.37 and p=0.40 respectively) between results at velocities of 180°/s and 240°/s. Reversely cyclists have significantly stronger power values in knee extensors and flexors at velocity of 240°/s and runners have no significant differences (p=0.46 and p=0.31 respectively) between results at velocities of 180°/s and 240°/s.

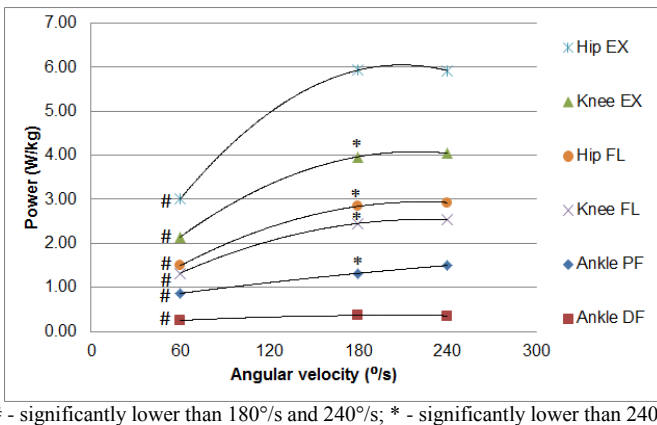


Figure 2. Power-velocity curves of tested muscle groups in cyclists group (n=10)

Discussion

The purpose of this study was to compare the isokinetic muscle performance of lower limbs between middle distance runners and road cyclists. Main differences in local muscle performance between runners and cyclists were in strength, power and speed endurance values of knee flexors and ankle plantar flexors, in where the cyclists achieved higher results. Cyclists had also better knee extensors power at low velocity and larger speed endurance at velocity of 240°/s. Our findings are partly, in case of knee extensors and ankle planter flexors, supported by research of Izquierdo et al. (2002) who showed that highly trained amateur road cyclists had, compared with same level middle-distance runners, higher leg extensors maximal strength and power in low resistance conditions.

Buško et al. (2008) found that the cycle ergometer training elicits the hip extensors isometric torque growth in low and moderate cadence and in endurance and sprint regime, but did not influence knee flexors torque at any condition. The data of the present study showed that cyclists have significantly stronger knee flexors than runners. But Cyclists had only tendency to higher power values at hip extensors in velocity of 60°/s, compared to runners. If we assume, that middle-distance runners maximal strength values are not significantly different of untrained subjects (Kanehisa et al., 1997; Sleivert et al., 1995; Lattier et al., 2003), then we can speculate that our results show different adaption patterns created by long term, high amount and variable intensity of training and competition loads (Jeukendrup et al., 2000; Ebert et al., 2006) in specific road cycling position. The significant higher knee flexors performance values and lower hip flexors total work results of cyclists may due from lower upper-body position (Bini and Diefenthaler, 2010) and pedalling movement. In conditions of low upper body position and closed hip angles, used in competitive cycling (Bini and Diefenthaler, 2010), the biarticular knee flexors are more stretched and hip flexors shortened than in running and this affects muscle morphology and muscle fibres length (Brughelli et al., 2010 ; Savelberg and Meijer 2003). Also knee extensors are more loaded on a second half of pedalling pushing phase than in the stance phase during running (Bijker et al., 2002). Upper body position also affects the ankle plantar and dorsi flexors activation and coactivation (Chapman et al., 2008) - this may be one factor why cyclists have relatively higher plantar flexors performance. Also cyclists had lower ankle dorsi and plantar flexors ratio – this is similar to So et al. (1994) findings who declared that running and jumping athletes need to stabilise ankle joint and for this reason they have more balanced dorsi-flexion/plantar-flexion strength ratio.

This study found also different patterns of power-velocity relationships between muscle groups of cyclists and runners. Runners achieved best power values at hip extensors and ankle dorsi flexors in higher velocity than cyclists and cyclists achieved best power values in higher velocities at knee extensors and flexors. Izquierdo et al. (2002) found also that cyclists achieved maximal power output in half squat, where mainly knee extensors are in use, with lower resistance and higher speed than runners.

Conclusions

We found that cyclists have higher isokinetic muscle performance values in ankle plantar flexors, knee extensors and flexors and runners have higher speed endurance ability of hip flexors. No significant differences in ankle dorsi flexors and hip extensors performance between cyclists and runners were found. Runners had more balanced ankle dorsi flexors - plantar flexors ratio and cyclists had higher knee flexors-extensors ratio. Middle distance runners and road cyclists have also different power-velocity patterns of ankle dorsi flexors, knee extensors, knee flexors and hip extensors.

References

1. Bezodis, N. E., Salo, A. T., & Trewartha, G. (2012). Modeling the Stance Leg in Two-dimensional Analyses of Sprinting: Inclusion of the MTP Joint Affects Joint Kinetics. *Journal Of Applied Biomechanics*, 28(2), 222-227.
2. Bijker, K. E., de Groot, G. G., & Hollander, A. P. (2002). Differences in Leg Muscle Activity During Running and Cycling in Humans. *European Journal Of Applied Physiology*, 87(6), 556-561. DOI 10.1007/s00421-002-0663-8
3. Bini, R. R., & Diefenthaler, F. (2010). Kinetics and Kinematics Analysis of Incremental Cycling to Exhaustion. *Sports Biomechanics*, 9(4), 223-235.
4. Brughelli, M., Cronin, J., Nosaka, K. (2010) Muscle Architecture and Optimum Angle of the Knee Flexors and Extensors: a Comparison Between Cyclists and Australian Rules Football Players. *Journal Of Strength & Conditioning Research*, 24(3):717-21.
5. Buško, K. K., Madej, A. A., & Mastalerz, A. A. (2008). Changes of Muscle Torque after Sprint and Endurance Training Performed on Cycle Ergometer. *Biology Of Sport*, 25(3), 275-294.
6. Chapman, A. R., Vicenzino, B., Blanch, P., Knox, J. J., Dowlan, S., Hodges, P. W. (2008) The Influence of Body Position on Leg

- Kinematics and Muscle Recruitment During Cycling. *Journal Of Science and Medicine in Sport*, 11(6):519-26.
7. Elmer, S. J., Barratt, P. R., Korff, T., & Martin, J. C. (2011) Joint-Specific Power Production during Submaximal and Maximal Cycling. *Medicine & Science in Sports & Exercise*, 43(10): 1940-1947.
 8. Farrell, K. C., Reisinger, K. D., & Tillman, M. D. (2003) Force and Repetition in Cycling: Possible Implications for Iliotibial Band Friction Syndrome. *Knee*, 10(1):103-9.
 9. Farup, J., Kjølhed, T., Sørensen, H., Dalgas, U., Møller, A. B., Vestergaard, P. F., & Vissing, K. (2012). Muscle Morphological and Strength Adaptations to Endurance vs. Resistance Training. *Journal Of Strength & Conditioning Research*, 26(2), 398-407.
 10. Gottschall, J. S., & Kram, R. (2005). Ground Reaction Forces During Downhill and Uphill Running. *Journal Of Biomechanics*, 38(3), 445-452.
 11. Harrison, A. J., Keane, S. P., & Cogan, J. (2004). Force-velocity Relationship and Stretch-shortening Cycle Function in Sprint and Endurance Athletes. *Journal Of Strength & Conditioning Research*, 18(3), 473-479.
 12. Izquierdo, M., Häkkinen, K., Gonzalez-Badillo, J. J., Ibáñez, J., & Gorostiaga, E. M. (2002) Effects of Long-term Training Specificity on Maximal Strength and Power of the Upper and Lower Extremities in Athletes from Different Sports. *European Journal Of Applied Physiology*, 87(3):264-71.
 13. Jeukendrup, A. E., Craig, N. P., & Hawley, J. A. (2000). The Bioenergetics of World Class Cycling. *Journal Of Science & Medicine In Sport*, 3(4), 414-433.
 14. Kanehisa, H. H., Ikegawa, S. S., & Fukunaga, T. T. (1997). Force-velocity Relationships and Fatiguability of Strength and Endurance-Trained Subjects. *International Journal Of Sports Medicine*, 18(2), 106-112.
 15. Kyröläinen, H., Komi, P.V., & Belli, A. (1999) Changes in Muscle Activity Patterns and Kinetics with Increasing Running Speed. *Journal Of Strength & Conditioning Research*, 13(4): 400-406.
 16. Kyröläinen, H., Pullinen, T., Candau, R., Avela, J., Huttunen, P., Komi, P. (2000) Effects of Marathon Running on Running Economy and Kinematics. *European Journal Of Applied Physiology*, 82:297-304

17. Lattier, G., Millet, G. Y., Maffiuletti, N. A., Babault, N., Lepers, R. (2003) Neuromuscular Differences Between Endurance-trained, Power-trained, and Sedentary Subjects. *Journal Of Strength & Conditioning Research*, 17(3), 514-21.
18. Martin, J. C., & Brown, N. T. (2009). Joint-specific Power Production and Fatigue During Maximal Cycling. *Journal Of Biomechanics*, 42(4), 474-479.
19. Paavolainen, L. M., Nummela, A. T., & Rusko, H. K. (1999). Neuromuscular Characteristics and Muscle Power as Determinants of 5-km Running Performance. *Medicine & Science In Sports & Exercise*, 31(1), 124-130.
20. Savelberg, H.H., Meijer, K. (2003) Contribution of Mono- and Biarticular Muscles to Extending Knee Joint Moments in Runners and Cyclists. *Journal Of Applied Physiology*, 94(6):2241-8.
21. Schache, A. G., Blanch, P. D., Dorin, T. W., Brown, N. A. T., Rosemond, D., & Pandy, M. G. (2011) Effect of Running Speed on Lower Limb Joint Kinetics. *Medicine & Science in Sports & Exercise*. 43(7), 1260–1271.
22. Sleivert, G. G., Backus, R. D., & Wenger, H. A. (1995). Neuromuscular Differences Between Volleyball Players, Middle Distance Runners and Untrained Controls. *International Journal Of Sports Medicine*, 16(6), 390-398.
23. So, C. H., Siu, T. O., Chan, K. M., Chin, M. K., & Li, C. T. (1994). Isokinetic Profile of Dorsiflexors and Plantar Flexors of the Ankle - a Comparative Study of Elite Versus Untrained Subjects. *British Journal Of Sports Medicine*, 28(1), 25-30.
24. Vrints, J., Koninckx, E., Van Leemputte, M., & Jonkers I. (2011) The Effect of Saddle Position on Maximal Power Output and Moment Generating Capacity of Lower Limb Muscles During Isokinetic Cycling. *Journal Of Applied Biomechanics*, 27(1), 1-7.
25. William, D. S. 3rd, Green, D. H., & Wurzinger, B. (2012). Changes in Lower Extremity Movement and Power Absorption During Forefoot Striking and Barefoot Running. *International Journal Of Sports Physical Therapy*, 7(5), 525-532.

Submitted: April 15, 2013

Accepted: October 31, 2013

ORIGINAL RESEARCH PAPER

RELATIONSHIP BETWEEN LOWER LIMB ISOKINETIC STRENGTH AND 60m SPRINT RUNNING TIME**Mikola Misjuk, Indrek Rannama, Edgar Niglas**

Tallinn University

Address: Tondi 55, 11316 Tallinn, Estonia

Phone: +372 5341 5281, fax. +372 6996 696

E-mail: mikola.misjuk@tlu.ee

Abstract

Aim: The purpose of this study was to investigate relationship between lower limb isokinetic strength and 60m sprint running time. Subjects: 9 male competitive Estonian sprinters (age 20.7 ± 2.6 yrs, height 181.2 ± 5.7 cm, mass 76.0 ± 7.1 kg) volunteered to participate in the study. Methods: Peak torque of ankle plantar flexion, ankle dorsiflexion, knee and hip extension and flexion were measured with HUMAC NORM isokinetic dynamometer in angular speeds 60, 180 and 240°/s. The sprint performance, 60m from blocks (7.10 ± 0.13 sec), was fixed in competition conditions during the winter season 2013. The isokinetic testing took place shortly after the competition season. The correlations between relative isokinetic peak torque values corrected with body mass and sprint times were calculated. Results: Statistically significant relationship was found between isokinetic strength of ankle dorsiflexion, knee extension, hip extension and sprint running time. Statistically strongest relationships were found between average peak torque (Nm), average relative peak torque (Nm/kg) of hip flexion at 180°/s ($r=-0.737$; $r=-0.818$), at 240°/s ($r=-0.719$ °/s; $r=-0.805$ °/s) and sprint running time. Statistically less significant relationships were found between average peak torque, average relative peak torque of knee extension at 60°/s ($r=-0.746$; $r=-0.679$) and sprint running time. Statistically significant relationships were also found between average peak torque of ankle dorsiflexion at 60°/s ($r=-0.708$), at 240°/s ($r=-0.682$) and sprint running time. No statistically significant relationships were found between isokinetic strength of ankle plantar flexion, knee flexion, hip extension and sprint running time. The main finding of the study is that in addition to extensors also dorsiflexors ankle stabilizers play a significant role in sprint performance.

Key words: *isokinetic strength, peak torque, 60m running, lower limbs strength.*

Introduction

Muscle strength is highly important factor in sprint running (Delecluse et al. 1994, Dowson et al. 1998, Olmo & Castilla 2005). Good running speed is needed not only for sprint running but for various sports (Cronin & Hansen 2005, Sugisaki et al. 2011). Despite the actuality and importance of this topic, the literature covering the relationship between muscle strength and sprint running performance is limited (Dowson et al. 1998). Many previous studies focus on relationships between acceleration phase (until 40m) and isokinetic strength (Bračič et al. 2011, Cronin & Hansen 2005, Dowson et al. 1998, Nesser et al. 1996, Sugisaki et al. 2011), but not for classical sprint running distances. In addition, there is lack of studies investigating relationship between isokinetic strength and sprint running time where sprint running time is registered in competition situation.

The lower limb muscles need to carry out the most important role in the production of speed during sprint running. For sake of investigating each joint muscle correctly we need to use isokinetic dynamometer. Isokinetic dynamometer enables to measure each joint's movement strength at different angular velocity, while velocity is held constant through the range of movement. (Baltzopoulos & Brodie 1989). Most of previous studies have investigated relationship between strength of knee flexion, extension and sprint running (Alexander 1989, Bračić et al. 2011, Cronin & Hansen 2005, Delecluse et al. 1994, Dowson et al. 1998, Farrar & Thorland 1987, Nesser et al. 1996, Olmo & Castilla 2005). In addition, there are studies investigating relationship between isokinetic strength of ankle (Alexander 1989, Delecluse et al. 1994, Dowson et al. 1998, Inal et al. 2012, Nesser et al. 1996) and hip joint muscles and sprint running performance (Alexander 1989, Blazevich & Jenkins 1998, Dowson et al. 1998, Farrar & Thorland 1987, Guskiewicz et al. 1993, Nesser et al. 1996). Inal (2012) has investigated the relationship between isokinetic strength of ankle inversion and eversion. Using different angular velocities in testing, we can define slow, medium and high speed tests. (Brown 2000). Isokinetic studies usually find relationship between isokinetic strength and running speed using angular 60°/s (slow) - 300°/s (high) (Cronin & Hansen 2005, Cronin et al. 2007, Farrar & Thorland 1987, Olmo & Castilla 2005). Some studies have used greater speeds as 450°/s (Nesser et al. 1996) and 480°/s (Blazevich & Jenkins 1998).

The purpose of this study was to investigate relationship between lower limb isokinetic strength and 60m sprint running time. Previous studies have found that the relationship between muscle strength and running performance are usually weak (Cronin & Hansen 2005, Cronin et al. 2007, Dowson et al. 1998). Most of previous studies have admitted that the findings about the relationship between isokinetic strength and running performance are conflicting. The major reasons for these conflicting results could be that first, different authors have not studied the same isokinetic parameters and the studied running distances have been different. Second, the studies investigating relationship between isokinetic parameters and running performance are often using athletes from other sport fields, which make it difficult to generalise these results for competitive sprinters. Third, sprinters are heterogeneous by anthropometrical and strength parameters, which makes it difficult to develop universal predictors for running performance. Forth, the studies have often been performed on a small and homogeneous sample of athletes.

Methods

The study was conducted on 9 male Estonian national level sprinters (age 20.7 ± 2.6 yrs, height 181.2 ± 5.7 cm, mass 76.0 ± 7.1 kg). Average 60m sprint running time was 7.10 ± 0.13 sec. The sprint performance, 60m from blocks was fixed in competition conditions during the winter season 2013. In this study the sprint performance of an athlete was defined as the seasonal best time of each athlete. All competitions were part of Estonian Athletics Federation official competition calendar. Electronic timing system was used to measure the sprint time and the rules of international athletics federation were enforced by certified referees. The isokinetic testing took place shortly after the competition season.

A HUMAC NORM (Computer Sports Medicine, Inc. Stoughton, MA, USA) was used to assess the average peak torque (Nm) and average relative peak torque (Nm/kg) of ankle plantar flexion, ankle dorsiflexion, knee and hip extension and flexion of both legs were tested accordingly. All tests procedures, dynamometer settings and securing of subjects to seat and measurement arms were carried out in accordance with the HUMAC NORM user manual. Ankle plantar and dorsiflexion tests were performed in the "Modified Seated" (supine) position, knee extension and flexion tests in seated position and hip extension and flexion tests in lying position. The axis of rotation of the dynamometer lever arm was aligned with the anatomical axis of the joint being tested, as described in the HUMAC NORM test manual. The "gravity correction" features were used in all tests to avoid

gravity effect of limb weight. All joint movements were tested concentrically at velocities 60 (slow speed), 180 (medium speed) and 240°/s (high speed). At each test velocity, the subject performed 4 submaximal warm-up trials followed by 5 (60 and 180°/s) or 15 (240°/s) maximal test trials after 30 seconds recovery. A recovery period of 60s between test velocities, 5 minutes between body sides and 10 minutes between different joint actions was used.

Analysis

Descriptive statistics was expressed as mean \pm standard deviation (SD) (table 1). Results were statistically analysed using Excel. A Pearson correlation analysis (table 2) was used to estimate relationship, significance level for all tests was set at $p < 0.05$.

Results

The average peak torques and relative peak torques are shown in table 1.

Table 1

Isokinetic data of the ankle, knee and hip joints at different velocities (n=9; mean \pm s)

<i>Muscle action</i>	<i>Velocity (degree)</i>	<i>Peak torque (Nm)</i>	<i>Peak torque (Nm/kg)</i>
<i>Ankle</i>			
Plantar flexion	60	126 \pm 31.9	1.66 \pm 0.39
	180	80 \pm 13.9	1.06 \pm 0.19
	240	77 \pm 15.1	1.02 \pm 0.21
Dorsiflexion	60	34 \pm 3.8	0.45 \pm 0.04
	180	30 \pm 6.8	0.39 \pm 0.07
	240	31 \pm 7.4	0.40 \pm 0.07
<i>Knee</i>			
Extension	60	254 \pm 31.7	3.45 \pm 0.42
	180	185 \pm 28.9	2.46 \pm 0.27
	240	161 \pm 28.6	2.14 \pm 0.27
Flexion	60	155 \pm 21.2	2.16 \pm 0.37
	180	120 \pm 22.5	1.65 \pm 0.28
	240	108 \pm 22.8	1.47 \pm 0.28
<i>Hip</i>			
Extension	60	414 \pm 96.0	5.43 \pm 1.01
	180	314 \pm 82.2	4.08 \pm 0.81
	240	262 \pm 71.9	3.48 \pm 0.86
Flexion	60	206 \pm 29.0	2.73 \pm 0.32
	180	155 \pm 26.4	2.05 \pm 0.23
	240	139 \pm 21.2	1.86 \pm 0.20

Peak torque (Nm)

Results of correlation analysis are shown in table 2. Statistically significant relationship ($p < 0.05$) was found between sprint running time and: average peak torque of ankle dorsiflexion; knee extension at low speed; and hip flexion at high speed. No statistically significant relationship was found between running time and: average peak torque of ankle plantar flexion; knee flexion; and hip extension.

Table 2

Relationships between the peak torque, relative peak torque and sprint running time (n=9)

<i>Muscle action</i>	<i>Velocity (degree)</i>	<i>Peak torque (Nm)</i>	<i>Peak torque (Nm/kg)</i>
<i>Ankle</i>			
Plantar flexion	60	-0.045	0.164
	180	0.048	0.274
	240	0.068	0.295
Dorsiflexion	60	-0.708*	-0.409
	180	-0.566	-0.491
	240	-0.682*	-0.651
<i>Knee</i>			
Extension	60	-0.746*	-0.679*
	180	-0.658	-0.646
	240	-0.607	-0.604
Flexion	60	-0.267	-0.034
	180	-0.267	-0.071
	240	-0.344	-0.215
<i>Hip</i>			
Extension	60	-0.392	-0.202
	180	-0.500	-0.454
	240	-0.527	-0.474
Flexion	60	-0.614	-0.437
	180	-0.737*	-0.818*
	240	-0.719*	-0.805*

* $p < 0.05$

Relative peak torque (Nm/kg)

After taking into account body weight, the statistically significant relationship ($p < 0.05$) was found between sprint running time and: relative peak torque of knee extension at low speed; and hip flexion at high speed. No statistically significant relationship was found between sprint running time and: relative peak torque of ankle dorsiflexion; ankle plantar flexion; knee flexion; and hip extension.

Discussion

Similarly to the study of Alexander (1989) we find statistically significant result between ankle dorsiflexion and sprint performance. He

found this result in eccentric regime, while we tested athletes at concentric regime.

Unlike in previous studies, which did not find statistically significant relationship between ankle dorsiflexion and running time (Dowson et al. 1998, Inal et al. 2012, Nesser et al. 1996), we find the relationship to be statistically significant. After taking into account body weight (relative peak torque), we did not find any of the relationships to be statistically significant. Similarly to the study of Dowson et al. (1998), we found that after taking into account the body weight of a sprinter, no statistically significant relationship could be found between torque of ankle muscles and running performance.

In general, the sprint coaches see that the ankle plantar flexion has a more important role than ankle dorsal flexion in sprinting. This is also confirmed by every day training practice where lot of attention is paid on plantar flexors. It should be also kept in mind that the balance between plantar and dorsiflexors very important, the ratio of plantar and dorsiflexion should be 30-40% in peak torque at 60°/s. The balance of plantar flexion and dorsiflexion is more important for sprinters and for jumping events (So et al. 1994).

This study found the strongest relationship between knee extension at 60°/s and 60m running time. The strength of the correlation was highest with knee extension at 60°/s ($r=-0.746$) compared to other statistically significant relationships with peak torque. Previous studies (Alexander, 1989, Dowson et al. 1998) have found the same result that there is a relationship between peak torque and running time, but at higher speeds (150°/s, 240°/s and 230°/s), at lower speed (60°/s) no statistically significant relationship has been found (Dowson et al. 1998). In this study the correlation coefficient at 180°/s ($r=-0.658$) and 240°/s ($r=-0.607$) was not significant at the 5% threshold ($p<0.05$, $r=-0.666$), but were significant at the 10% threshold. Hence, we can confirm that there is a positive relationship also at higher speeds between peak torque and running time. The results of this study do not confirm the findings of Cronin & Hansen (2005), Dowson et al. (1998), Nesser et al. (1996) that at higher speeds knee extension and running performance are related. Similar trend to ankle dorsiflexion was found in knee extension.

By taking into account body weight (relative peak torque), all the relationships with running time became weaker. Our findings are in line with the findings of Dowson et al. (1998), where relative peak torque of knee muscles and running time relationship was weaker than the relationship between absolute peak torque of knee muscles and running time.

The findings of this study are in line with the findings of Nesser et al.(1996), where statistically significant relationship was found between peak torque of hip flexion at speed 180°/s and running performance. Our results also overlap with the ones of Blazeovich et al. (1998), indicating that in all speeds (60°/s, 270°/s and 480°/s) the hip flexors strength was more important factor for sprint performance than hip extensors strength. While for ankle and knee the relationship became weaker after taking into account the body weight, the relationships became stronger for hip flexors after taking into account the body weight. The results of our study are well in line with the study of Guskiewicz et al. (1993), where the strongest relationship was found between relative peak torque of hip strength and running speed ($p < 0.01$). It should be emphasised that the peak torque of hip extension at 60°/s was 414 ± 96.0 Nm in this study, which is significantly higher than in previous studies, for example 228 ± 35.6 Nm in Dowson et al. (1998) and 282 ± 56.1 Nm in Nesser et al. (1996).

The limitation of our study is that there was a short time distance between measuring the sprint performance and measuring the isokinetic parameters. However, the advantage of our study is that the sprint performance was measured in competition conditions, national level track and field athletes specialising on sprint and strength disciplines formalised the test group, and wide set of isokinetic parameters was studied.

Conclusions

This study found the strongest relationship sprint running time and peak torque of knee extension at the velocity of 60°/s and relative peak torque of hip flexion at 180°/s. According to our study the most important peak torque parameters for sprint running are ankle dorsiflexion, knee extension and hip flexion. Our study found that the relationships between some isokinetic strength parameters that are perceived to play an important role in running (plantar flexion and knee flexion) and sprint performance are weak. The main finding of the study is that in addition to extensors also dorsiflexors as ankle stabilizers play a significant role in sprint performance. This indicates that attention should be paid in addition to big muscle groups also to ankle stabilizers in sprint training.

References

1. Alexander, M.J.L. (1989). The Relationship Between Muscle Strength and Sprint Kinematics in Elite Sprinters. *Canadian Journal of Sport Sciences*, 14(3), 148-157.

2. Baltzopoulos, V., & Brodie, D.A. (1989). Isokinetic Dynamometry-Applications and Limitations. *Sport Medicine*, 8 (2), 101-116.
3. Blazevich, A.J., & Jenkins, D.G. (1998). Predicting Sprint Running from Isokinetic and Squat Lift Test: A Regression Analysis. *Journal of Strength and Conditioning Research*, 12(2), 101-103.
4. Bračić, M., Hadžič, V., Čoh, M. & Dervičević. (2011). Relationship Between Time to Peak Torque of Hamstrings and Sprint Running Performance. *Isokinetics and Exercise Science*, 19, 281-286.
5. Brown, L. E. (2000). *Isokinetics in Human Performance*. New Zealand:HumanKinetics.
6. Cronin, J., Ogden, T., Lawton, T. & Brughelli, M. (2007). Does Increasing Maximal Strength Improve Sprint Running Performance? *Strength and Conditioning Journal*, 29(3), 86-95.
7. Cronin, J.B. & Hansen, K.T. (2005). Strength and Power Predictors of Sports Speed. *Journal of Strength and Conditioning Research*, 19(2), 349-357.
8. Delecluse, C., Van Leemputte, M., Willems, E., Diels, R., Andries, R., & Van Capponelle, H. (1994). Study of Performance Related Strength Tests for Competition Level Sprinters.12 International Symposium on Biomechanics in Sports.
9. Dowson, M.N., Nevill, M.E., Lakomy, H.K.A., Nevill, A.M., & Hazeldine, R. J. (1998). Modelling the Relationship Between Isokinetic Muscle Strength and Sprint Running Performance. *Journal of Sport Sciences*, 16, 257-265.
10. Farrar, M., & Thorland, W. (1987). Relationship Between Isokinetic Strength and Sprint Times in College-age Men. *Journal of Sport Medicine & Physical Fitness*, 27(3), 368-372.
11. Guskiewicz, K., Lephart, S., & Burkholder, R. (1993). The Relationship Between Sprint Speed and Hip Flexion/Extension Strength in Collegiate Athletes. *Isokinetics and Exercise Science*, 3(2), 111-116.
12. Inal, H. S., Erbug, B., & Kotzamanidis, C. (2012). Sprinting, Isokinetic Strength, and Range of Motion of Ankle Joints in Turkish Male and Female National Sprinters May have a Relationship. *Turkish Journal of Medical Sciences*, 42 (6), 1098-1104.
13. Nesser, T.W., Latin, R.W., Berg K., & Prentice, E. (1996) Physiological Determinants of 40-Meter Sprint Performance in Young Male Athletes. *Journal of Strength & Conditioning Research*, 10.(4), 263-267.

14. Olmo, J., & Castilla, N. (2005) Explosive Strength-related Isokinetic Parameters in High-level Sprinters and Long-distance Runners: The Relative Power Index. *Isokinetics and Exercise Science*, 13(4), 243-249.
15. So, Chi-Hung, Siu, T.O., Chan, K., M., Chin, M., K., Li, CT (1994) Isokinetic Profile of Dorsiflexors and Plantar Flexors of the Ankle – a Comparative Study of Elite Versus Untrained Subjects. *British Journal of Spors Medicine*, 28(1), 25-30.
16. Sugisaki, N., Kanehisa, H., Tauchi, K., Okazaki, S., Iso, S. & Okada, J. (2011)The Relationship Between 30-m Sprint Running Time and Muscle Cross-sectional Areas of the Psoas Major and Lower Limb Muscle in Male College Short and Middle Distance Runners. *International Journal of Sport and Health Science*, 9, 1-7.

Submitted: April 6, 2013

Accepted: November 27, 2013

ORIGINAL RESEARCH PAPER

MUSCLE ACTIVATION LEVEL IN GENERIC AND SPECIFIC STRENGTH TRAINING EXERCISES FOR ORIENTEERS

Johnny Nilsson¹, Egil Johansen², Asbjörn Gjerset², Mikkel Lund²

¹ The Swedish School of Sport and Health Sciences, Stockholm Sweden

²The Norwegian School of Sport Sciences, Oslo, Norway

Address: Johnny Nilsson-The Swedish School of Sport and Health Sciences (GIH)

Box 5626, S-114 86 Stockholm, Sweden

Phone: +46 8 12053739

E-mail: johnny.nilsson@gih.se

Abstract

The purpose was to compare the EMG activation level in specific strength training exercises used by orienteers with the activation level in generic strength exercises and MVDA (maximum voluntary dynamic action) in order to evaluate possible strength training potential in the specific exercises. In total six male regional to national level elite orienteers participated in the study. Mean (range), height and weight were 25 (19-32) years, 180 (1.74-1.88) m and 71 (67-75)kg. The electrical activity in m. gluteus maximus (GM), m. rectus femoris (RF), m. vastus lateralis (VL) and m. soleus (SOL) of the right leg was recorded with bipolar surface electrodes. The EMG data was recorded at 1000 Hz with a portable data logger. The participants performed the following generic strength exercises: 5RM (repetition maximum) squats and 5RM ankle extensions on the right leg. In addition MVDA in form of 5 consecutive maximal vertical jumps were performed on the right leg and with both legs. The participants performed the following specific exercises: leaping i.e. running with very long strides and maximal effort on a horizontal gravel stone road and uphill in forest terrain. Both generic (squats and ankle extensions) and specific strength training exercises (leaping on the horizontal and uphill) reached sufficiently high relative EMG levels. The results also show that the activation levels during the specific strength exercises are compatible with the 5RM generic exercises commonly used to increase muscle strength.

Key words: *Specific strength training, activation level, leaping.*

Introduction

Orienteering is a typical aerobic sport i.e. the time when the orienteer utilize a large part of their aerobic power is so long that in sprint orienteering distances and longer the major energy contribution will come from aerobic energy processes (Åstrand & Rodahl 1986, Bird et al. 1993, Jensen et al. 1994). However, there are situations in an orienteering course such as steep inclines and rough terrain when muscle action may need to be much larger than the average muscle action used in the course. This emphasize the need for strength training among orienteers.

Although the strength training is a relatively small part of the total training volume among orienteers it may still be important for the performance in orienteering. Previous studies have shown that the increased strength may contribute to improvement in running economy as reviewed by Saunders and co-workers (2004). However, to our knowledge it is still not shown if the results obtained in studies on strength training with weights and running economy on the flat also comprise improved running economy in the terrain. According to Sale and MacDougall (1981) training is specific with respect to muscle action type, speed of contraction and muscle length/joint angle. This leads the question towards specific strength training. It would be safer concerning specificity in speed, angular displacement and muscle action type if the strength training could be performed in a running like action. This form of strength training is sometimes performed with leaping, which is running with a powerful and overemphasized running movement amplitude and stride length on level ground and uphill (see Figure 2). Each running cycle is performed with maximal effort and the running sequences are seldom longer than 10 to 20 seconds. The rest periods between runs are long enough to recharge phosphate depots. The typical running-like movement pattern is indicative for a larger degree of specificity compared to generic strength training exercises. However, the question arises if the relative muscle tension is large enough to stimulate improvement in strength.

To improve muscular strength a relative tension in the musculature of approximately 60 - 70 percent of one repetition maximum (1RM) is needed (McDonagh & Davies 1984). By means of electromyography (EMG) it is possible to determine the EMG activation level at different levels of 1RM in generic exercises such as squats and ankle extensions. It is also possible to determine the highest EMG activation level in different maximal voluntary dynamic actions (MVDA) such as in vertical jump, squat and ankle extension. The relationship between activation level and relative muscle tension (% 1RM) allow specific strength training exercises among orienteers

to be evaluated. The purpose of the present study was to compare the EMG activation level in specific strength training exercises used by orienteers with the activation level in generic strength exercises and MVDA in order to evaluate possible strength training potential in the specific exercises.

Material and methods

Participants. In total six male regional to national level elite orienteers participated in the study. Mean (range), height and weight were 25 (19-32) years, 180 (1.74-1.88) m and 71 (67-75)kg. The study was approved by the Regional Ethic Committee. The participants wore conventional orienteering shoes and light clothes during the tests.

Electromyography (EMG). The electrical activity in *m. gluteus maximus* (GM), *m. rectus femoris* (RF), *m. vastus lateralis* (VL) and *m. soleus* (SOL) of the right leg was recorded with bipolar surface electrodes taped over the belly of the muscles (see Figure 1 for placements of the electrodes). The site of the electrode placement was gently shaved and cleaned with alcohol before application of the surface electrodes.

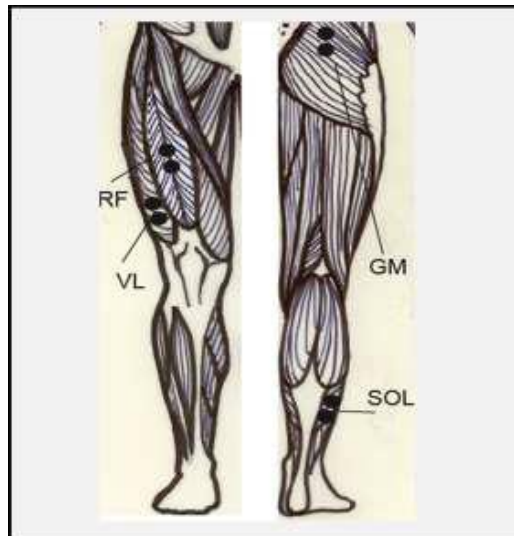


Figure 1. Placement of the surface electrodes on *m. gluteus maximus* (GM), *m. rectus femoris* (RF), *m. vastus lateralis* (VL) and *m. soleus* (SOL) of the right leg.

Data logging. EMG data were recorded by means of a portable data logger (ME3000P, Mega Electronics, Finland) and sampled at 1000Hz.

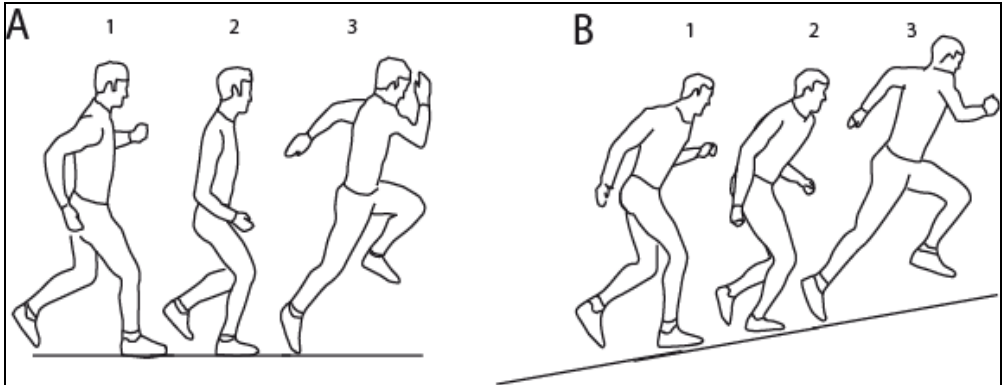


Figure 2. The support phase of the right leg during leaping on a level gravel road (A) and uphill in the forest (B)

Procedures. The participants performed the following generic strength exercises: 5RM squats and 5RM ankle extensions on the right leg. In addition MVDA in form of 5 maximal vertical jumps were performed on the right leg and with both legs. The participants performed the following specific exercises: leaping i.e. running with very long strides and maximal effort on a horizontal gravel road and uphill (7 degrees slope) in forest terrain with light undergrowth (Figure 2). All exercises were recorded. The maximal average level of EMG activity during the generic exercises and MVDA was set to 100%.

Statistics. Standard descriptive statistics including means, standard deviations (sd) and ranges were employed in the data analysis. Differences between mean data were tested using repeated measures ANOVA and the alpha level was set to 0.05 to assume statistical significance. Post hoc comparisons were made using the Tukey procedure.

Results

Figure 3 shows that both generic (squats and ankle extensions) and specific strength training exercises (leaping on the horizontal level and uphill) reach higher mean levels of EMG activation than was suggested by McDonagh & Davies (1984) for adaptive responses in mammalian skeletal muscles to exercise. The results also show that the activation levels during the specific strength exercises are compatible with the 5RM generic exercises commonly used to increase muscle strength.

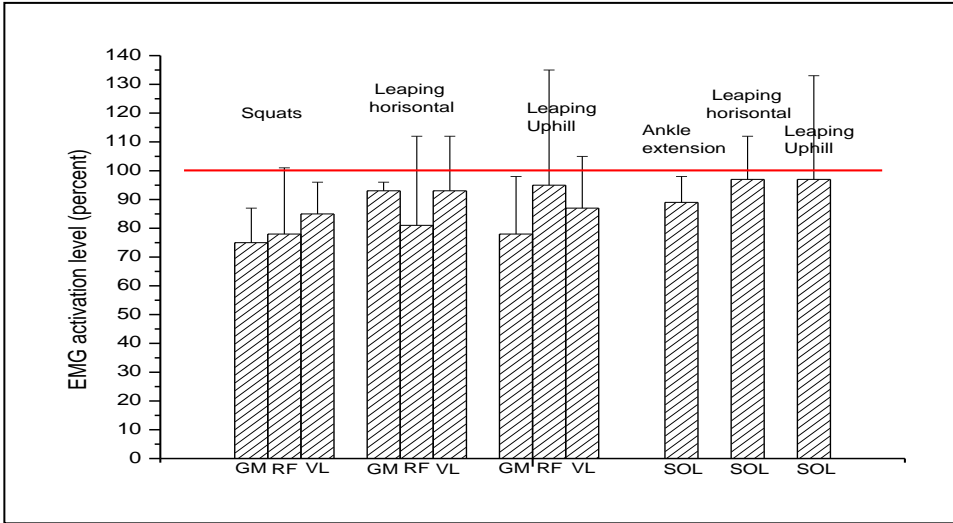


Figure 3. Mean (+sd) EMG activation level in generic strength exercises (squats and ankle extensions) and specific strength training exercises (leaping on the horizontal and uphill). Recorded muscles: *m. gluteus maximus* (GM), *m. rectus femoris* (RF), *m. vastus lateralis* (VL) and *m. soleus* (SOL). The reference muscle activation level representing 5 RM squats and vertical jumps is set to 100 percent.

Discussion

From the results in the present investigation it can be concluded that the EMG activation level in specific strength exercises such as leaping on level ground and uphill are compatible with mean EMG activation level in generic strength exercises and with respect to maximal EMG activation levels, which indicate a possible strength training potential. The high activation levels obtained in leaping compared to generic strength training methods indicate that the training form can compete with generic training forms concerning muscle activation.

In the studies performed on strength training and running economy it is shown that increased muscle strength is associated with a better running economy (for references see Saunders et al. 2004). Today, we do not know if increased muscle strength also improve running economy in orienteering terrain. However, the implementation of leaping, which is an exaggerated form of running, the prerequisite for specificity is fulfilled. It is reasonable to suggest that the range of motion of the hip, knee and ankle joints in the support phase (which is assumed the most relevant phase with respect to specificity) during leaping (cf. Figure 2) are larger than normal running at different speeds. This means that all smaller angles i.e. muscle lengths are

comprised in leaping. The muscle length in leaping is probably on the extreme side of what can be expected when running in the terrain. The duration of the support phase is somewhat longer in leaping compared to e.g. running at competition speed (approximately 0.20 and 0.25 s, respectively) but only on one extreme side of the range in normal running (Nilsson and Thorstensson 1987). Looking at the flexion – extension angular displacement during the support phase in the hip, knee and ankle joint during leaping (Figure 2) it is reasonable to conclude that the type of muscle action for GM, VL and SOL must be similar to normal running.

With the above presented data it is reasonable to assume that leaping show specificity with respect to normal running but still with a high degree of muscle activation. This may have impact on the running economy on a gravel road but also in terrain. Future studies should emphasize the analysis of running economy in terrain after intervention periods of generic and/or specific (for example leaping) strength training. Information obtained in this study can be used to enable a development of specificity in strength training and also a larger degree of integration between trained capacities among orienteers.

Conclusions

The EMG activation in the specific strength exercise leaping on horizontal level and uphill are compatible with mean EMG activation levels in generic strength exercises and with respect to maximal EMG activation levels i.e. indicating a possible strength training potential.

References

1. McDonagh, M.J.N., & Davies, C. T.M. (1984) Adaptive Responses of Mammalian Skeletal Muscle to Exercise with High Loads. *Eur J Appl Physiol*, 52, 139-155.
2. Jensen K, Franch J, Kärkkäinen O., et al. (1994) Field Measurements of Oxygen Uptake in Elite Orienteers During Cross-country Running Using Telemetry. *Scand J Med Sci Sports*, 4: 234-238.
3. Bird SR, Bailey R, Lewis J. (1993) Heart Rates During Competitive Orienteering. *Br J Sports Med*, 27: 53-57.
4. Åstrand PO, Rodahl K. (1986) Textbook of Work Physiology: Physiological Bases of Exercise, 3rd ed. London: McGraw-Hill Book Company.
5. Sale, D.G. & MacDougall, D. (1981) Specificity in Strength Training: A review for the Coach and Athlete. *Can J Appl Sport Sci*, 6(2): 87-92.

6. Nilsson, J. & Thorstensson, A. (1987) Adaptability in Frequency and Amplitude of Leg Movements During Human Locomotion at Different Speeds. *Acta Physio Scand*, 129: 107-114.
7. Saunders, P.U., Pyne, D.B., Telford, R.D. and Hawley, J.A. (2004) Factors Affecting Running Economy in Trained Distance Runners. *Sports Med*, 34(7): 465-485.

Submitted: October 23, 2013
Accepted: November 27, 2013

ORIGINAL RESEARCH PAPER

CHANGES IN PHYSICAL FITNESS OF 9–10 YEAR-OLD SPORTS DANCERS DURING A TEN-MONTH TRAINING CYCLE**Aistė Barbora Ušpurienė, Algirdas Čepulėnas**

Lithuanian Sports University

Address: Sporto 6, LT-44221 Kaunas, Lithuania

Phone: +37061269645

E-mail: aiste.uspuriene@lsu.lt

Abstract

Research shows that the mastery level of dancers in dance sport is closely related to their physical fitness though there has not been enough research in the changes of indices in physical fitness of juvenile (9–10-year-old) sports dancers while training dance sport. Research aim was to test the effect of training in dance sport on the indices in physical fitness of 9–10-year-old sports dancers. The subjects in the research were 9–10-year-old sports dancers (n=20): 10 girls and 10 boys. The dancers were tested twice: in January 2012 and in November 2012. We established the following indices in physical fitness: hand grip strength, the frequency of fine hand movements, the frequency of leg movements running on the spot for 10 s, speed of hand movements performing 25 cycles of movements, static balance, trunk flexibility, dynamic strength endurance of abdominal muscles, explosive strength and speed strength of legs, explosive strength endurance, simple and complex psychomotor reaction to light stimulus. Dancing practice sessions add a positive effect on psychomotor abilities – simple psychomotor reaction for girls and boys ($p < 0.05$) and complex psychomotor reaction for boys ($p < 0.05$). The indices in physical fitness of juvenile sports dancers did not change much in the research period. Specialized dancing practice sessions did not have significant effect on the improvement in physical fitness, however, a tendency of improvement in physical fitness was observed.

Key words: *dance sport, motor skills, dancing practice sessions, juvenile dancers.*

Introduction

Dance sport is a sport, but it is also an art (Karpenko & Sivitsky, 2009). Dance is one way of human communication, cognition and expression (Bannon & Sanderson, 2000; Lavender & Predock-Linnell, 2001; Smith-Autard, 2003).

Dance sport is becoming more and more popular among children and adolescents. Even children start participating in dance sport contests.

The process of athlete training is oriented to sports results and is associated with the realization of physical fitness in the mastership development, emotional satisfaction in dancing, the development of artistic abilities to express the idea of dance in body movements (Bannon & Sanderson, 2000; Kostić et al., 2003; Smith-Autard, 2003; Karpenko & Sivitsky, 2009; Torrents et al., 2011). Synchronicity of movements, interaction between dancers, repeated sequences of movements, dancers' contact in a pair are of great importance (Torrents et al., 2011). Sports dancers perform non-standard dynamic movements at shifting intensities (Dornowski and Zabrocka, 2008). Movements are performed both in a locomotor way – while moving dancers from one space to another – and in a non-locomotor way – staying in one place. Dance sport contests' intensity demand good physical fitness and functional capacity from dancers (Kostić et al., 2003; Klonova & Klonovs, 2010; Radionov, 2011; Vissers et al., 2011; Ushpurene & Chepulenias, 2012). During a dance much time is spent performing the workload at the intensities exceeding the anaerobic threshold (Klonova & Klonovs, 2010; Vissers et al., 2011; Ushpurene & Chepulenias, 2012). The mastership of dancers much depends on their physical fitness (Kostić et al., 2003; Radionov, 2011).

Technical fitness of sports dancers is closely related to their motor skills: coordination, speed, flexibility, speed strength and endurance (Radionov, 2011). Professional literature highlights teaching and improving dancing technique (The Revised Technique of Latin-American Dancing ISTD, 1983; The Ballroom Technique, 1994), but little attention is paid to the problems of physical training. Research sources (Kostić et al., 2003; Torrents et al., 2011) maintain that training children, their program should include physical exercises for the development of their motor skills. The problem in physical training of juvenile (9–10-year-old) sports dancers has not received adequate attention yet. We suppose that changes in training and physical fitness indices of juvenile sports dancers are relevant research problems worth studying.

Research aim was to study the impact of training dance sport on the indices in physical fitness of 9–10-year-old sports dancers.

Material and Methods

Participants. The study was carried out in Lithuanian dance sport club “Bonus”. The subjects were 20 dancers of juvenile (9–10-year-old) age group – 10 boys and 10 girls. The age of the girls (mean \pm SD) was 9.88 ± 0.83 years, and that of the boys was 9.86 ± 1.07 years. According to the age classifier in dance sport (Age Restrictions, 2011) the subjects were attributed to juvenile group. According to the mastery level in sports the subjects matched level E4 and E6 classificatory classes (Regulations of Classificatory Classes, 2011). The height of girls dancers was 141.50 ± 6.28 cm, body mass – 31.13 ± 5.14 kg, body mass index (BMI) – 15.51 ± 2.08 kg/m². The boys’ height was 143.29 ± 7.70 cm, body mass – 37.43 ± 7.32 kg, BMI – 18.12 ± 2.62 kg/m². Before the start of the study, the parents of participants signed a written informed consent form.

Testing procedures. The dancers were tested two times. The first period of testing was January 2012, and the second – November 2012. Organized group training sessions with a coach were held three times a week. The dancers developed their special technical, tactical fitness according to the coach’s plan (Table 1).

Table 1.

Annual training plan for juvenile group dancers

Periods	Preparatory		Competition		Transition	Preparatory		Competition			Transition	
	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII
Technical training, %	80	70	50	50	45	70	60	35	35	35	60	Vacation
Tactical training, %	20	30	50	50	55	30	40	65	65	65	40	
Competitions	-	+	+	+	-	-	+	+	+	+	-	
Number of hours for training a week	9	9	7	7	6	9	9	7	7	7	6	

The following methods of the research were approved with junior (12–13-year-old) sports dancers (Ušpurienė & Čepulėnas, 2011).

The hand grip strength was measured with a dynamometer which had to be clenched with maximal effort. Motor abilities (speed, flexibility, balance, strength endurance) were measured using recommended approved tests: running on the spot raising the knees high (when the thigh reaches the horizontal position) for 10 s; Tapping Test 3 x 10 s; hand movement speed test – the person had to perform 25 movements as fast as possible and to

touch circles on a plane which were 60 cm apart from each other (Eurofit, 1988); Sit and Reach Test for 30 s (Johnson & Nelson, 1986); standing on the front foot of one leg until the person can keep balance, and the time is recorded; standing vertical jumps measured with the contact board SBM-1, taking off with both feet without hand movement with a squat of 90° , with a squat of 135° and with hand movement. Leg muscles' fatigue and endurance were estimated when the dancers performed a series of 20 jumps from a squat position at the angle of 90° (Bosco et al., 1982). Psychomotor reactions were measured applying diagnostic device KTD-8. We measured simple psychomotor reaction time, when the dancers knew exactly what stimulus they had to react to, and complex psychomotor reaction, when there were several stimuli, and the dancers had to react only to one of them. The subjects had to react to light stimuli.

Statistical analysis. The research data were processed applying the methods of statistical analysis (Microsoft Office Excel Programme). We calculated the arithmetic mean (\bar{x}), standard deviation (SD), Student (t) test criterion, and index p for statistical significance. The level of significance was set at 95%, when $p < 0.05$.

Results

Research findings given in Table 2 allow estimating the achieved levels of motor abilities (speed, flexibility, balance, strength endurance) for dancers – girls and boys. The frequency of steps for girls was 40.06 ± 5.20 steps during 10 s in the first stage of the research, and that for boys was 45.64 ± 7.85 steps, and in the second stage they were at the same level ($p > 0.05$). The speed of hand movements can be evaluated and estimated according to the time needed for 25 movement cycles for the right and the left hands. In the first stage of the research girls performed 25-movement cycles with the right hand in 16.34 ± 2.33 s, with the left hand – in 16.46 ± 2.04 s, for boys those indices were relatively 17.64 ± 1.67 and 18.00 ± 2.02 s. In the second stage the indices of hand movement's speed for girls and boys were slightly higher, but the changes were not statistically significant ($p > 0.05$). The number of fine movements of boys (Tapping Test) during 30 s was 141.43 ± 5.44 to 142.57 ± 8.73 times ($p > 0.05$), but for girls it increased ($p < 0.05$). Both girls and boys achieved the greatest number of fine movements during the first 10 s, and later the frequency of movements gradually decreased.

Table 2.
Changes in the indices of physical fitness for juvenile girls and boys in dance sport

Research stages	Indices	Hand grip strength, kg		Number of steps while running in place during 10 s, times	Hand movement speed-time needed for 25-movement cycles, s		Number of fine movements during 30 s in tapping test, times	Sit and lie down test during 30 s, times	Sit and reach test, cm	Vertical jump in place taking off with both feet, cm		
		Left hand	Right hand		Left hand	Right hand				With a squat at the of 90°	squat at the angle of 45°	With hand movement
Girls												
I	\bar{x}	9.75	10.13	40.06	16.46	16.34	140.38	22.25	29.00	20.63	16.61	26.64
	SD	2.38	2.85	5.20	2.04	2.33	10.20	4.95	4.75	3.02	1.97	3.35
II	\bar{x}	10.50	10.88	40.00	16.01	15.88	142.25	23.13	29.50	21.63	17.47	26.93
	SD	2.45	2.59	4.94	2.02	2.08	5.55	4.58	4.47	2.69	1.79	3.38
	p	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p<0.05	p>0.05	p>0.05	p<0.05	p<0.05	p>0.05
Boys												
I	\bar{x}	13.00	14.00	45.64	18.00	17.64	141.43	21.71	23.57	21.50	13.19	29.54
	SD	4.55	4.56	7.85	2.02	1.67	5.44	1.98	3.74	1.36	2.33	3.76
II	\bar{x}	14.00	14.43	45.86	17.51	17.39	142.57	22.14	24.29	22.01	13.54	30.45
	SD	4.47	4.54	7.20	1.78	1.58	8.73	1.46	3.25	1.08	2.18	3.93
	p	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05

Flexibility of girls was better than that of boys ($p < 0.05$) (Tab. 2), and in the second stage the index of flexibility for girls was 29.50 ± 4.47 cm, and for boys – 24.29 ± 3.25 cm. The hand-grip strength of the left hand of girls and boys decreased during the second stage, but the changes were insignificant ($p > 0.05$) (Tab. 2).

Both girls and boys achieved the highest indices of static balance standing on one foot in the third trial in the first and the second stages (Figure 1).

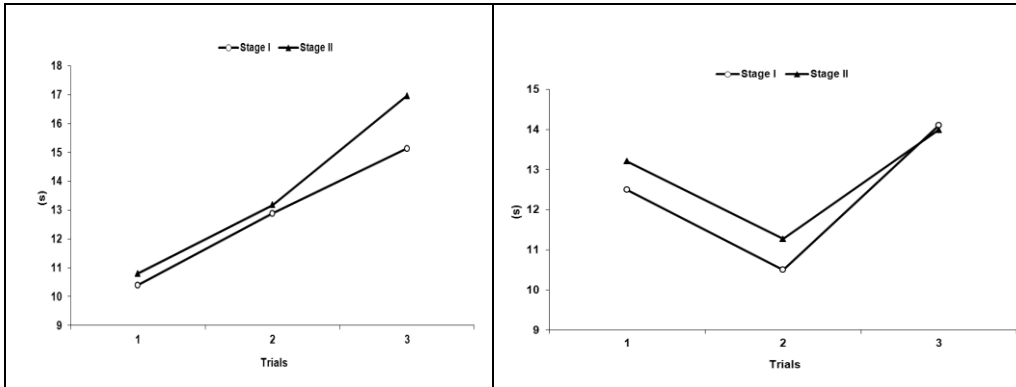


Figure 1. Indices of standing on the front foot of one leg for girls (A) and boys (B)

The indices of the Sit up Lie down Test during 30 s (Table 2) did not change during the whole research ($p > 0.05$). The indices of the vertical jumps show the explosive strength of legs (jump from a squat position at the angle of 90°) and speed strength (jump from a squat position at the angle of 135°). The explosive strength of leg muscles of both boys and girls tended to improve in the course of the study, but the changes were low ($p > 0.05$). The indices of 20-jump series show that strength endurance of leg muscles for girls and boys slightly improved (Fig. 2).

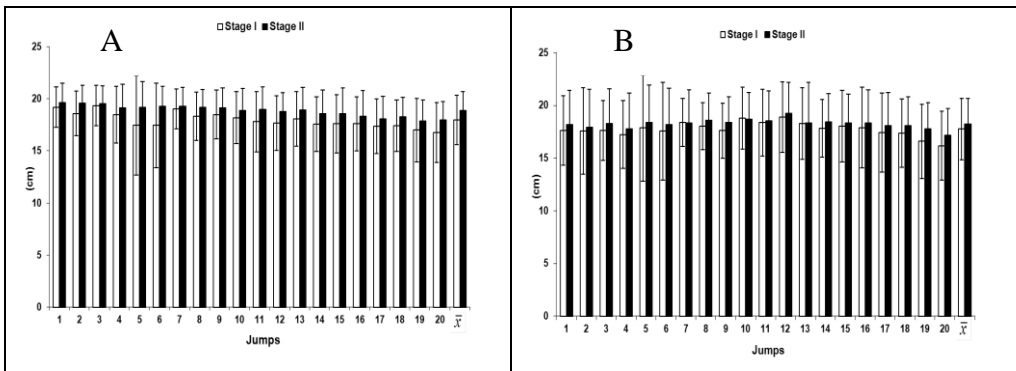


Figure 2. Changes in the height of jumps for girls (A) and boys (B) performing a series of 20 jumps

The average height of jump in a series during the second stage was 18.85 ± 0.53 cm for girls and 18.25 ± 0.41 cm for boys. Simple psychomotor reaction for boys and girls (Table 3) performing the task with the right and the left hands improved ($p < 0.05$). The indices of complex psychomotor reaction for boys in the second stage were higher compared to the first stage ($p < 0.05$). The girls' indices of complex psychomotor reaction did not differ when the task was performed with the right or the left hands ($p > 0.05$).

Table 3.

Changes in the indices of psychomotor reactions for boys and girls in juvenile group of dancers

Research stages	Indices	Girls				Boys			
		Simple reaction time, ms		Complex reaction time, ms		Simple reaction time, ms		Complex reaction time, ms	
		Left hand	Right hand	Left hand	Right hand	Left hand	Right hand	Left hand	Right hand
I	\bar{x}	297.42	319.67	327.00	319.00	284.52	278.95	300.62	324.57
	SD	55.39	42.35	56.35	51.27	42.59	52.59	53.22	26.54
II	\bar{x}	262.38	263.00	307.50	294.38	257.43	249.00	261.43	287.43
	SD	54.10	21.25	55.84	38.53	28.65	52.12	32.48	35.80
	p	p<0.05	p<0.05	p>0.05	p>0.05	p<0.05	p<0.05	p<0.05	p<0.05

Discussion

Training young sports dancers much attention should be paid to their physical training (Kostić et al., 2003; Karpenko & Sivitsky, 2009; Radionov, 2011). In practice, dancers develop their physical fitness independently, and not in the practice sessions with a coach. Research shows that physical fitness of young dancers improves more rapidly when dancing practice sessions include physical training or physical exercises for motor abilities development (Radionov, 2011).

The speed of leg movements of boys and girls performing the test "Frequency of steps running on the spot during 10 s" matched the level of persons engaged in sports. The speed of hand movements of boys and girls matched the low level of 10–11-year-old schoolchildren (Eurofit, 1988). Changes in the frequency of fine movements of the hand showed that the

nervous system of female and male juvenile dancers is not capable of maintaining constant maximal frequency of fine movements.

The results of the test “Sit up Lie down during 30 s” of juvenile dancers matched the girls and the boys lower than average level in physical fitness of children of the same age according to the scale in physical fitness in Eurofit (1988). Flexibility indicators for both boys and girls according to the scale of Johnson & Nelson (1986) were rather high. The girls’ duration indicator standing on the front of one leg (static balance) in the first stage was 15.13 ± 8.78 s, and in the second one – 16.96 ± 8.86 s. The balance indices of junior girls (12–13-year-old) dancers according to this test were from 20.73 ± 6.96 s to 32.63 ± 14.69 s (Ušpurienė & Čepulėnas, 2011). The boys’ duration indicator standing on the front of one leg during the second stage reached to 13.99 ± 6.28 s the relative indices of junior boys dancers were from 21.85 ± 14.37 s to 36.35 ± 20.52 s (Ušpurienė & Čepulėnas, 2011).

In dance sport, body balance during the whole dance is of great importance. The ability to maintain static balance helps to keep balance in the required positions, and keeping dynamic balance helps to perform various movements and actions under the influence of external powers (Dornowski & Zabrocka, 2008). The results of the jump with hand movements show the power of single leg muscle contraction (Bosco et al., 1982). The indices of girls jump with hand movements corresponded to the high level of juvenile dancers according to Mero et al. (1992) scale. For boys the level was very high. Dancing practice sessions had a remarkable positive effect on the psychomotor domain. The indices of simple psychomotor reactions improved for girls and boys ($p < 0.05$) and complex psychomotor reactions for boys ($p < 0.05$).

Summing up the research findings we suggest that specialized dancing practice sessions did not have greater effect on the improvement of dancers’ physical fitness, but we could observe a tendency of improvement in some elements of physical fitness. The juvenile (9–10-year-old) dancers’ indices of speed, flexibility, strength endurance and explosive strength were adequate to those of boys and girls of the same age group and complied with the average or high level standards.

In the perspective, dance sport training should also include training sessions of general physical fitness and it would be appropriate to verify their effect on the physical fitness of juvenile sports dancers.

Conclusions

The indices in physical fitness of juvenile sports dancers did not change much in the research period. Loads of technical and special training did not affect the changes in dancers' motor skills.

Physical fitness is a significant component of juvenile sports dancers' sports fitness, and the improvement of physical fitness indices requires inclusion of physical training into the programs of training sports dancers, or regular practice sessions in dance sport should be supplemented with physical exercises for the motor skills' development.

The perspective of further research is to establish the optimal ratio of exercises for general physical fitness for juvenile dancers' technical training in their training sessions.

References

1. Age restrictions (2011, May). Retrieved November 20, 2012, from <http://www.dancesport.lt/nariams/>.
2. Bannon F. & Sanderson P. (2000). Every Moment: Aesthetically Significant Dance Education. *Research in Dance Education*, 1: 9–26.
3. Bosco C., Tihanyi J., Komi P., Fekete G., & Apor P. (1982). Store and Recoil of Elastic Energy in Slow and Fast Types of Human Skeletal Muscles. *Acta Physiol Scand*, 116: 343–349.
4. Dornowski M., & Zabrocka A. (2008). Static and Dynamic Body Balance Maintenance Ability in Young Dance Sport Athletes on the Beginning Stage of Training. World Congress of Performance Analysis of Sport VIII. Book of Proceedings, 577–581.
5. *Eurofit: handbook for the EUROFIT tests of physical fitness*. (1988). Italy: Rome.
6. Johnson B. L. & Nelson J. K. (1986). *Practical measurements for evaluation in physical education*. United States of America.
7. Karpenko L. A. & Sivitsky V. A. (2009). Basic Training in Parquet Sport Dance. *Ychenye Zapiski*, 51: 36–40 (In Russian, anotation in English).
8. Kļonova A. & Kļonovs J. (2010). Heart Rate and Energy Consumption During Standard Sport Dancing. *LASE Journal of Sport Science*, 1: 48–52.
9. Kostić R., Miletić D., Jocić D., & Uzunović S. (2003, May). The Influence of Dance Structures on the Motor Abilities of Preschool Children, 2003. Retrieved December 2, 2012, from <http://www.facta.junis.ni.ac.rs/pe/pe2002/pe2002-08.pdf>.

10. Lavender L. & Predock-Linnell J. (2001). From Improvisation to Choreography: the Critical Bridge. *Research in Dance Education*, 2: 195–210.
11. Mero A., Komi P., & Gregor R. (1992). Biomechanics of Sprint Running. *Sports Medicine*, 13: 376–392.
12. Radionov M. V. (2011). Physical Preparedness of Junior Dancers as Mean of Increase of Sports Result. *Theory and practise of physical culture*, 4: 58–61 (in Russian, abstract in English).
13. Regulations of Classificatory Classes (2009, December). Retrieved December 3, 2012, from <http://www.dancesport.lt/nariams/>.
14. Smith-Autard J. M. (2003). The Essential Relationship Between Pedagogy and Technology in Enhancing the Reaching of Dance Form. *Research in Dance Education*, 4:151–169.
15. *The revised technique of Latin-American dancing ISTD* (1983). London: Lithoflow LTD.
16. *The ballroom technique ISTA* (1994). London: Lithoflow LTD.
17. Torrents C., Castañer M., & Anguera M. T. (2011). Dancing with Complexity: Observation of Emergent Patterns in Dance Improvisation. *Education. Physical Training. Sport*, 80: 76–82.
18. Ushpurene A. B. & Chepulenias A. (2012). Intensity of Physical Load in Sport Dance Competitive Programs for 12–13 Years Old Dancers. *Theory and practise of physical culture*, 4: 59–61 (in Russian, abstract in English).
19. Ušpurienė A. B. & Čepulėnas A. (2011). Changes in Athletic Fitness of Junior Sports Dancers During a Ten-month Training Cycle. *Education. Physical Training. Sport*, 82: 52–61.
20. Vissers D., Raussel N., Mistiaen W., Crickemans B., Truijien S., Nijs J. & Backer W. (2011). Can a Submaximal Exercise Performance in Dancers? *European Journal of Sport Science*, 11: 397–400.

Submitted: April 11, 2013

Accepted: November 27, 2013

ORIGINAL RESEARCH PAPER

**THE INFLUENCE OF SERVICE CLOSING SETS
ON THE WORKING CAPACITY****Viesturs Lāriņš, Andris Rudzītis, Zane Pavāre**¹Latvian Academy of Sports Education²University of Latvia

Address: 333 Brivibas Street, Riga LV-1006, Latvia

Phone: + 371 67543444, Fax: +371 76543480

E-mail: viesturs.larins@lspa.lv, andris.rudzitis@lspa.lv, zane.pavare@lspa.lv

Abstract

The aim of study was to determine the specific clothing sets impact on physical working capacity. Repeated working capacity tests were conducted on Latvian police officers` summer and winter wear clothing sets (uniforms), in order to assess the changes in physical working capacity under the influence of specially designed garment sets. Step-ergometry and physical fitness testing after EUROFIT test methodology was used to evaluate the working capacity under certain dynamic conditions. Physical working capacity in Harvard steptest by HSTI index averaged out to 78.6 ± 1.3 , which indicates mediocre work capacity of participants. The fitness of the experiment participants by EUROFIT test results was evaluated as average or below average, but by separate indicators (static muscle strength, abdominal muscle strength, cardiorespiratory system functional capability) as low. Under influence of the clothing sets, physical work ability decrement was determined in the winter uniform of an average of 29,8% ($P < 0,05$) compared to the summer uniform. The set of winter clothing significantly ($P < 0.05$) decreases body's strength indicators that are involving large amplitude motions, as body's flexors dynamic strength (17,6%), leg muscle explosive power indicators (5,4%). The movement speed agility (3,5%) and body flexibility reduces significantly. Insignificant ($P > 0.05$) changes appear in static muscle strength, arm movement speed, hand's dynamometry indicators, as well as a static body balance. Comparing the changes of body's physical fitness indicators under the influence of summer and winter wear uniforms, it can be concluded that significant performance decrease of policemen working capacity was detected while wearing winter uniforms. That was caused by too tightly designed clothing restricting body and arm movements, especially in wide range body and arm motion, but practically

does not affect the performance of small range motions of body and arms or static body muscle tension. Significant deterioration of physical working capacity and the result deterioration of cardiorespiratory or endurance running tests with gradually increasing speed, are caused by the movements limiting effects of winter clothing kit, total weight of winter uniform, as well as the loss of thermoregulatory efficiency shown by the gathering of excreted sweat in winter clothing.

Key words: *Service clothing sets, physical working capacity, Harvard steptest, EIROFIT test*

Introduction

This research was carried out as a part of ESF financed RTU project aimed at development of new functional properties of smart textile and integration in innovative products. Depending on the job activity, service clothing can be very specific and different. The police uniforms' impact on police officers performance was investigated in this research.

Police uniforms have very high standards, due to difficult and various working environments, having to spend long hours both in offices, cars, and outdoors both in summer and winter. But the actually police officers uniforms was produced many years ago and have grown out-of-date and are not functional any more. RTU is implementing now a new project, to create new functional materials that can be used in police uniforms.

The aim of the research was to determine how do the new service clothing sets influence police officers performance ability.

Materials and methods

12 participants from the Riga region State Police Office took part in 30 experiments, testing 3 sets of 6 types of uniform developed during the customer's project.

The average age of the experiment participants was 25.7 ± 1.6 years. During the experiment all participants were apparently healthy and expressed no complaints about the state of their health.

All participants' physical performance was evaluated according to standard Harvard Steptest procedure (5), and using the EUROFIT test battery which tests 9 various abilities such as muscular strength, endurance, balance, speed, agility, and cardio respiratory endurance by using 20 meter shuttle test (1,2,7).

Hand dynamometry was used to determine static force of the muscles. Maximal force of the hand flexors was determined during a test using hydraulic hand dynamometer Saehan Masan (Korea).

Heart rate (HR) was registered at rest, during physical exercise and recovery period and monitored using telemetric pulse system Polar Team System (Finland).

The tests were organised in LASE laboratory premises and in sport game hall in the morning and before noon. The temperature during laboratory tests was 15 – 16 C on average, the air humidity was 78 – 82%.

Results and discussion

The physical performance ability according to the Harvard Steptest Index (HSTI) was on average 78.6 ± 1.3 which indicates a mediocre participant performance (6).

Body mass index (BMI) that describes body weight and height ratio was on average 28.3 ± 1.1 kg/m² in participants, which according to normative (4) corresponds to increased body mass. Increased BMI can be explained with increased muscle mass, as well as increased fat percentage in the upper arms, abdomen and back area.

Forced vital capacity of the lungs (FVC), was determined by using flow spirometer (One Flow Spirometer, UK) and was on average 5.09 ± 0.40 liters in group, which exceeds the normative but only for untrained men (5).

If the FVC indicators that describe the functional state of the respiratory system can be considered good, then Life index (LI), which describes the vital capacity of the lungs and body mass ratio in a group was on average 55.9 ± 5.1 ml/kg which is lower than the average normative for untrained men (5). The differences in respiratory system functional indicators can depend on increased body mass, indicated by body mass index (BMI) scores.

The EUROFIT test results (Tab.1) – body static balance in Flamingo test on average 10.0 ± 0.9 times per minute; plate tapping – 12.0 ± 0.1 seconds, Sit-and-reach flexibility test – 8.0 ± 1.0 cm, speed and agility by 10x5m shuttle – 20.0 ± 0.22 seconds, showed an average balance, flexibility, speed and agility performance.

Table 1

EUROFIT test indicators in summer and winter clothing sets

Indicators	Flamingo Balance (1min)	Sit-Ups (1min)	Sit-and-Reach (cm)	Plate tapping(sek)	Bent arm Hang (sek.)	Standing broad jump (m)	Shuttle run (10x5m) sek	Endurance shuttle run (20 m) min.	Body weight (kg)	Right hand grip (kg)	Left hand grip (kg)
Summer clothing sets	10.0 ±0.9	34.0 ±2.0	8.0 ±1.0	12.0 ±0.1	12.4 ±1.7	2.22 ±0.07	20.0 ±0.2	4.23 ±0.29	93.4 ±2.8	56.0 ±2.0	57. ±1.8
Winter clothing sets	7.5 ±0.4	28.4 ±2.2	0.75 ±1.8	10.7 ±0.1	13.0 ±1.9	2.10 ±0.05	20.7 ±0.3	3.77± 0.19	92.9 ±2.6	55.5 ±1.8	56. ±2.2
Difference	-2.5	-6.0	-7.25	-1.3	0.6	-0.12	-0.7	-0.46	-0.45	-0.5	-1.0
Confidence	>0.05	<0.05	<0.05	<0.05	>0.05	<0.05	<0.05	<0.05	<0.05	>0.05	>0.05

The strength indicators, such as arm strength on average was 56.0 ± 2.0 kg, sit-ups – 34.0 ± 2.0 times in a minute, bent arm hang – 12.4 ± 1.7 seconds, standing board jump – 2.22 ± 0.07 meters, indicate mediocre or low core, leg, arm, and shoulder muscle group strength performance.

The performance of cardio respiratory. system indicated 20 meters endurance in the shuttle – run by 4.23 ± 0.29 min which indicates that participants have a generally low endurance and the body's aerobic abilities pointing out a lack of cardio respiratory training.

In general the EUROFIT test results of the participants are average or below average, but separate results such as static muscle strength, abdominal muscle strength, cardio respiratory system functional capability are low.

To evaluate how the changes in performance can be influenced by the clothing sets, repeated tests were carried out, both in summer and winter clothing sets (Tab.1).

Physical performance according to the Harvard Steptest Index in winter clothing sets were evaluated as 55.2 ± 6.8 or low. Physical performance according to HSTI was by 29.8% lower in comparison to the police officers who performed in summer clothing, which is significant and statistically feasible ($pp < 0.05$). Such a significant reduction can depend on several factors. It is important to verify the movement restriction of the winter clothing sets, since the movement is particularly problematic when stepping on the 50cm high Harvard Steptest bench. When the resistance created by the clothing is

solved, the muscle load and performance increases, which in its turn increases the heart rate during the test and recovery period thus decreasing the Steptest index evaluation (Fig.1).

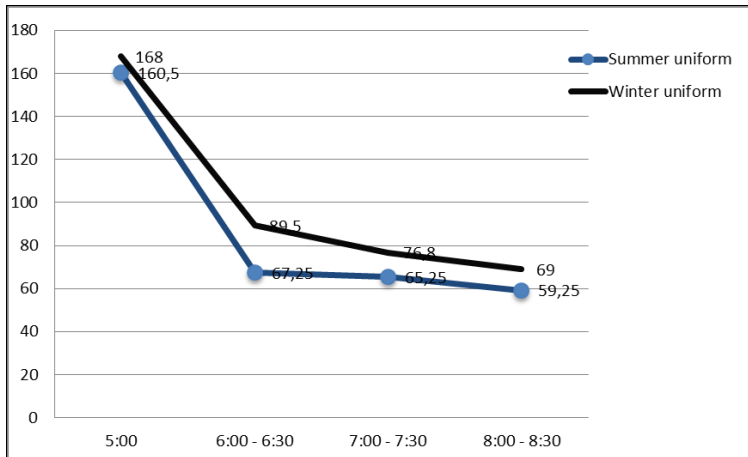


Figure 1. Heart rate frequency during Harvard steptest and recovery period in experiment participants wearing various clothing sets

The overall body load including heart rate is increased in the steptest by the weight of winter clothing set, which is 4.6kg in comparison to summer clothing set that is 2.9kg.

The heart rate during performance is affected by the endogenous heat discharge efficiency. The changes in the body and clothing mass due to sweat after the performance tests indicate efficient endogenous heat discharge (8). The amount of water lost by sweating during the experiments was determined by the changes of body mass by weighing before and after an entire day of tests. Throughout the tests, the participants were not allowed to consume water or any other liquids.

Among various clothing sets, the greatest body mass loss was determined to participants wearing summer clothing sets, where as participants with the winter clothing sets, that is, with the greatest overall load – the average loss of water in the group was 36.8% ($p < 0.05$). Such a reduction in sweat release suggests that the sweat is stored by the winter clothing and it remains there (3.8). Thus it can be concluded that the winter uniform decreases water vapor penetrability, which results in decreased water loss through sweat in comparison to the summer uniform. Therefore

the results indicate that the winter clothing has insufficient thermoregulation efficiency.

When evaluating the clothing set influence on performance, it was vital to analyze the test results changed performed in various clothing sets (Tab.1). A significant ($p < 0.05$) decrease by 17.6% of body flexor dynamic force was observed, as well as decrease in muscle explosive force in the jump test by 12.0 cm or 5.4% on average, also decrease of 0.7sec or 3.5% in running speed and agility when performing 5x10m shuttle-run, which were mainly because of the winter uniform restrictions to the amplitude of body movement. The decrease in flexibility and static balance was insignificant ($p > 0.05$).

There was a significant decrease ($p < 0.05$) in cardio vascular endurance when performing 20m shuttle-run with gradually increasing speed – 0.46sec or 10.9% on average in the group. The decrease in cardio respiratory performance in winter clothing sets is caused by fatigue, which occurs when overcoming the clothing restrictions, as well as overcoming the additional body load with the total winter clothing set weight.

Regardless of the clothing sets, the hand dynamometry indicators remained almost unaffected ($p > 0.05$) because the execution of the test is basically not affected by the police winter uniform.

A positive dynamics in the winter clothing sets was determined in two tests. The plate tapping test result, when tapping 25 times on the plate, increased by 1.3sec or 10.8% on average ($p < 0.05$). Since one has to move the hand on the board back and forth in a short distance, it can be concluded that the winter uniform does not affect arm movements within small amplitudes.

Regardless of the increased total weight of the winter uniform set, the bent arm hang test results increased by 0.6sec or 4.8%. During the test, the arms are fixed in a particular position and no movements are made which could explain the insignificant ($p > 0.05$) increase in static muscle endurance.

Thus, in general, one can conclude that under the influence of winter clothing sets significantly ($p < 0.05$) body strength indicators connected with wide amplitude movements are decreased, such as body muscle dynamic strength and leg muscle explosive force. Significant decrease ($p < 0.05$) is observed in the movement speed and agility, as well as flexibility, causing reduced performance in winter clothing sets.

At the same time muscle static strength, hand movement speed, hand dynamometry, as well as the static balance of the body are not affected because the winter clothing sets do not affect the body and arm movement

performance with small amplitude or static muscle exertion with no movements.

The results of cardio respiratory or endurance running test with gradually increasing speed suggest that winter clothing sets significantly ($p < 0.05$) affect the performance – cardio respiratory system abilities decrease because of the movements restrictive winter clothing sets, in the addition to the extra winter clothing weight, as well as decrease in thermoregulation, which is connected to the accumulation of sweat in the winter uniforms. General tiredness and lack of motivation to achieve the best result possible during the last load test cannot be excluded in this test.

Conclucions

1. In order to assess the changes in working performance under the influence of clothing set developed by the customer, repeated performance tests were carried out using summer and winter police uniform sets. Physical working capacity in Harvard steptest as per HSTI index decrease by 29.8%, as compared with the participants' performance when wearing summer police uniform. Such significant ($p < 0.05$) decrease of working capacities is caused by several factors, such as movement restriction by winter clothing set, general body load caused by the weight of winter clothing set which is 1.7kg heavier, and lower endogenic thermal conduction effectiveness which is proven by body mass and clothes weight change as a result of sweating after performance and physical training tests. The sweat excreted by the body in winter clothing set accumulates and remain on the clothing set which is determined by reduced water steam conductivity that leads to reduced water loss while sweating, as compared with summer uniform. Thus, the results obtained show a lack of winter clothing uniforms thermoregulatory effectiveness.

2. Having assessed the impact of the developed clothing sets on the body performance in general, we can conclude that winter uniform sets cause significant decrease of the performance of force indicators ($p < 0.05$) which is related to large amplitude motions, such as dynamic force of body flexors, speed indicators of leg muscles. The speed of movement and agility, body flexibility significantly decrease which leads to decreased performance of the police in winter uniform. Static endurance of the muscles, speed of arm movements, dynamometric indicators for the arms and body static balance function change insignificantly ($p > 0.05$), as winter uniform does not affect the movements with small range of body and arm movements or static body muscle tension without motion performance.

The results of cardiorespiratory or 20m endurance shuttle running test with gradually increased speed show that winter clothing sets cause significant decrease in cardiorespiratory system performance ($p < 0.05$) which is related to motion restricting impact of winter clothing sets, additional body load with the total weight of winter uniform and decrease in thermoregulation effectiveness related to accumulation of excreted sweat in winter uniform.

References

1. *Eurofit Fitness Testing Battery*. The Sport Science Resource. Retrieved 22.09. 2013. from <http://www.topendsports.com/testing/eurofit.htm>.
2. *EUROFIT metode*. Medicīniskās tehnoloģijas metodes izvērsts apraksts. Nacionālais veselības dienests. Retrieved 22.09.2013. from <http://www.vmnvd.gov.lv/lv/datu-bazes/arstnieciba-izmantojamo-medicinisko-tehnologiju-datu-baze/32-sporta-medicinas-mediciniskie-pakalpojumi/eirofit-metode>
3. *Heat transfer and evaluation of clothing. ACCP-1* (1992). Allied Combat Clothing publication. NATO International Staff – Defence Support Division. Military agency for standardization.
4. Kent, M. (2007). *The Oxford Dictionary of Sports Science and Medicine*. -3rd ed. – Oxford, NY: Oxford University Press, 624 p.
5. Lāriņš, V. (2004). *Sporta medicīna*. LSPA, Rīga, 100 lpp.
6. *The Harvard Steptest*. The Sport Science Resource. Retrieved September 22.09.2013. from <http://www.topendsports.com/testing/tests/step-harvard.htm>.
7. Sauka, M., Priedite, I.S., Artjuhova, L., Larins, V., Selga, G., Dahlstrom, O. Et al. (2011). Physical Fitness in Northern European Youth: Reference values from the Latvian Physical Health in Youth Study. *Scandinavian Journal of Public Health*, 39, 35-43.
8. Šitvjenkins, I., Viļumsone, A., Lāriņš, V., Ābele, I., Torbicka, H., & Pavāre, Z. (2012). Quality Evaluation of the Combat Individual Protection System by EUROFIT Physical Fitness Testing. *LASE Journal of Sport Science*. Riga, Vol.3, Nr.1, p.31-46.

Submitted: April 19, 2013

Accepted: November 27, 2013

ORIGINAL RESEARCH PAPER

NON-FORMAL PHYSICAL EDUCATION IN SCHOOL AS FACTOR FOR INNATE PHYSICAL POWERS TRAINING

Asta Šarkauskienė

Klaipėda University,

Address: S. Neries str. 5, LT-92227 Klaipėda, Lithuania

Phone: +37068072393

E-mail: asta.sarkauskiene@gmail.com

Abstract

The aim of the study was to investigate the influence of two-year non-formal physical education content on innate physical powers development of 11-13 years old children. The study continued for two years in four Klaipėda city comprehensive schools that were selected under the criterion method. Children from two schools were assigned to the experimental group E (n=119); children from the other two schools were assigned to the control group C (n=120). Considering young adolescents' participation in non-formal physical education (NFPE) activities, children from experimental and control groups were appointed to one of three groups: E₁ and C₁, E₂ and C₂, E₃ and C₃. At the beginning (2007-10, 11), in the middle (2008-05), and at the end (2009-05) of the pedagogical experiment, physical development measures and physical capacity tests were taken and health indices were analyzed under the method of data analysis. During experimental period, children of E₁ group were ill the least. During the second year, their morbidity rate was statistically significantly ($p=0,034$) lower than C₁ group's. Educational content did not affect the changes in height indices ($p>0.5$) but it positively influenced changes in normalization of body mass index of E₁ group girls and boys. Physical fitness results of experimental groups (E₁, E₂, E₃) children in many cases were statistically significantly ($p<0.05$) higher than children' from control groups (C₁, C₂, C₃). Education content as being implemented, while uniting and integrally developing knowledge, abilities, and attitudes as well as applying child activating education methods and forms, positively influences children physical health, physical development, and physical capacity.

Key words: *non-formal physical education, 11-13 years old children, innate physical powers.*

Introduction

The period of early adolescence (age 11-13) is a very complex and significant human's development phase on psychological as well as on biological aspect. A very intense biological maturation process and physical characteristics development proceed in this life phase. Normal young adolescents' growth and development need physical activeness on a daily basis. World Health Organization and European Commission approved documents (COM(2005) 637; EUR/05/5048378; EUR/06/5062700/8; WHA63.14 (2010) et al.) that emphasize the importance of physical health, physical activity, and other innate powers training.

Empirical researches estimated that physical activity of 11-13 year children is insufficient (Janssen, 2007; Velert et al., 2008; Bucks, Finne, Kolip, 2008; Beaulac, Bouchard, Kristjansson, 2009; Schneider, Dunn, Cooper, 2009), organism's functional (Tutkuvienė, 2005; Комков et al. 2008) and physical capacity (Мирошниченко, Астраханцев, 2005; Сиявский, Власов, Сергеев, 2009) have a tendency to decline as well as state of their health (Gaidelytė, Cičėnienė, 2008; Barnekow et al. 2009; Габдрахманова, Коган, 2009).

Lithuanian scientists emphasize the significance of innate physical powers development but major attention goes on the formal training of these powers. In recent years there has been a growing appreciation of the importance of learning in non-formal settings (European Commission, 2012). In Lithuania non-formal physical education (NFPE) is carried out inside and outside school. NFPE in school is described as non-structural, organized, and purposeful after-school physical education (Šarkauskienė, 2011). It is still understood narrowly and from one-sided view, i.e. is oriented towards teaching and development of the motion and training of physical qualities. Curriculum content is focused on upcoming sport events.

Lithuanian scientists suggest reforming the content and organization of NFPE in school. V. Blauzdys, D. Šinkūnienė (2005) offer implementation of various sport competitions and, in such way, to involve the whole school community. L. Trinkūnienė et al. (2009) conclude, under the following empiric research results, that such activity is especially useful for pupils with lower level of physical fitness and recommend finding ways to involve those children into the process of NFPE in school.

Foreign scientists also discuss this issue. A. L. Carel et al. (2011) recommend for NFPE to concentrate most attention on lifestyle-focused

activities such as walking, games, station-based activities, and snowshoeing. B. Wnek (2006) proposes education content that includes physical fitness activities, skills, games, and rhythm and dance activities, each based on a specific holiday or seasonal theme.

In present study the following research question was formulated: *What content of NFPE in school can positively influence innate physical powers development of 11-13 years old children?*

The aim of the study was to investigate the influence of two year non-formal physical education content on innate physical powers development of 11-13 years old children.

Material and methods

Subject. The target sample consisted of groups from grades 5-6 (n = 239). The study included 123 (51.5 %) girls and 116 (48.5 %) boys. Girls' and boys' results were analyzed separately.

Organization of the study. The study continued for two years in four Klaipėda city secondary schools, which were selected using the criterion method. Students from two schools were assigned to the experimental group E (n = 119) (Fig. 1); students from the other two schools were assigned to the control group C (n = 120).

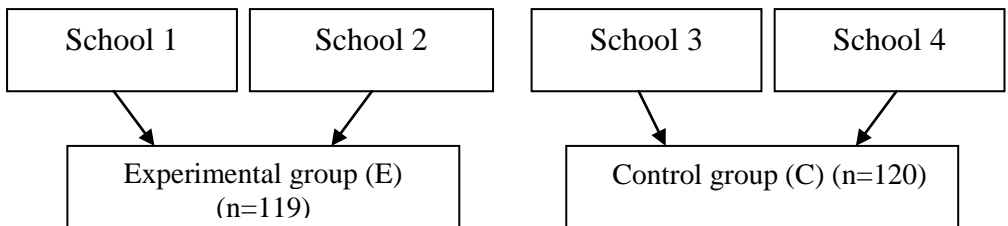


Figure 1. Distribution of schools

Taking into account students' participation in NFPE in school, location, and frequency, testees from the experimental and the control groups were assigned to E₁ and C₁, E₂ and C₂, E₃ and C₃ groups accordingly:

1. Children, who regularly participate in NFPE in their secondary school (E₁, C₁).
2. Children, who participate in NFPE outside school and are only indirectly involved in NFPE in school to participate in organized sport and fitness activities (E₂, C₂).
3. Children, who are only indirectly involved in NFPE in school to participate in organized sport and fitness activities (E₃, C₃).

The experimental group (E) had been working under the program developed by the author of this article. The content of the program included various sport and agility games, relay races, athletics, and gymnastics. The following principles were followed: willingness to volunteer, accessibility, relevance, and individualization; different activating methods (discussion, case study, “Brain hedgehog“, arguments “For and against“, “Brainstorm“, learning in groups, etc.) were applied as well. Education content was implemented during sport activities and in various sport and wellness events (sport and wellness festivals, competitions, quizzes, trips). 80 % of trainings content consisted of sport activities and 20 % - of various sport and fitness events.

The control group (C) worked under NFPE programs prepared by teachers and approved by school directors, who followed the regulations of Lithuanian Olympic festival.

Priorities of the experimental group:

1. Integral growth of physical development, physical activity, physical fitness, and health.
2. Integration of children with lower level of health and physical fitness.
3. Content that corresponds to the needs and preferences of children.
4. Methods and forms that activate and train individual development process.

Priorities of the control group:

1. Teaching and development of motions performance.
2. Physical qualities training.
3. Training of the most physically capable pupils.
4. Curriculum content focused on upcoming sport events.

Both experimental and control groups shared the duration (1 hour) and frequency (twice a week) but were different in their education content.

Methods: pedagogical experiment, document analysis, measuring physical development level, testing, and statistical analysis. Pedagogical experiment continued for two years in two Klaipėda city secondary schools. Non-formal education activities were held at the end of formal education twice a week. Activity duration was 1 hour. *Document analysis:* after applying this method, the average of pupils' age was determined. The age average was 11.3 years during the research I, 11.9 years – during the research II, and 12.9 years – during the research III. Children' health indices were analyzed: assigning to medical groups of physical capacity, morbidity and morbidity in one academic year (academic year 2007–2008,2008–2009)

Measuring physical development level: anthropometric (height, weight) and physiometric (vital capacity; right and left hands power) measuring were performed and comparative values – BMI that reveals weight and height proportion - was established. *Testing:* five physical fitness tests were conducted: sit and reach (lower back flexibility), sit-ups (abdominal strength and muscular endurance), flexed-arm hang (upper body strength and endurance), standing long jump (explosive leg power) and 1 mile walk/run (cardiorespiratory endurance). *Statistical analysis:* the arithmetic mean (\bar{x}), the mean difference (MD), the standard deviation (SD), and the effect size r were calculated. Student's t test, Wilcoxon test, and Mann–Whitney U test were applied. Statistical analysis was performed using SPSS software (version 17.0).

Results

Alternation and evaluation of 11-13 years old children health indices.

Data analysis of 11-13 years old children's morbidity during one academic year revealed that, during the first and the second academic year of pedagogical experiment, pupils from the experimental group, who regularly participated in NFPE in school (E_1), were ill occasionally (Fig. 2).

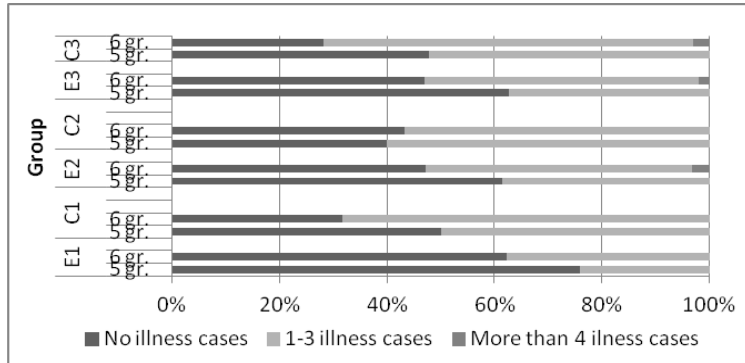


Figure 2. Percentage distribution of morbidity rates during one academic year in experimental and control groups

It was established that, during the second research year (academic year 2008–2009), pupils' from E_1 group morbidity rate was statistically significantly lower than children' from C_1 group, $U=222.50$, $z=-2.12$, $p=0.034$; $r=-0.30$. During the same year, the indices of morbidity during one academic year also statistically significantly differed in pupils, who participated in NFPE in school only partly – in sport and wellness events (E_3

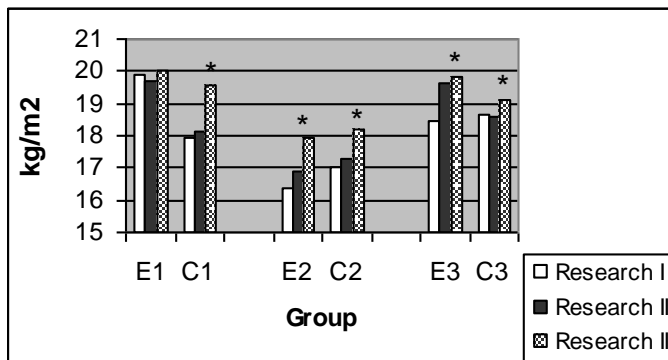
and C₃): pupils from experimental group were ill more rarely, $U=222.50$, $z=-2.06$, $p=0.040$; $r=-0.19$. Cases of respiratory system were identified in children from all groups mostly.

After one-year of the pedagogical experiment and after comparing results of groups' E₁ and E₂ assigning to medical physical capacity groups, it was established that more testees from group E₁ were assigned to the main physical capacity group but these indices did not differ statistically significantly, $U=265$; $z=-1.56$; $p=0.120$; $r=-0.22$. Group's E₂ indices of assigning to special medical physical capacity group did not differ statistically significantly from testees of group C₂, $U=543.00$; $z=-0.80$; $p=0.423$; $r=-0.10$. Significant differences were not found between groups E₃ and C₃ either, $U=1595.00$; $z=-0.931$; $p=0.352$; $r=-0.09$.

When analysing cases of children of age 11-13 it was estimated that diseases of eye and adnexa and symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified - were the most common cases in all testees' groups.

Alternation and evaluation of 11-13 years old children physical development indices. Morphologic (height and weight) indices of all groups both sexes respondents increased statistically significantly ($p<0.05$).

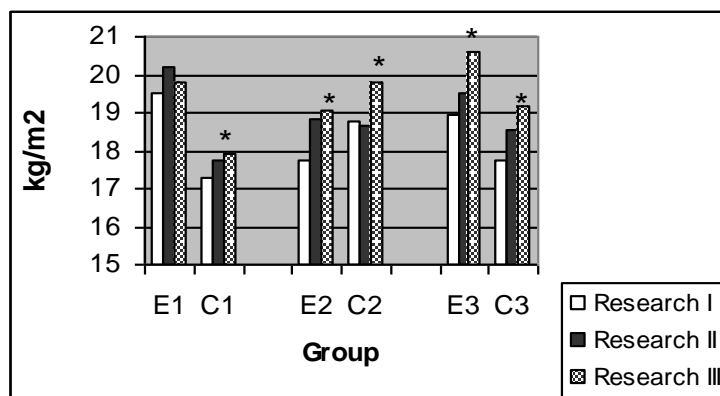
At the beginning of the pedagogical experiment, the highest BMI rates were estimated in E₁ girls' group ($19.90 \pm 2.65 \text{ kg/m}^2$) - they on average were higher in 2.92 kg/m^2 than average meanings of Lithuanian girls of this age. However, during two academic years, BMI of this group young adolescents varied fractionally and, at the end of pedagogical experiment, this difference decreased to 1.31 kg/m^2 , i.e. height and weight ratio of girls, who participated in NFPE in school, became more proportional (Fig. 3).



Note. * $p<0.05$

Figure 3. Alternation of body mass index (BMI) in experimental and control group girls

During two-year experimental period, boys' BMI indices improved significantly ($p < 0.05$) in all groups except in experimental group, which constantly participated in NFPE in school (E_1) (Fig. 4). BMI of all groups were higher than average meaning of 13 years old Lithuanian boys (18.07 kg/m^2 ; Tutkuvienė, Jakimavičienė, 2004).



Note. * $p < 0.05$

Figure 4. Alternation of body mass index (BMI) in experimental and control group boys

Right and left hands power in all groups varied similarly ($p > 0.05$). Vital capacity (future – VC) indices improved in 11-13 years children of all groups. However, these changes were not equal in all groups and this revealed the influence of means, applied during experimental period, on alternation of VC indices. During two academic years, statistically significant ($p < 0.001$) changes were estimated in all experimental (E_1, E_2, E_3) girls groups and in one control (C_3) girls' group.

Boys' VC indices statistically significantly ($p < 0.05$) improved in all groups, however, in experimental groups, which constantly participated in NFPE in school (E_1) and in school organized sport and wellness events (E_3), these changes were higher than in control groups (C_1 and C_3): during two years of the pedagogical experiment, VC indices in E_1 group boys grew on average in $394,45 \text{ cm}^3$ and in C_1 - $204,54 \text{ cm}^3$. In E_3 group, during the experimental period, VC indices improved in $238,9 \text{ cm}^3$, C_3 - $136,5 \text{ cm}^3$.

Alternation and evaluation of 11-13 years old children physical capacity indices. When analyzing physical capacity indices during the research III, it was estimated that E_1 group girls' indices of flexibility, abdominal strength and muscular endurance, cardiorespiratory endurance and boys' indices of flexibility, abdominal strength and muscular endurance, upper body strength and endurance, and cardiorespiratory endurance indices

were statistically significantly ($p < 0.05$) higher than young adolescents' from C_1 group (Table 1). E_2 group girls' and boys' indices of abdominal strength and muscular endurance, upper body strength and endurance, and cardiorespiratory endurance were statistically significantly ($p < 0.05$) higher than young adolescents' from C_2 group. E_3 group girls' indices of flexibility, explosive leg power, abdominal strength and muscular endurance, and cardiorespiratory endurance and boys' indices of cardiorespiratory endurance were statistically significantly ($p < 0.05$) higher than young adolescents' from C_3 group.

Table 1

Differences of physical capacity indices in experimental and control groups young adolescents' (research III)

Groups	Statistical indicators	Sit and reach (cm)	Standing long jump (cm)	Sit-ups (N/30 sec)	Flexed-arm hang (ms)	1 mile walk/run (sec)
<i>GIRLS</i>						
$E_1:C_1$	t	4,200	0,487	3,709	-0,422	-2,150
	p	0,000***	0,631	0,002**	0,677	0,044*
$E_2:C_2$	t	0,339	1,772	2,216	2,368	-4,376
	p	0,739	0,090	0,042*	0,026*	0,000***
$E_3:C_3$	t	2,089	3,547	3,719	1,859	-8,840
	p	0,040*	0,001***	0,000***	0,067	0,000***
<i>BOYS</i>						
$E_1:C_1$	t	3,177	1,714	2,379	2,848	-2,770
	p	0,005**	0,103	0,029*	0,010**	0,015*
$E_2:C_2$	t	0,069	1,335	3,414	2,504	-4,286
	p	0,945	0,190	0,002**	0,017*	0,000***
$E_3:C_3$	t	0,517	1,228	1,979	1,560	-4,564
	p	0,608	0,226	0,058	0,133	0,000***

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Discussion

Under the data of Klaipėda City Public Health Bureau (2009), 77.9% of 5-8 graders were assigned to the main, 19.3 % - to preparatory, and 2.7 % – to special medical physical capacity group in Klaipėda city in 2008. Pupils in our research were assigned to the main physical capacity group in higher number than average statistics in Klaipėda city.

The main cases of young adolescents, who participated in the research, were eye diseases and adnexa and symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified. Scientists and health professionals indicate sight disorders to be as one of the most

common diseases of adolescents. R. Gaidelytė, V. Cicėnienė (2009) state that sight disorders were identified in 15.6 % of children (age 0-17). In 2008 sight disorders were identified in one third of 5-8 graders. Additionally, professionals tend to address that cases of diseases of eye and adnexa rapidly grow: the number of sight disorders grew in 3.4% in the period 2001–2005 (Gaižauskienė et al., 2006) and in the period 2005 – 2007 it increased more in 1.9%; and among children of age 0-17 it amounted 15.2% of all cases (Gaidelytė, Cicėnienė, 2008).

Empiric data substantiate the influence of physical exercises that were performed during non-formal physical education in school process on children's organism resistance to diseases (morbidity during one academic year). When analyzing 11-13 years old children's assigning to medical physical capacity groups and results of morbidity and their alternation, influence of experimental program did not emerge. We use to think for these changes to be attained, NFPE only is not enough; children's wellness (healthy nutrition, physical activity, prophylaxis of chronic non-infectious diseases) promotion is necessary in formal and non-formal education as well as in family environment.

J. Tutkuvienė (1995) indicates that height is the most innate and the least changing of all morphological and functional condition indices. Our research results have revealed that experimental program did not influence alternation of pupils' height indices – statistically significant changes between groups were not identified. A. D. Baxter-Jones et al. (2008), M. C. Erlandson et al. (2008) also estimated that format and extent of physical activity do not determine growing speed.

Other development index – weight – was much more labile than height and varied more because of biological (nutrition, diseases), social, economical, and cultural factors and even because of beauty criteria (Tutkuvienė, Jakimavičienė, 2004). Scientists (Lowry et al., 2007; Julia et al., 2008; Cora et al., 2009) indicate that every year more and more adolescents' weight does not correspond recommendation norms. World Health Organization (2010) admits that children' overweight and obesity indices have reached epidemic level in many industrial countries. Supposedly, the number of children with overweight and obesity in EU grows in more than 400 000 cases per year (European Parliament, 2007/2086 (INI)). Alternation of BMI index during pedagogical experiment grounds positive influence of applied program on the BMI indices alternation of experimental group girls and boys (E_1), who participated in NFPE in school: their height and weight ratio became more proportional. Physical development in early adolescence was evaluated depending on

functional parameters as well, i.e. on vital capacity and hands power. When child grows, his/her VC also grows (Malina, Bouchard, Bar-Or, 2004; Armonaitė-Engelmanienė, 2008). This was proved by our research data: hands power and VC increased in all groups during the research period. Right and left hands power in all groups varied similarly, except changes of VC indices were more considerable in the experimental than in the control groups.

Theoretical and empirical research results reveal early adolescence period as particularly favorable for increase of physical capacity (Курамшин 2007; Сальников, 2008; Фролов, 2009). Statistically significant ($p < 0.05$) differences in the experimental and the control groups' physical capacity indices at the research III revealed positive influence of created education content and children activating strategies on physical capacity of young adolescents, who participated in non-formal physical education in school for two years (group E₁), as well as of schoolchildren, who only partly experienced influence of non-formal physical education in school (groups E₂ and E₃).

Conclusions

11-13 years old children innate physical powers training, when non-formal education content is being implemented, while uniting and integrally developing knowledge, abilities, attitudes and applying child activating training methods and forms, positively influences their physical health, physical development, and physical capacity.

References

1. Armonaitė-Engelmanienė, R. (2008). Brendimas, priežiūros ypatybės. *Paauglių sveikatos priežiūra šeimos gydytojo praktikoje* [Maturation, care peculiarities. *Adolescents' health care in the practice of family doctor*]. Kaunas: Vitae Litera.
2. Barnekow, V., Currie, C., Letsch, C. et al. (ed.) (2009). A Snapshot of the Health of Young People in Europe. *A report prepared for the European Commission Conference on Youth Health*. Brussels, Belgium. Retrieved on 28 February 2010 from <http://www.euro.who.int/Document/E93036.pdf>.
3. Baxter-Jones, A. D., Eisenmann, J. C., Mirwald, R. L. et al. (2008). The Influence of Physical Activity on Lean Mass Accrual During Adolescence: A Longitudinal Analysis. *Journal of Applied Physiology*, 105(2), 734–41.

4. Beaulac, J., Bouchard, D., Kristjansson, E. (2009). Physical Activity for Adolescents Living in a Disadvantaged Neighbourhood: Views of Parents and Adolescents on Needs, Barriers, Facilitators, and Programming. *Leisure/Loisir: Journal of the Canadian Association for Leisure Studies*, 33(1), 537–561.
5. Blauzdys, V., Šinkūnienė, D. (2005). *Mokinių papildomo fizinio ugdymo plėtra mokykloje. [Schoolchildren complementary physical education development in school]*. Vilnius: VPU.
6. Bucksc, J., Finne, E., Kolip, P. (2008). The Trans theoretical Model in the Context of Physical Activity in a School-based Sample of German Adolescents. *European Journal of Sport Science*, 8(6), 403-412.
7. Carrel, A. L. et al. (2011). An After-school Exercise Program Improves Fitness, and Body Composition in Elementary School Children. *Journal of Physical Education and Sports Management*, 2(3), 32-36.
8. COM (2005) 637. *Green paper “Promoting healthy diets and physical activity: a European dimension for the prevention of overweight, obesity and chronic diseases”*. Retrieved on 18 May 2008 from http://ec.europa.eu/health/ph_determinants/life_style/nutrition/documents/nutrition_gp_en.pdf.
9. Cora, E. Lewis, M. D., MSPH et al. (2009). Mortality, Health Outcomes, and Body Mass Index in the Overweight Range. *Circulation*, 119, 3263–3271.
10. Erlandson, M. C., Sherar, L. B., Mirwald, R. L. et al. (2008). Growth and Maturation of Adolescent Female Gymnasts, Swimmers, and Tennis Players. *Medicine and science in sports and exercise*, 40(1), 34–42.
11. EUR/05/5048378: *European strategy for child and adolescent health and development*. Retrieved on 10 October 2008 from http://www.euro.who.int/__data/assets/pdf_file/0020/79400/E87710.pdf
12. EUR/06/5062700/8. *European Charter on counteracting obesity*. Retrieved on 14 July 2010 from http://www.euro.who.int/__data/assets/pdf_file/0009/87462/E89567.pdf.
13. European Commission (2012). *Validation of non-formal and informal learning*. Retrieved on 15 June 2012 from http://ec.europa.eu/education/lifelong-learning-policy/informal_en.htm.
14. Gaidelytė, R., Cicėnienė, V. (edit.) (2009). *Lietuvos gyventojų sveikata ir sveikatos priežiūros įstaigų veikla 2008 m. [Lithuanian citizens' health and health care institutions activity in 2008]*. Retrieved on 29 January 2010 from www.lsic.lt

15. Gaidelytė, R., Cicėnienė, V. (edit.) (2008). *Lietuvos gyventojų sveikata ir sveikatos priežiūros įstaigų veikla 2007 m.* [Lithuanian citizens' health and health care institutions activity in 2007]. Vilnius: Lietuvos sveikatos informacijos centras.
16. Gaižauskienė, A. et al. (edit.) (2006). *Lietuvos gyventojų bendrasis sergamumas 2001–2005 m. privalomojo sveikatos draudimo informacinės sistemos SVEIDRA duomenimis.* [Lithuanian citizens' common morbidity in 2001-2005 under the data information system SVEIDRA of compulsory health insurance]. Vilnius: Lietuvos sveikatos informacijos centras.
17. INI/2007/2086. *Role of sport in education.* Retrieved on 27 February 2010 from <http://www.europarl.europa.eu/oeil/file.jsp?id=5478932>.
18. Janssen, L. (2007). Physical Activity Guidelines for Children and Youth. *Applied Physiology, Nutrition & Metabolism*, 32, 109–121.
19. Julia, M. et al. (2008). Tracking for Underweight, Overweight and Obesity from Childhood to Adolescence: A 5-Year Follow-Up Study in Urban Indonesian Children. *Hormone Research*, 69, 301–306.
20. *Klaipėdos miesto visuomenės sveikatos biuras* [Klaipėda City Public Health Bureau], (2009). Retrieved on 24 November 2009 from www.sveikatosbiuras.lt.
21. Lowry, R., Lee, S. M., Galuska, D. A. et al. (2007). Physical Activity-Related Injury and Body Mass Index Among US High School Students. *Journal of Physical Activity and Health*, 2007, 4, 325–342.
22. Malina, R. M., Bouchard, C., Bar-Or, O. (2004). *Growth, maturation, and physical activity.* Champaign, Ill: Human Kinetics.
23. Schneider, M., Dunn, A., Cooper, D. (2009). Affect, Exercise, and Physical Activity Among Healthy Adolescents. *Journal of Sport & Exercise Psychology*, 2009, 31, 706–723.
24. Šarkauskiene, A. (2011). *Jaunujų pauglių prigimtinių fizinių galių neformalusis ugdymas mokykloje* [Non-Formal Education In School Of Young Adolescents' innate Physical Powers]. Doctoral Dissertacion. Klaipėda, KU.
25. Trinkūnienė, L. et al. (2009). Papildomo fizinio aktyvumo pratybų poveikis silpno fizinio pajėgumo mergaitėms [Influence of extra-curricular physical activity on girls with poor physical fitness]. *Ugdymas Kūno kultūra Sportas*, 4 (75), 86–91.
26. Tutkuvienė, J. (1995). *Vaikų augimo ir brendimo vertinimas.* [The assessment of children development and maturation]. Vilnius: Meralas.

27. Tutkuvienė, J. (2005). Lietuvos vaikų ir paauglių morfologinių ir funkcinių rodiklių sąsajos ir pokyčiai per pastaruosius dešimtmečius. *Fizinis aktyvumas ir sveikata: vaikų ir jaunimo fizinio aktyvumo problemos*. [Lithuanian children and adolescents correlations of morphological and functional indices and changes during the latter decades. *Physical activeness and health: children and youth physical activeness problems*]. [Electronic optical disc]: national symposium, 18-19 September, Birštonas.
28. Tutkuvienė, J., Jakimavičienė, E. M. (2004). Kūno sudėjimo rodikliai ir jų sąsajos su bendra sveikatos būkle [Indices of body frame and their connections with general health status]. *Medicinos teorija ir praktika*, 1(37), 59–63.
29. Velert, C. P., Devis, J. D., Carrillo, V. et al. (2008). Variability of Spanish Adolescents' Physical Activity Patterns by Seasonality, Day of the Week and Demographic Factors. *European Journal of Sport Science*, 8(3), 163–171.
30. WHA63.14 (2010). *Set of recommendations on the marketing of foods and non-alcoholic beverages to children*. Retrieved on 12 November 2010 from http://whqlibdoc.who.int/publications/2010/9789241500210_eng.pdf.
31. WHO (2010). *Reproductive health issues among adolescents and youth*. Retrieved on 18 March 2010 from www.searo.who.int/LinkFiles/Reproductive_Health_Profile_reproductive1.pdf.
32. Wnek, B. (2006). *Celebration Games: Physical Activities for Every Month*. Champaign, Human Kinetics Publishers.
33. Габдрахманова, Л. И., Коган, О. С. (2009). Научное обоснование системы оздоровления школьников младших классов методами адаптивной физической культуры. *Физическая культура: воспитание, образование, тренировка*, 2, 23–26.
34. Комков, А. Г., Филиппов, С. С., Малинин, А. В. et al. (2008). Развитие педагогических направлений физического воспитания школьников на основе социально – педагогического мониторинга. *Теория и практика физической культуры*, 3, 22–26.
35. Курамшин, Ю. Ф. (2007). *Теория и методика физической культуры*. Москва: Советский спорт.
36. Мирошниченко, Л. И., Астраханцев, Е. А. (2005). Инновационная программа физического воспитания школьников. *Физическая культура: воспитание, образование, тренировка*, 4, 60–64.

37. Сальников, В. А. (2008). Сенситивные и критические периоды как составляющие индивидуального развития. *Теория и практика физической культуры*, 2, 55–61.
38. Синявский, Н. И., Власов, В. В Сергеев, К. В. (2009). Мониторинг физической подготовленности детей младшего школьного возраста Среднего Приобья. *Физическая культура: воспитание, образование, тренировка*, 3, 31–32.

Submitted: April 12, 2013
Accepted: November 27, 2013

ORIGINAL RESEARCH PAPER

PSYCHOMETRIC INDICATORS OF GENERAL HEALTH QUESTIONNAIRE IN LATVIA

Iveta Zelča , Žermēna Vazne, Aleksandra Čuprika, Ingrīda Amantova,
Zinta Galeja , Lilita Ozoliņa, Oskars Vaisjūns, Lāsma Ozola

Latvian Academy of Sport Education
Address: 333 Brivibas Street, Riga, LV 1006, Latvia
E-mail: Zermena.Vazne@lspa.lv, Iveta.Zelca@lspa.lv

Abstract

General Health Questionnaire (GHQ) is widely used all over the world to state psychological load and overload, as well as general mental state. Various GHQ versions were used in practice including questionnaires of 12, 28, 30 and 60 questions. GHQ-12 is the most popular and shortest version of the inquiry which is often used as a means to state psychological stress. The aim of the research was to state the psychometric indicators of the General Health Questionnaire -12 for the Latvian Academy of Sport Education student sample (N=225). Students aged 18 – 40 years of the Latvian Academy of Sport Education participated in the research including 41% of the 1st year students, 14% of the 2nd and 45% of the 3rd year students. 44% of the respondents were the representatives of the individual sports, 15% – of the team sports, but 41% did not do any sport. 59% of them were women and 41% – men. The following research methods were used: inquiry-questionnaire (GHQ-12) and mathematical statistics. In data analysis Cronbach's alpha was stated, the dispersion analysis, factor analysis and correlation analysis were made. As a result it was concluded that GHQ-12 can be used in psychological research in Latvia, as the questionnaire has adequate validity (the Cronbach's alpha coefficient is 0.72) and the factorial validity indicators. GHQ-12 three factor structure ("Emotional condition", "Psychological distress", "Social function") is recognized as the most suitable. Mutual correlations ($p < 0.01$) were stated: "Place of residence" ($r = .260$) and "Combining studies and work" ($r = .180$) are weak and positive, but "Relation status" ($r = -.177$) correlates weakly and negatively with the factor "Emotional condition". A kind of sport correlates weakly and negatively with the factor "Psychological distress" ($r = -.140$). The results of the research differ from the ones obtained by other researchers.

Key words: GHQ-12, validity, factor structure, correlation analysis.

Introduction

General Health Questionnaire (GHQ) is widely used all over the world to state psychological load and overload, as well as general mental state (Werneke, Goldberg, Yalcin, Ustin, 2000). Various GHQ versions were used in practice including questionnaires of 12, 28, 30 and 60 questions. GHQ-12 is the most popular and shortest version of the inquiry which is often used as a means to state psychological stress (Winifield, Goldey, Winifield, Tiggemann, 1989). One, two and three factor structures of GHQ are described in the world practice.

The research carried out in New Zealand (Kalliath, O'Driscoll, Brough, 2004) involved 23 employees of different organizations (both males and females), aged 16 to 74. Participants were required to complete two confidential questionnaires, administered at a 3-month interval. A total of 691 respondents responded to the first questionnaire and 415 of them responded to the second questionnaire. The findings of this study confirmed that the GHQ-12 is not unidimensional. As a result of confirmatory factor analysis 2 factor model was recognized as the most suitable to characterize two dimensions of stress formation: „social dysfunction” and „anxiety/depression”.

A significant research, using GHQ-12, was carried out also in Japan (Doi, Minova, 2003). The study subjects were 1808 randomly selected Japanese adults aged 20 years and over. Participants were required to complete questionnaire. It was concluded that GHQ-12 results decreased with the respondents' age decreasing. The values of the Cronbach's alpha 0.83 of the male group and 0.85 of the female group showed sufficient scale validity. The factor analysis produces a two-factor solution for females. The first factor was designed as „psychological distress” (lose sleep over worry, constantly under strain, hardly overcome difficulties, feel depressed, lose confidence, think yourself worthless). The second factor was designed as „social dysfunction” ((not) concentrate, (not) play a useful part, (not) make decisions, (not) enjoy activities and (not) face up to problems). However, 3 factor structure was recognized as the most suitable for the male group. In the sample of Japanese men the question 12 was separated from the 2nd factor, forming the 3rd factor – „happiness”. This suggests that Japanese men may feel happy especially when they are aware of playing a useful part of their social or family life. The results of the research were similar to the ones obtained when researching industrial workers of Japan, as well as when researching militarists in Turkey. The results support 2 factor distribution for women and 3 factor distribution for men. Similar factor

distribution was obtained by researching young men in Italy (Doi, Minova, 2003).

In 2001 in Belgium Vanheule S. and Bogaerts S. researched GHQ-12 factorial structure with 9442 respondents aged 15-98. One questionnaire was given to the subjects. The authors of the research recognized 2 factor model as the most suitable (Vanheule, Bogaerts, 2005).

The Chinese version of GHQ-12 is widely used in Hong Kong to screen women during pregnancy and in the postnatal period. In the research GHQ-12 psychometric indicators of pregnant women in the 3rd trimester and in the postnatal period were analyzed using confirmatory factor analysis, linear regression analysis and stating of validity. In accordance with the above mentioned researches concerning the application of GHQ-12 during pregnancy period, a sufficient test validity using the Cronbach's alpha coefficient was stated for the Chinese GHQ-12 version however the retest results showed low test validity degree.

The factor structure of the GHQ-12 was extensively investigated and two- and three- factor models offered superior fit to the data compared to the presumed uni-dimensional structure (Ip, Martin, 2006).

In Japan in November 2002 GHQ-12 was applied to state mental health of basketball players in upper secondary school teams. In the research close correlation between “undertaking of responsibility” and “experienced stress” was stated (Kurokawa, Inoue, Oguri, Kato, Matsuoka, 2002).

In 2006 GHQ-12 inner validity and factor structure of 20-60 years old adult sample were tested in Latvia (n=200) for the first time.

As a result it was concluded that GHQ-12 can be used in psychological research in Latvia, as the questionnaire has adequate validity indicator (the Cronbach's alpha coefficient 0.77). GHQ-12 three factor structure was recognized as the most suitable: “psychological distress”, “social dysfunction” and „subjective welfare (Cekule, Kamerāde, Mūrniece, Reinfelds, Urbāns, Vazne, 2006). Similar to other researches, the place of the variables “feeling of happiness” and “concentration” in the factors differed a little in this research, what allowed us conclude that an additional research would be necessary with representative sample in order to make questionnaire factor structure more precise.

The aim of the study

The aim of the research was to state the psychometric indicators of the General Health Questionnaire-12 for the Latvian Academy of Sport Education student sample (N=225).

Material and methods

225 students aged 18 – 40 years of the Latvian Academy of Sport Education participated in the research including 41% of the 1st year students, 14% of the 2nd and 45% of the 3rd year students. 44% of the respondents were the representatives of the individual sports, 15% – of the team sports, but 41% did not do any sport. 59% of them were women and 41% – men.

All respondents anonymously filled out the GHQ-12. They were asked to evaluate how they are feeling and life during the last 2- 3 weeks, as well as to give the following information about themselves: gender, study course, a kind of sport, place of residence, occupation, relation status, present financial situation. The research was carried out in 2012. The inquiry and data collection were held anonymously in accordance with the Vienna Convention on Human Rights.

The following research methods were used: inquiry-questionnaire (GHQ-12) and mathematical statistics (in data analysis Cronbach's alpha was stated, the dispersion analysis, factor analysis and correlation analysis were made, Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity was used to determine research groups match with factor analysis).

Results

223 out of 225 filled out questionnaires were useful and appropriate for further analysis. As a result it was concluded that GHQ-12 as the questionnaire (n=223) has adequate validity indicator (the Cronbach's alpha coefficient is 0.72) (Tab. 1).

Table 1

GHQ-12 validity (LASE, n=223)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.724	.723	12

Research groups match with factor analysis was determined with Kaizer-Maijer-Olkin ($0,745 > 0,7$) and Bartlett's criterions ($p < 0,05$) (Tab. 2).

Table 2

Kaizer-Maijer-Olkin and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.745
Bartlett's Test of Sphericity	Approx. Chi-Square	629,964
	df	66
	Sig.	.000

Analyzing the initial and extracted eigenvalues, it was concluded that all components are adequate to make factor analysis, as each of the used variables explains sufficiently big part of dispersion to be used in further analysis (Tab. 3).

Table 3

Initial and extracted eigenvalues

	Initial	Extraction
Concentration on work to be done	1.000	.629
Effect of anxiety on sleep	1.000	.640
Awareness of oneself as a significant part of society	1.000	.315
Ability to make decisions	1.000	.553
Feeling stress	1.000	.629
Ability to overcome difficulties	1.000	.550
Joy of everyday activities	1.000	.457
Problem solving	1.000	.448
Feeling depressed	1.000	.676
Self-confidence	1.000	.616
Self-perception as an insignificant individual	1.000	.456
Feeling of happiness	1.000	.532

In the analysis of the obtained data, using the extraction method (Extraction Method: Principal Component Analyses), it was concluded that the component 1 explains 28.26%, the second component – 14.88% and the third component – 11.05%, in total they make 54% (Tab. 4). Thus, the results show that 3 factor structure can be extracted.

Table 4

Total Variance Explained

Component	Extraction Sums of Squared Loadings		Rotation Sums of Squared Loadings		
	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	28.259	28.259	2.645	22.039	22.039
2	14.876	43.135	2.179	18.162	40.201
3	11.049	54.184	1.678	13.983	54.184

In Figure 1 it is seen that only three factors has an eigenvalue which is bigger than one what affirms 3 factor structure.

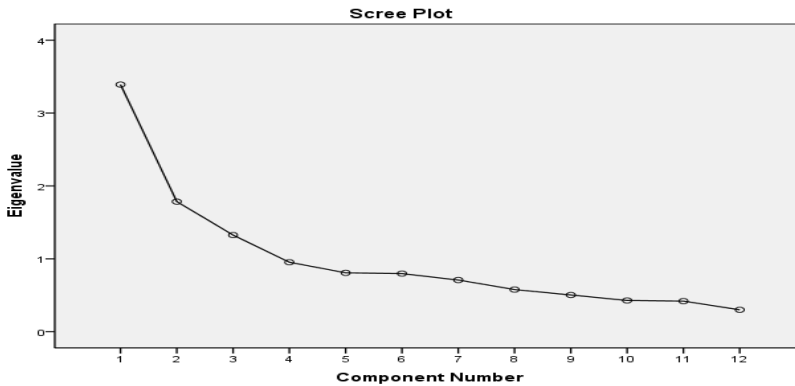


Figure 1. Point diagram

The extraction method was used in data analysis: principal component analyses and rotation method: varimax with Kaiser normalization. The factor structure has been acquired after the fifth rotation. Table 5 presents the correlation between variables and each of the factors.

Table 5

Factor rotation matrix

		Component		
		1	2	3
1.	Feeling depressed	.758	.305	.093
2.	Self-confidence	.755	.216	-.005
3.	Feeling of happiness	.669	.042	.287
4.	Self-perception as an insignificant individual	.669	.044	-.102
5.	Joy of everyday activities	.585	-.139	.309
6.	Effect of anxiety on sleep	.082	.795	.035
7.	Feeling stress	.138	.779	.061
8.	Ability to overcome difficulties	.191	.704	.131
9.	Awareness of oneself as a significant part of society	-.347	.424	-.123
10.	Ability to make decisions	.019	-.047	.742
11.	Concentration on work to be done	.285	.316	.669
12.	Problem solving	.038	.031	.668

When analyzing the obtained data it was concluded that “Feeling depressed” (.758), „Self-confidence” (.755) „Feeling of happiness” (.669), „Self-perception as an insignificant individual” (.669), „Joy of everyday activities” (.585) correlate positively with the first factor. This factor could be called „Emotional condition”.

„Effect of anxiety on sleep” (.795), „Feeling stress” (.779), „Ability to overcome difficulties” (.704), and „Being aware of oneself as a significant part of society” (.424) correlate positively with the second factor which is called by authors as “Psychological distress”. That is true that the last component has low score in the second factor (.424). Thus, it is a contraversial issue whether to include it in the “Psychological distress” factor.

„Ability to make decisions” (.742), „Concentration on work to be done” (.669) and „Problem solving” (.668) make the third factor „Social function”.

When making the Pearson correlation analysis, the obtained 3 factor interconnection with the following indicators: place of residence, kind of sport, combining studies and work and relation status was studied. The following statistically significant mutual correlations ($p < 0.01$) were stated: “Place of residence” ($r = .260$) and “Combining studies and work” ($r = .180$) are weak and positive, but “Relation status” ($r = -.177$) correlates weakly and negatively with the factor “Emotional condition”. A kind of sport correlates weakly and negatively with the factor “Psychological distress” ($r = -.140$).

Discussion

Comparing the obtained research results to the ones gained in other countries, we can conclude that unlike the research of New Zealand, Belgium and Japan, where 2 factor model was pointed out to be the most suitable, the authors have recognized 3 factor structure model as the most adequate in Latvia. Comparing the results of this research to the one done in Latvia in 2006 about GHQ-12 validity and factor structure of 20-60 years old adult sample in Latvia (Cekule, Kamerāde, Mūrniece, Reinfelde, Urbāns, Vazne, 2006), it can be concluded that, although 3 factor structure model was obtained in both researches, differences are observed. The authors of the carried out research obtained different component correlation with the factors (Tab. 6).

Table 6

Comparison of the component correlation with the factors
(2012 and 2006)

		Author research (2012)			Research of 2006		
		1	2	3	1	2	3
1.	Feeling depressed	.758			.658		
2.	Self-confidence	.755			.546	.586	
3.	Feeling of happiness	.669					.463
4.	Self-perception as an insignificant individual	.666				.629	
5.	Joy of everyday activities	.585					.710
6.	Effect of anxiety on sleep		.795		.708		
7.	Feeling stress		.779		.665		
8.	Ability to overcome difficulties		.704		.657		
9.	Awareness of oneself as a significant part of society		.424			.629	
10.	Ability to make decisions			.742		.641	
11.	Concentration on work to be done			.669			.772
12.	Problem solving			.668		.639	

Essential differences in question correlation in factors have been stated. In the authors' research the 9th question "Awareness of oneself as a significant part of society" correlation (0.424) is significantly lower than the one in the research of 2006 (0.629). At the same time the correlation coefficient of "Feeling of happiness" in the authors' research is 0.669, but in the results of the research of 2006 – 0.463. In the research of 2006 the 2nd question "Self-confidence" did not have a close mutual connection with some of the factors. However, in the authors' research the 2nd question closely correlates (0.755) with the 1st factor – "Emotional condition". In the authors' research the 9th question "Awareness of oneself as a significant part of society" has a lower correlation than other questions, what can be explained by the fact that students were the subjects of the research, they are aware of their identity and they are determined to reach their aims in sport and life in general.

Conclusions

GHQ-12 can be used in psychological research in sport environment in Latvia, as the questionnaire has adequate validity (the Cronbach's alpha coefficient is 0.72) and the factorial validity indicators.

GHQ-12 three factor structure ("Emotional condition", "Psychological distress", "Social function") is recognized as the most suitable. The first factor is „Emotional condition”, which includes the following components: „Feeling depressed” (.758), „Self-confidence” (.755) „Feeling of happiness” (.669), „Self-perception as an insignificant individual” (.669), „Joy of everyday activities” (.585). The second factor is „Psychological distress” including the components: „Effect of anxiety on sleep” (.795), „Feeling stress” (.779), „ Ability to overcome difficulties” (.704), and „Awareness of oneself as a significant part of society” (.424). The third factor is „Social function”, which is made of „Ability to make decisions” (.742), „ Concentration on work to be done” (.669) and „Problem solving” (.668).

Mutual correlations ($p < 0.01$) were stated: “Place of residence” ($r = .260$) and “Combining studies and work” ($r = .180$) are weak and positive, but “Relation status” ($r = -.177$) correlates weakly and negatively with the factor “Emotional condition”. A kind of sport correlates weakly and negatively with the factor “Psychological distress” ($r = -.140$).

References

1. Cekule, L., Kamerāde, D., Mūrniece, D., Reinfelds, S., Urbāns, I., & Vazne, Ž. (2006). General Health Questionnaire Reliability and Factor Structure in Latvia. *Theory for Practice in the Education of Contemporary Society*, 64-68.
2. Doi, Y., & Minova, M. (2003). Factor Structure of the 12-item General Health Questionnaire in the Japanese General Adult Population. *Psychiatry and Clinical Neurosciences*, 57, 379-383.
3. Ip, W.Y., & Martin, C.R. (2006). Psychometric Properties of the 12-item General Health Questionnaire (GHQ-12) in the Chinese Women During Pregnancy and in the Postnatal Period. *Psychology, Health & Medicine*, 11(1), 60-69.
4. Kalliath, T.J., O'Driscoll, M.P., & Brough, P. (2004). A Confirmatory Factor Analyses of General Health Questionnaire-12. *Stress and Health*, 20, 11-20.
5. Kurokawa, J., Inoue, M., Oguri, K., Kato, Y., & Matsuoka, T. (2005). Investigation of Stress Coping Mechanisms and Mental Health among

Basketball Club Members of a Girls' High School. *Japanese Journal of Clinical Sports Medicine*, Vol. 13 Issue 3, p 429, 10p.

6. Vanheule, S., & Bogaerts, S. (2005). Short Communication: The Factorial Structure of the GHQ-12. *Stress and Health*, 21,217-222.
7. Werneke, U., Goldberg, D., Yalcin, I., & Ustin, B. (2000). The Stability of the Factor Structure of the General Health Questionnaire. *Psychological medicine*, No 30,823-829.
8. Winefield, H.R., Goldey, R.D., Winefield, A.H., & Tiggemann, M. (1989). The General Health Questionnaire: Reliability and Validity for Australian Youth. *Australia and New Zealand Journal of Psychiatry*, 23, 53-58.

Submitted: April 17, 2013

Accepted: November 27, 2013

ORIGINAL RESEARCH PAPER

**ANAEROBIC POWER AND MUSCLE WORK CAPACITY
OF LITHUANIAN BASKETBALL PLAYERS****Rūtenis Paulauskas**

Lithuanian university of educational sciences,
Faculty of Sports and Health Education, Department of sport teaching, Studentų
str. 39, LT-08106 Vilnius Tel. +370 698 39079
Email: rutenis.paulauskas@leu.lt

Abstract

Basketball players need to repeat performance of highly intensive work for a particular time combining them with rest intervals. However, the anaerobic power and repetitive work capacity of players has not been extensively analysed all over the world. The aim of our study is to investigate anaerobic power and specific capacity of elite and young basketball players. Methods. During competition period the indicators of anaerobic power of basketball players were measured: vertical jump power, anaerobic alactic muscular power, anaerobic capacity of intermittent work. Laboratory 5x6 second repeat-effort test with rest intervals of 24 sec were employed. Results. A statistically significant difference was observed for absolute muscle power of elite and young basketball players in the first sprint ($p < 0.004$). The research on relative indicators for one kilogramme of the body mass showed that the power of elite (13.06W/kg) and young players (11.74W/kg) did not differ statistically ($p < 0.09$). The fatigue index investigated in both groups did not differ ($p < 0.77$). Conclusions. Vertical jump anaerobic power test showed that Lithuanian elite basketball players have higher jump but a longer contact time during the jump than young athletes. The research revealed that relative anaerobic alactic muscle power of elite basketball players did not differ from those of young (14y.o) and junior (17y.o.) athletes. The same anaerobic repetitive muscle work capacity was observed in both groups. It was established that the concentration of lactate in the blood increased after physical load and did not differ in all groups.

Keywords: anaerobic, power, fatigue, lactate, recovery, muscles.

Introduction

During the basketball game the duration of work may vary from a momentary throw or a pass to repetitive work that lasts for several hours. A player is referred to as possessing high endurance if he is able to demonstrate technical-tactical abilities and skills as well as physical possibilities during the match (Bompa, Haff, 2009). Muscular endurance is the capacity to sustain a static contraction or repeated muscle contractions (Wilmore et al., 2008)

Taking into account the content of basketball players', that is, duration and intensity of play actions (Trninic et al., 2000), proportions of breaks with work, emotional effect on the organism (Karipidis et al., 2001), the dominant role is assumed by repetitive work power and specific capacity (Hargreaves et al., 1992). This embraces an ability to cope with fatigue striving for achievement of best results under specific conditions of play (Mendes, Janeira, 2001).

Players need to repeat performance of highly intensive work for a particular time combining them with rest intervals. This is predetermined by the rules of the game: size of basketball court, duration of attack, duration of match, timeouts and other breaks during play (Krause et al., 2008). The biggest role is here played by the ability of the player's organism to recover fast (Buceta, 2000; Wissel, 2004). The situations, when players are given different time to play is characteristic of basketball (Carter et al., 2005). Such indicators as speed of recovery of energetic substances in muscles, functional power of circulatory and respiratory systems are among the most important indicators of basketball players' capacity (Foster et al., 1996; Kraemer, 2000). We have established that while playing basketball energy is generated resynthesizing ATP from PCr and from mixed energy source PCr - glycogen, without oxygen, i.e., working very intensively for a short period of time (Paulauskas et al., 2010). However, the anaerobic power and repetitive work capacity of players has not been extensively analysed all over the world. Being aware of repetitive work power and endurance, we could evaluate and more efficiently develop and train players.

The aim of our study is to investigate anaerobic power and specific capacity of elite and young basketball players and to carry out comparative analysis of indicators in these groups.

Material and methods

The sample included 3 groups of participants (Tab. 1). 14y.o. young basketball players (I gr.), who regularly train 4 times a week and play in school learners' competitions, 17 y.o. junior players (II gr.) who regularly

Table 1

The participants of the research

<i>Group</i>	<i>Participants</i>	<i>n=</i>	<i>Age (year)</i>	<i>Height</i>	<i>Body mass</i>
<i>I</i>	<i>Young players</i>	12	14.1±0.2	183.7 ±3,4	69.5±2.2
<i>II</i>	<i>Junior players</i>	15	16,5±0,7	193,7±8,5	82,1±13,1
<i>III</i>	<i>Elite players</i>	13	25,6 ± 0,6	195,9 ± 1,7	94,7 ±4,3

trained 6 times a week and play in Lithuanian junior basketball league and 25.6y.o elite basketball players (III gr.), who regularly train 8 times per week and play in competitions of Lithuanian Basketball League (LBL) and Baltic Basketball League (BBL) were researched.

The participants and their guardians where necessary were informed to the aims and procedures of the study before providing their written informed consent. The study was approved by Lithuanian Bioethics Committee, according to Resolution #30/2008.

During competition period the indicators of anaerobic power of basketball players were measured:

- Jump height with both legs and swinging with both hands, length of contact time and vertical jump power (Bosco et. al., 1983)
- Anaerobic alactic muscular power (AAMP) (Margaria et. al., 1966)
- Anaerobic capacity of intermittent work (AC). Laboratory 5x6 second repeat-effort test with rest intervals of 24 sec were employed (Ward, 1991; Fitzsimon et al., 1993). The veloergometer “*Monark Ergomedic 894 Ea*” was employed for this test. The average muscle power during each work interval was provided in watts (W) and fatigue index (FI) was calculated applying the formula: $FI (\%) = 100 - (P5 / P1 \times 100)$
- Three minutes after the physical load, the concentrate of lactate in the blood was measured applying the blood lactate test meter “Lactate Pro“.
- Psychomotor response time (PRT) to light stimulus was measured and 10-s Taping-test was used (Skernevičius ir kt., 2004).

All data were analysed using SPSS for Windows v. 14.0. The results were processed applying methods of descriptive statistics: *MEAN* value were calculated, dispersion was evaluated calculating standard deviation of sample (s) and according to coefficient of variation (CV), providing parameters (Min and Max) of dispersion area. Dispersion analysis (ANOVA) were used to compare the three groups. Statistical significance was set at $P < 0,05$.

Results

The study showed that young players and adult players in a single muscle contraction power were significantly different (Tab. 2).

Table 2

Anaerobic power and psychomotor functions of elite (III) , junior (II) and young (I) basketball players

Sample		Jump height (cm)	Contact time (mls)	Vertical jump power (W)	Vertical jump power (W/kg)	AAMP (W)	AAMP (W/kg)	PRT (mls)	MF (t/10s)
I group	Mean	46,3	195,9	1700,0	23,8	1051,9	14,8	176,5	87,8
	S	5,5	40,1	440,6	5,2	139,1	1,3	8,7	12,1
	CV%	11,9	20,5	25,8	21,8	13,2	8,8	4,9	13,7
II group	Mean	49,9	195,6	2076,1	25,6	1243,3	16,3	181,0	84,1
	S	7,0	29,0	425,0	5,4	394,9	1,4	18,6	11,1
	CV%	14,0	14,8	20,5	21,1	31,7	8,5	10,2	13,3
III group	Mean	56,7	213,6	2454,7	26,2	1610,0	17,2	165,8	85,8
	S	8,6	29,7	363,7	3,8	158,1	1,1	9,1	8,7
	CV%	15,2	13,6	14,8	14,5	9,8	6,4	5,5	10,1
P-value	I-II	<0,18	<0,5	<0,001	<0,43	<0,1	<0,01	<0,2	<0,16
	II-III	<0,025	<0,1	<0,025	<0,5	<0,025	<0,51	<0,001	<0,48
	I-III	<0,04	<0,32	<0,001	<0,26	<0,001	<0,001	<0,035	<0,5

It can be seen to have influenced by jump height and length of contact time. However, we see that all three groups of players differ only in the absolute vertical jump power. While the difference of relative vertical jump power is not statistically significant. This leads to the elite players is not large enough jump height (56.7cm) and a long contact time (213mls).

The first and second group of players AAMC differ insignificantly while in group II the absolute indicator of AAMC was statistically higher ($p < 0.01$). There are indications that the elite players absolute AAMC is higher than that of young players.

PRT is the best elite basketball players – 165.8mls, while the worst are young players – 181mls. Taping test showed no differences between the groups.

Average muscle power was highest during the first sprint and then gradually decreased in all groups. A statistically significant difference was observed for absolute muscle power of elite and young basketball players in the first sprint ($p < 0.004$) (Tab. 3). Significant dispersion of indicators was characteristic of three groups: coefficient of variation (CV) exceeded 20%.

Table 3

Anaerobic muscle power of elite (III), junior (II) and young (I) basketball players performing 5×6 sec repeat-effort test

Sample		1 sprint		2 sprint		3 sprint		4 sprint		5 sprint	
		W	W/kg	W	W/kg	W	W/kg	W	W/kg	W	W/kg
I group	Mean	816.00	11.74	770.83	11.09	752.75	10.81	763.75	10.94	739.08	10.59
	S	210.61	1.24	203.98	0.99	211.04	1.13	215.50	0.88	216.29	1.13
	CV%	25.81	10.52	26.46	8.91	28.04	10.43	28.22	8.07	29.26	10.66
II group	Mean	1060,07	12,78	1030,47	12,47	980,73	11,86	938,13	11,35	918,33	11,05
	S	280,77	1,66	235,80	1,20	233,64	1,19	220,94	1,08	237,42	1,16
	CV%	26,41	12,98	22,81	9,62	23,77	10,03	23,45	9,51	25,81	10,49
III group	Mean	1235.8	13.06	1207.08	12.78	1160	12.28	1144.2	12.11	1101.2	11.65
	S	289.08	2.37	264.24	2.22	272.77	2.33	265.58	2.21	249.15	2.04
	CV%	23.39	18.17	21.89	17.39	23.51	18.97	23.21	18.28	22.62	17.52
P-value	I-II	<0.025	0.10	<0.005	<0.001	<0.005	<0.005	<0.025	0.35	<0.025	0.36
	II-III	0,1	0,32	<0,05	0,4	<0,05	0,32	<0,025	0,15	<0,05	0,15
	I-III	<0.002	0.09	<0.0001	<0.015	<0.003	<0.05	<0.0006	0.07	<0.006	0.25

Note: CV – coefficient of variation

The research on relative indicators for one kg of the body mass showed that the power of elite (13.06W/kg) and young players (11.74W/kg) did not differ statistically ($p < 0.09$). The dispersion of indicators of young basketball players totaled 10.5%, junior players – 12.98%, whereas it amounted 18,2% in the group of elite basketball players.

The most significant difference in muscle power was recorded in I and II groups during the second work interval. The absolute indicators of higher performance basketball players were higher by 436.2W ($p < 0.0001$), the same tendency was observed in values of relative indicators, which were 1.7W/kg bigger in the group of elite players ($p < 0.02$).

Power indicators decreased at similar rate in all groups during the third, fourth and fifth work intervals. The absolute muscle power of elite basketball players remained statistically higher during these work intervals, whereas relative power did not differ. Dispersion of power indicators around the mean changed insignificantly in all the intervals of work.

Table 4 present values of muscle capacity. Evaluating repetitive work capacity, the difference between the first and fifth work interval was calculated. The absolute muscle power of elite basketball players totalled 128.2W and that of junior players was higher by – 13.51W while that of young athletes was lower by 76.9W. The difference between the I-III and I-

II groups was statistically significant. The fatigue index investigated in both groups did not differ.

After the physical load, the lactate concentration in the blood was measured, which was 9.1mmol/l in the group of young basketball players, whereas the lactate concentration in the blood of professional basketball players equalled 9.5mmol/l. No statistically significant difference was recorded in all three groups. As it can be seen from the results, very large dispersion about the mean $CV = 41.4\%$ was observed in the group of young players. Dispersion of these indicators in the group of professionals is smaller compared to the other group but it is still remains large ($CV = 25.5\%$).

Discussion

The study shows that elite players vertical jump power is higher due to the higher jump height. Other studies have shown that the NCAA DI (U.S.) players this rate can reach up to 69.9 cm, while NBA 68,5 cm (Hoffman, 2006). However, the negative is that an older Lithuanian player during the jump the length off contact time is the same as young players or even lower.

It is interesting to note that all three groups of players absolute single vertical jump power and anaerobic alactic muscle power are statistically different. While the relative, where to move only your body weight did not differ statistically between the groups (Villa, Vaquera, Rodríguez, 2009).

Hoffman (2006) argues that elite basketball player is an excellent result which aims to 21.97 W/kg, while our elite players, it was 17.2W/kg.

The study shows that during the 5x6 sec. test absolute indicators of muscle power are higher in the group of elite athletes compared to the same indicators of younger players (Fig. 1).

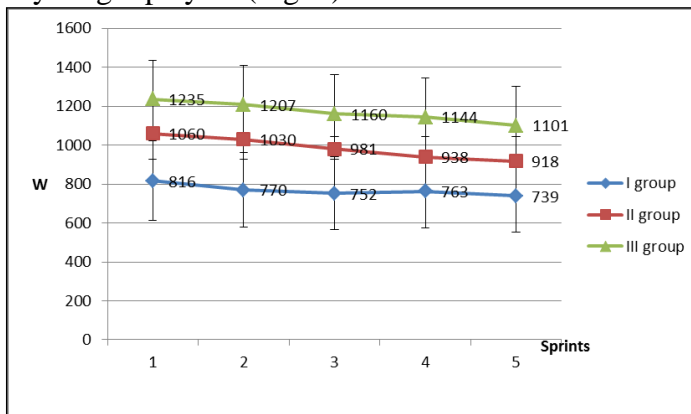


Figure 1. Change in absolute muscle power (W) of elite, junior and young basketball players performing 5×6 second repeat-effort test

However, differences in relative muscle power were observed only in the second work interval. This means that 14 year old players equal elite athletes in relative power of short muscle work. It can be stated that the average relative anaerobic alactic muscle power of professionally trained athletes is not sufficient. However, both relative and absolute anaerobic alactic muscles powers are significant because in play situations an athlete has to overcome not only power of own body gravity but also to cope with a personal contact with an opponent.

Ellis et al., (2000) point out that in game situations high average indicator is of utmost importance during all the five work intervals. Average relative muscle power of the researched elite basketball players equalled 12.4W/kg, and the average relative muscle power in the group of junior basketball players totalled 11.9W/kg, young players – 11W/kg (Fig. 2).

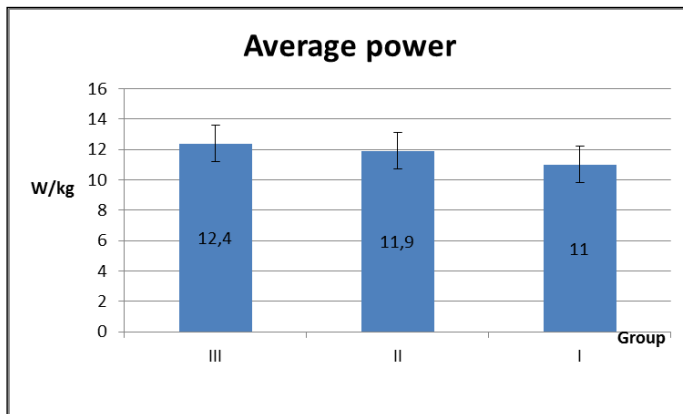


Figure 2. Average working power during 5×6 sec repeat-effort test of elite basketball players (III gr.), junior basketball players (II gr.) and young basketball players

Applying this test it was necessary to evaluate change in power of short muscle work under conditions of short recovery time. A decrease in work power is expressed through fatigue index (FI), whose lower value refers to better endurance of muscle power. Table 4 contains the fatigue index of anaerobic alactic muscle powers, which is particularly important for basketball and other sportive games. It can be seen that young players fall behind adult ones. Astrand and Rodahl (1986), Wilmore, Costill and Kenney (2008) point out that the prevailing duration of anaerobic alactic energy production reactions ranges from 6 to 10sec. Working at maximum

intensity for such a period, phosphocreatine (PCr) is enough resynthesising ATP.

Table 4

Muscle power decrement and fatigue index of elite basketball players (III), junior (II) and young players (I) between 1 and 5 as well as concentration of lactate in the blood

<i>Sample</i>		<i>1-5 sprints</i>			<i>La mmol/l</i>
		<i>W</i>	<i>W/kg</i>	<i>FI (%)</i>	
I group	Mean	76.92	1.15	9.74	9.12
	S	38.08	0.57	4.65	3.77
	CV%	49.51	49.79	47.77	41.40
II group	Mean	141.74	1.73	13.37	8,82
	S	52.31	0,61	4.36	3,97
	CV%	36,09	35.01	49,15	35,23
III group	Mean	128.23	1.35	10.11	9.48
	S	71.80	0.70	4.42	2.42
	CV%	55.99	52.33	43.77	25.52
<i>P-value</i>	<i>I-II</i>	<i><0,025</i>	<i>0,25</i>	<i>0,45</i>	<i>0,63</i>
	<i>II-III</i>	<i><0,5</i>	<i>0,15</i>	<i>0,89</i>	<i>0,67</i>
	<i>I-III</i>	<i><0.038</i>	<i>0.505</i>	<i>0.990</i>	<i>0.772</i>

According to the above mentioned authors, recovery depends on a big number of factors but the main processes occur within 1.5 – 3min. During the conducted research, the rest period between work intervals amounted 24 sec. Therefore, the main factor predetermining better capacity of anaerobic alactic muscle capacity could be a bigger reserve of PCr accumulated in muscles as well as higher activity of creatine-kinase (Kraemer, Ratamess, 2005).

The fatigue index has no significant differences in all three groups. Stapf (2000) states that good fatigue index of repetitive work capacity of elite Australian basketball player's equals 5%. The FI of elite basketball players in the research sample was 10.1%, similar to that of young players (9.7%) and junior (13.37%) (Fig. 3).

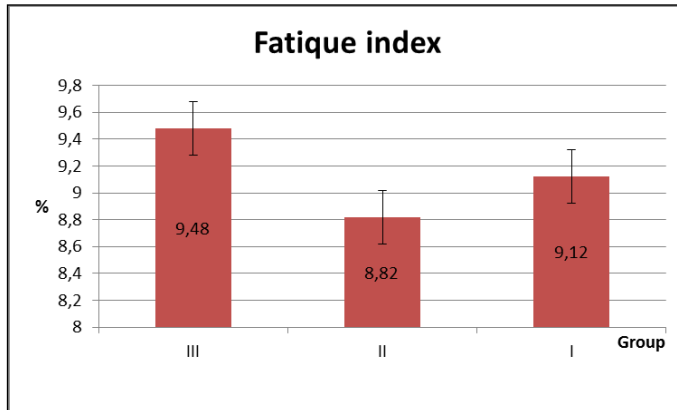


Figure 3. Fatigue index during repeat-effort test of elite basketball players (III gr.), junior basketball players (II gr.) and young basketball players (I)

Fatigue index is not correlated with a large number of indicators of physical development and physical fitness (Fitzsimons et al., 1993). Evaluating effect of repetitive work on activity of glycolytic reactions in muscles, the concentration of lactate in the blood was measured. The concentration in the blood of all the basketball players considerably exceeded lactate accumulation threshold (LAT) and was the same in all groups. This shows that the amount of PCr, which is necessary for ATP resynthesis, starts decreasing during repetitive work and the activity of anaerobic glycolytic reactions increases. However, the dispersion of indicators around the mean show that contribution of energy sources to capacity of repetitive work is very individual.

Conclusions

1. Vertical jump anaerobic power test showed that Lithuanian elite basketball players have higher jump but a longer contact time during the jump than young athletes. While jump height power of elite basketball players muscle is less than the world's elite players.
2. The research revealed that relative anaerobic alactic muscle power of elite basketball players did not differ from those of young (14y.o) and junior (17y.o.) athletes.
3. The same anaerobic repetitive muscle work capacity was observed in both groups.
4. It was established that the concentration of lactate in the blood increased after physical load and did not differ in the two groups.

References

1. Astrand, P., & Rodahl K. (1986). *Textbook of Work Physiology*. New York: McGraw Hill.
2. Bompa, T.O., & Haff, G. (2009). *Periodization: theory and methodology of training*. Champaign, IL: Human Kinetics.
3. Buceta, J.M. (2000). Planing Basketball Activities. *Basketball for young players*. Madrid: FIBA.
4. Carter, J. E. L., Ackland, T. R., Kerr, D. A., & Stappf, A. B. (2005). Somatotype and Size of Elite Female Basketball Player. *Journal of sport Sciences*, 23, 1057-1063.
5. Ellis, L., Gatin, P., Lawrence, S., Savame, B., Buckeridge, A., Stappf, A., Tumilty, D., Quinn, A., Woolford, S., & Young W. (2000). Protocols for the Physiological Assesment of Team Sport Players. In Ch., J. Gore (Ed.), *Physiological tests for elite atletes*. Australian sport comision. (p.p. 128-144). Champaign, IL: Human Kinetics
6. Fitszimons, M., Dawson, B., Ward, D., & Wilkinson, A. (1993). Cykling and Running Tests of Repeated Sprint Ability. *Australian Journal of Science and Medicine in Sport*, 25, 82-87.
7. Foster, C., Brackenbury, C., Moore, M., & Snyder, A. (1996). System of Sports Specific Performanfce Diagnosis and Monitoring of Training in Endurance Sports and Ball Games in the United States. *Deutche Zeitschrift fur Sportmedizin*, 45, 190 - 195.
8. Hargreaves, M., Meredith, I., & Jennings, G. L. (1992). Muscle Glycogen and Glucose Uptake During Exercise in Humans. *Experimental Physiology*, 77, 641-644.
9. Hoffman, J. (2006). *Norms for fitness, performance, and health*. Human Kinetics, Inc. Champaign, IL
10. Karipidis, A., Fotinakis, P., Taxildaris, K., & Fatouros, J. (2001). Factors Characterising a Successful Performance in Basketball. *Journal of Human Movement Studies*, 41, 385-397.
11. Krause, J. V., Meyer, D., & Meyer J. (2008). *Basketball skills and drills 3rd ed*. Champaign: IL, Human Kinetics.
12. Kraemer, W.J (2000). Physiological Adaptation to Anaerobic and Aerobic Endurance Training Programs. In T.R. Baechle (Ed.), *Essentials of strengths training and conditioning* (2nd ed.). Champaign, IL: Human Kinetics.
13. Kraemer, W.H, & Ratamess, N. A. (2005) Hormonal Responses and Adaptations to Resistance Exercise and Training. *Sports Medicine*, 35, 339-361.

14. Mendes, L., & Janeira, M. (2001). Basketball Performance - Multivariate Study in Portuguese Professional Male Basketball Teams. In Proceedings of Notational Analysis of Sport IV (pp. 103—111). Cardiff: UWIC.
15. Paulauskas, R., Skernevičius, J., & Paulauskienė, R. (2010). The Anaerobic Muscle Capacity of High Level Female Basketball Players and it Evaluation Scales. In J. Grants (Ed.), Poceedings of Physical Avtivity and Sport in Changing society: research, theory, practice and management.(p.p. 101-102). Riga, Latvia: Latvian Academy of Sport Education.
16. Stapff, A. (2000). Protocols for the Physiological Assesment of Basketball Players. . In Ch., J. Gore (Ed.), *Physiological tests for elite atletes* (p.p. 224-238). Champaign: IL, Human Kinetics.
17. Trninic, S., Dizdar, D., & Dezman, B. (2000). Empirical Verification of the Weighted System of Criteria for the Elite Basketball Players Quality Evaluation. *Collegium Antropologicum*, 24, 443-465.
18. Villa, J.G., Vaquera, A., & Rodríguez, J.A. (2009). Analysis and Energy Requirements in Basketball. Bases científicas para la salud y un óptimo rendimiento en baloncesto. Drobnic, F.; Puigdemívol, J. y Bové, T. Coord. Capitulo 2. 2009.
19. Ward, D. (1991). Laboratory Test of Repeated Effort Ability and its Relation to Aerobic Power, Anaerobic Power and Anaerobic Capacity. In Ch., J. Gore (Ed.), *Physiological tests for elite atletes* (p.p. 137-138). Champaign: IL, Human Kinetics.
20. Wilmore, J., Costill, D., & Kenney, W. (2008). *Physiology of sport and exercise*. Champaign: IL, Human Kinetics.
21. Wissel, H. (2004). *Basketball: steps to success*. Champaign: IL, Human Kinetics.

Submitted: March 4, 2013

Accepted: November 27, 2013

ORIGINAL RESEARCH PAPER

**AEROBIC AND ANAEROBIC CHARACTERISTICS IN
FEMALE AMATEUR LACROSSE PLAYERS IN
COMPARISON WITH UNTRAINED FEMALES**

Aija Kursīte, Inese Pontaga

LASE, Riga, Latvia
Latvan Academy of Sport Education,
Brivibas street 333, Riga, LV-1006, Latvia
Phone: +371 67543444, Fax: +371 76543480
e-mail: aija.kursite@lspa.lv, inese.pontaga@lspa.lv

Abstract

To achieve good results in lacrosse, the player need high muscles power, good agility and sufficiently high aerobic endurance. The aim of our investigation is to determine female lacrosse players' aerobic and anaerobic physical characteristics and compare them with the same characteristics in women control group. Twelve LASE/taxi Lady female amateur lacrosse team players (20 – 25 year olds) and 12 the same age untrained control group of healthy women participated in the investigation. The maximal height and power of the squat jump and the legs' muscles strength endurance during 30 second series of jumps are measured by Fitro Jumper (Slovakia). The absolute and relative maximum oxygen consumption is determined by indirect method performing the step load test on the cycle ergometer (Ergoline, Germany). The heart rate recovery after the load test is estimated. The absolute and relative maximal oxygen consumption is higher, but the heart rate recovery from the maximal value to its value after four minutes of cooling – down period in lacrosse players is faster than in untrained women ($p < 0.05$). The mean maximal vertical jump height and power are significantly greater in the group of players than in untrained women ($p < 0.05$). The difference between the mean strength endurance in 30s jumps series in the groups of athletes and untrained persons is none significant ($p > 0.05$). This can be explained by large variation of the results in both groups.

Key words: oxygen uptake, heart rate, arterial blood pressure, jump height, strength endurance, lacrosse, female

Introduction

Lacrosse is strenuous team sport game, an exhilarating mixture of basketball, soccer, and hockey (Gutowski & Rosene, 2011; Steinhagen, 1998). Therefore particularly relevant for athletes are rapid and variable intensity jogging, jump, powerful and accurate kick ball skills. To achieve good results, the player need high muscle power, good agility, and also sufficiently high aerobic endurance. Lacrosse is characterized by quick transitions, continuous physical activity, and bursts of high-intensity sprints (Enemark-Miller et al., 2009; Pistilli et al., 2008). It has been described as the fastest game on two feet and is one of the most strenuous team sports for women (Enemark-Miller et al., 2009; Steinhagen et al., 1998). Game play consists of long sprints up and down the field with abrupt starts and stops as well as precision passes and dodges, which is physically demanding for both the cardiovascular and musculoskeletal systems (Bruce et al, 1973; Enemark-Miller et al., 2009). Lacrosse athletes must have a high degree of hand-eye coordination, motor skill, agility, speed, strength, endurance, flexibility, and aerobic and anaerobic capacity (Steinhagen et al., 1998). From a physical fitness standpoint, lacrosse places a high demand on the oxidative capacity of participants; estimations have stated that 70% of energy consumption during lacrosse activity occurs through anaerobic pathways, while the remaining 30% occurs through aerobic pathways (Fox, 1984). Very large heart and slow heart rate at rest are not typical for sport games player, however aerobic endurance is necessary to maintain the performance during all the game. The high aerobic capacity of a player provides decrease of role of the anaerobic glycolysis in the energy supply of muscles and less amount of lactic acid accumulation in the body. It moves away onset of fatigue. Regular physical training causes a wide range of structural and morphological changes in the heart, which improves the blood ejection capabilities (Bovell et al. 1996). Ventricular myocardial hypertrophy, increase of heart cavities size and increased ventricular filling with blood during diastole determine the heart stroke volume increase at rest and during physical exercise, therefore maximum oxygen consumption increases.

The research topic was chosen based on the fact that preparation of sport game players often more emphasis is putted on sports specific or anaerobic capacity and technical preparation and little emphasis on aerobic capacity training. Coaches do not pay attention to the preparation stage of athletes' general physical fitness, but only on sports specific, which is representative for lower level teams. So we decided to compare anaerobic and aerobic characteristics in sport game athletes with at least two years

training experience and untrained women. The lacrosse players' physical characteristics are not investigated in wide scale in the research of other authors. Research describing the fitness profile of intercollegiate lacrosse athletes is limited (Enemark-Miller et al., 2009).

The aim of our investigation was to determine female lacrosse players' physical characteristics: maximal vertical jump height and power, the strength endurance of vertical jump series and aerobic capacity (maximal oxygen consumption and the heart rate and arterial blood pressure recovery after physical load test) and compare them with the same characteristics in women control group.

Material and methods

Subjects Twelve LASE / taxi Lady female amateur lacrosse team players (20 – 25 year olds) and 12 the same age untrained control group of healthy women participated in the investigation voluntary. Lacrosse players are trained three times per week and regularly participate in games in weekends. They had at least two years training experience in lacrosse. The physical activity level in untrained females was estimated by questionnaire and did not exceeded four hours per week.

The difference between the mean anthropometric characteristics in both groups of females was not statistically significant (Table 1). The body mass index was in norm in all females: in the borders of 19 – 25kg/m² (Mathews & Wagner, 2008). This means that groups are equal.

Table 1

Comparison of anthropometric characteristics in female lacrosse players and untrained women

Characteristic	Lacrosse players	Untrained women	Significance of difference
Age, years	22.2 ± 2.0	21.6 ± 2.0	None significant p = 0.455
Height in, cm	169.4 ± 3.0	169.7 ± 5.0	None significant p = 0.914
Body weight, kg	62.6 ± 6.0	66.1 ± 13.0	None significant p = 0.517
Body mass index, kg/m ²	22.6 ± 2.0	23.11 ± 3.0	None significant p = 0.722

Methods

The absolute and relative maximal oxygen consumption is determined using the indirect method (Siconolfi et al., 1982: modified Astrand & Ryhming test, 1977) by performing of dosed step load test on the cycle

ergometer (Ergoline, Germany) with the special arterial blood pressure measurement block (Ergoline, Germany). Astrand and Rodahl (1977) reported that the absolute maximal oxygen uptake estimated from the Astrand-Ryhming Nomogram (1954) underestimated the directly measured maximal oxygen uptake, when the values are low, but overestimated this value for well-trained athletes who have a high maximal oxygen uptake. Therefore the test can be useful for amateur level trained lacrosse players. The test load must be in the borders of heart rate from 120 to 170 beats per minute. This load intensity is aerobic. Therefore the relationships between the test load, heart rate and the oxygen uptake are linear. The rest heart rate must be determined in sitting athlete (measurement of pulsometer). If the rest heart rate exceeds 100 beats per minute, this athlete must be excluded from the test (the reasons of high heart rate may be increased body temperature, emotional stress etc.).

The athlete had to perform the load test on cycle ergometer, the test load increased step by step. This included three load steps. Duration of every step was six minutes. Test protocol for females: warming up load 49.0 W, duration two minutes; the first step load on the cycle ergometer was 73.5 W six minutes; the second step load 98.0 W six minutes; the third step load 122.5 W six minutes. Recovery (cooling-down) load was 25 W four minutes.

The athlete's heart rate must be determined in the end of every step load. Taking into account load intensity on cycle ergometer and the heart rate in the end of this load step, the maximal oxygen consumption (VO_{2max}) can be estimated from the nomogram. Three maximal oxygen uptake values (in the end of every load step) were obtained. The average value of the absolute maximal oxygen consumption was calculated. The average value of the absolute maximal oxygen consumption must be multiplied by the "age factor" to correct it in dependence on the age of athlete. This factor is 1.0 for young people (age 20 -30 years). The relative maximal oxygen uptake must be calculated dividing VO_{2max} by the body mass: $Rel.VO_{2max} (ml / kg \cdot min.) = VO_{2max} (l/min.) \cdot 1000 / m (kg)$; where m- athlete's body mass in kilograms.

The heart rate is monitored at rest, during the load test and four minutes during cooling – down exercises. The arterial blood pressure is measured every three minutes during all test and cooling – down period.

Research included the measurement of maximal height and power of the squat jump. The squat jump is performed from the standing position and before to jumping squat is performed until the knee is flexed approximately to 90° and hands on hips. The highest jump from five is taken into account.

The FiTRO Jumper (Fitro, Slovakia) consisting of a special contact switch mattress connected by means of a special interface to a computer is used for jump characteristics measurement (Zemkova & Hamar, 2005). The maximal jump's height in cm and the relative power of it in W/kg are estimated. The legs' muscles strength endurance is determined during 30sec series of jumps on the mattress by determining the jump height diminishing in percentages of the maximal jump height: expressed as a ratio of power decline $(P_{max} - P_{min} / P_{max}) \cdot 100 \%$ are calculated.

The mean values and standard deviations are calculated for all determined characteristics in female lacrosse players and untrained women. The significance of differences between the mean values of two females groups is determined by *t* - test for non equal groups. The differences are considered to be statistically significant at $p < 0.05$. The SPSS version 20 programs were used for statistical analysis of the data.

Results

The mean absolute and relative maximal oxygen consumption was significantly greater in the female lacrosse players in comparison with these characteristics in the untrained females, Table 2.

Table 2

Comparison of physical characteristics in female lacrosse players and untrained women

<i>Aerobic and anaerobic characteristics</i>	<i>Lacrosse players</i>	<i>Untrained women</i>	<i>Significance of difference</i>
Absolute maximal oxygen consumption, l/min.	2.69 ± 0,42	2.21 ± 0,27	Significant p = 0.003
Relative maximal oxygen consumption, ml / kg·min	43 ± 4	34 ± 6	Significant p = 0.001
Maximal heart rate during the load test, beats per minute	165 ± 3	168 ± 2	None significant p = 0.310
Recovery of heart rate during four minutes cooling – down period after the load test in comparison with the maximal heart rate in the test,%	69 ± 3	73 ± 4	Significant p = 0.005
Maximal arterial blood pressure during the load test, mm Hg	164/ 89	178/ 98	Significant p = 0.019
Arterial blood pressure four minutes after exercise test, mm Hg	130/ 70	140/ 80	None significant p = 0.516
Maximal vertical jump height, cm	23.5 ± 4.0	19.1 ± 3.2	Significant p = 0.01
Maximal mean power developed in vertical jump test, W / kg	16 ± 5	11 ± 1	Significant p = 0.007
Fatigue index in strength endurance test of 30 s vertical jumps series, %	70 ± 13	63 ± 12	None significant p = 0.207

Recovery of the heart rate from its maximal value during the test to the cooling-down period of four minutes was faster in lacrosse players than in untrained persons. The mean arterial blood pressure after four minutes of recovery time returned to normal rest values in lacrosse players, as well as, untrained females.

The mean maximal vertical jump height and the mean jump power were significantly higher in lacrosse players in comparison with the control group females, Table 2. The mean fatigue index differences in the trained and untrained female groups were not significant, which can be explained by large variation of the results in both groups.

Discussion

The anthropometric characteristics of our female lacrosse players (the mean height 169.4 ± 3.0 cm, body mass - 62.6 ± 6.0 kg and the mean body mass index - 22.6 ± 2.0 kg/m²) are similar with the data of other investigators. The participants in the study of Enemark-Miller et al. (2009) were 163.2 ± 25.6 cm tall and weighed 64.7 ± 9.6 kg. Descriptive statistics of Vescovi et al. (2007) showed the mean height of female lacrosse players - 168.3 ± 5.9 cm and body mass - 64.7 ± 6.9 kg. The Division I female players weighted more for approximately two kilograms in comparison with our players. This is possible to explain by increased muscle mass that is associated with improved athletic performance in Division I female players in comparison with our amateur level players.

Results of other authors (Enemark-Miller et al., 2009; Vescovi et al., 2007) showed that lacrosse players were above average for most tests when compared to normative data. For a population of women ages 18 - 25, the relative maximal oxygen consumption's score between 38 and 41 ml/ kg · min. is considered "average" aerobic fitness (Wood, 2012). The mean relative oxygen consumption in our females control group (34.0 ± 6.0 ml/ kg · min.) is slightly lower in comparison with these score values.

Fitness characteristics of lacrosse players are found to be similar to those previously found in women's basketball and soccer players. For example, the mean relative oxygen consumption in female soccer players from data of different researchers varies from 38.6 to 57.6 ml/ kg · min (Stolen et al., 2005). The mean relative oxygen consumption in our amateur female lacrosse players (43.0 ± 4.0 ml/ kg · min) is in this range. Our data are in good agreement with this characteristic in lacrosse athletes included Division I female players 45.7 ± 4.9 ml/ kg · min. (Enemark-Miller, Seegmiller, & Rana, 2009) and 46.8 ± 4.4 ml/ kg · min. (Vescovi, Brown, & Murray, 2007).

Anaerobic vertical power can be measured effectively with the vertical jump test (Gutowski & Rosene, 2011). Muscular power and explosiveness rely on both - the force produced and the magnitude, or speed, of the movement (Peterson et al., 2006). Peterson et al. (2006) found a positive correlation between lower body strength and measures of lower body muscular power, such as the vertical jump. Lacrosse players in the other authors study (Enemark-Miller et al., 2009) exhibited significantly higher countermovement jump scores of 44.0 ± 6.2 cm, measured by the distance between the height of the highest vane touched and standing vertical touch in comparison with normal vertical jump results for college-aged females based on activity level: 20 – 36cm for sedentary individuals and 38 - 39cm for recreational athletes. Using a countermovement jump, Vescovi et al. (2007) estimated the vertical jump scores of female lacrosse players to be 0.0 ± 5.6 cm. Maryland females intercollegiate lacrosse team average countermovement jump height was 39.6 ± 6.4 cm (Schmidt M.N. et al., 1981). The maximal vertical squat jump with the hands on the hips in our amateur lacrosse players (23.5 ± 4.0 cm) is significantly higher than in untrained females (19.1 ± 3.2 cm). Due to different methods of measurement and kinds of jumps these results are not comparable with the data of Enemark-Miller et al. (2009). Nevertheless to this, seems that vertical explosive power of our players is low in comparison with the female lacrosse players from Division I because the mean squat jump height of our players is twice lower than the countermovement jump height in the USA and Australian Division I teams' athletes. Lacrosse does not directly involve extensive jumping, such as is seen in basketball, but because the vertical jump test has been shown to be a reliable measure of explosiveness, it is expected that similar scores will be measured due to the explosive movements required in lacrosse. Our data can be used to create and improve strength and power training programs of female lacrosse players.

Conclusions

1. The absolute and relative maximal oxygen consumption, as well as, the heart rate recovery from the maximal value to its value after four minutes of cooling – down period in lacrosse players is significantly higher in comparison with untrained women ($p < 0.05$). These data confirm that training in lacrosse during two years period reliably increases players' aerobic capacity.
2. The mean maximal vertical jump height and power are also significantly greater in the group of players than in untrained women

($p < 0.05$). This means that training in lacrosse reliably increases players' power characteristics.

3. The difference between the mean strength endurance in 30 s jumps series in the groups of athletes and untrained persons is none significant ($p > 0.05$). This can be explained by large variation of the results in both groups. The recommendation for the coach of LASE/ taxi Lady female amateur lacrosse team is to emphasize the strength and power exercises in this training program.

References

1. Astrand, P.O., & Rodahl, K. (1977). *Textbook of Work Physiology. Physiologic Bases of Exercise*, 2nd Edition. (pp.349 – 353). New York: McGraw-Hill Book Co., USA.
2. Bovell, D., Nimmo, M. & Wood, L. (1996). Exercise. In: D. L. Bowell (Ed.) *Principles of Physiology. A Scientific Foundation of Physiotherapy* (pp.185-223). WB Saunders Company Ltd, United Kingdom.
3. Bruce, R.A., Kusumi, F., & Hosmer, D. (1973). Maximal Oxygen Intake and Nomographic Assessment of Functional Aerobic Impairment in Cardiovascular Disease. *American Heart Journal*, 85, 545–572. DOI: org/10.1016/0002-8703 (73)90502-4
4. Enemark-Miller, E. A., Seegmiller, J. G., & Rana, S. R. (2009). Physiological Profile of Women's Lacrosse Players. *The Journal of Strength and Conditioning Research*, 23 (1), 39-43. DOI: 10.1519/JSC.0b013e318185f07c
5. Fox, E. L. (1984). *Sports Physiology*. Philadelphia: Saunders.
6. Gutowski, A. E. & Rosene, J. M. (2011). Preseason Performance Testing Battery for Men's Lacrosse. *Strength and Conditioning Journal*, 33 (2), 16-22. DOI: 10.1519/SSC.0b013e318208cb04
7. Mathews, E.M., & Wagner, D.R. (2008). Prevalence of Overweight and Obesity in Collegiate American Football Players by Position, *Journal of American College of Health*, 57 (1), 33–38. DOI: 10.3200/JACH.57.1.33-38
8. Peterson, M. D., Alvar, B. A., & Rhea, M. R. (2006). The Contribution of Maximal Force Production to Explosive Movement Among Young Collegiate Athletes. *Journal of Strength and Conditioning Research*, 20 (4), 867-873. PMID: 17194245
9. Pistilli, E. E., Ginther, G. & Larsen, J. (2008). Sport-specific Strength-training Exercises for the Sport of Lacrosse. *Strength and Conditioning Journal*, 30 (4), 31-38. DOI: 10.1519/SSC.0b013e31817d1cf7

10. Schmidt, M. N., Gray, P., & Tyler, S. (1981). Selected Fitness Parameters of College Female Lacrosse Players. *Journal of Sports Medicine*, 21, 282–290. PMID: 7321560
11. Siconolfi, S. F., Cullinane, E. M., Carleton, R. A., & Thompson, P. D. (1982). Assessing VO₂max in Epidemiologic Studies: Modification of the Astrand Rhyming test. *Medicine and Science in Sports and Exercise*, 14 (5), 335 – 338. PMID: 7154887
12. Steinhagen, M. R., Meyers, M. C., Howard, H. E., Noble, L. & Richardson, M. T. (1998). Physiological Profile of College Club-sport Lacrosse Athletes. *Journal of Strength and Conditioning Research*, 12 (4), 226-231.
13. Stolen, T., Chamari, K., Castagna, C., & Wisloff, U. (2005). Physiology of Soccer. An Update. *Sports Medicine*, 35 (6), 501-536. DOI: 0112-1642/05/0006-0501/\$34.95/0
14. Vescovi, J. D., Brown, T. D., & Murray, T. M. (2007). Descriptive Characteristics of NCAA Division I Women Lacrosse Players. *Journal of Science and Medicine in Sport*, 10 (5), 334-340. PMID: 16962826
15. Wood, R. (2012). VO₂ max norms. Retrieved April 12, 2012, from Topend Sports: <http://www.topendsports.com/testing/vo2norms.htm>
16. Zemkova, E., & Hamar, D. (2005). Jump Ergometer in Sport Performance Testing. *Acta Universitatis Palacki., Olomuc., Gymn.*, 35 (1), 7 – 16.

Submitted: April 2, 2013
Accepted: November 27, 2013

CURRENT NEWS



Latvian Academy of Sport Education

*LASE 6th PhD and Master Student Scientific Conference
"Theory and Practice in Sport Science"*
March 27, 2014 Riga, Latvia

LASE International Scientific Conference in Sport Science
April 10, 2014 Riga, Latvia

LASE 66th Student Scientific Conference
June 5, 2014 Riga, Latvia

The official languages of the Conferences for oral and poster presentations are Latvian and English. The information is placed on the website: www.lspa.lv



OSRESS 2014

Outdoor Sports and Recreation Education Summer School 2014
Outdoor Games from the Historical Perspective in Latvia

September 4-11, 2014 Madona, Latvia

Organizers: Latvian Academy of Sport Education and Latvian Association of Outdoor Education and Recreation **in collaboration with** Jozef Pilsudski University of Physical Education in Warsaw, Faculty of PE in Biala Podlaska, Poland, State College of Computer Science and Business Administration in Lomza, Poland, Swedish School of Sport and Health Science, Sweden and University of Malaga, Spain.

GUIDELINES FOR CONTRIBUTORS

Instruction to Authors

The **LASE Journal of Sport Science** is a journal of published manuscripts in English from various fields of sport science. It covers the following types of papers:

- ✓ *original research papers* (maximum 12 standard pages of typescript, including tables, figures, references and abstract),
- ✓ *review papers* commissioned by the Editor (maximum 20 standard pages of typescript, including documentation),
- ✓ *short communications* (maximum 3 standard pages of typescript plus two table or figure and up to 5 references),
- ✓ *letters to the Editor* delivering an opinion or a comment to published manuscripts (maximum 2 standard pages of typescripts),
- ✓ *current news* (information on conference, abstracts of PhD. theses and Post-Doc. theses, book reviews, biographical notes),
- ✓ *advertisements* that may be covered on separate pages of the journal (prices are subjects to individual negotiations).

Papers must be accompanied by the following submission letter (form available at journal's website), signed by all Authors: "The undersigned Authors transfer the ownership of copyright to the **LASE Journal of Sport Science** should their work be published in this journal. Authors state that the article is original, has not been submitted for publication in other journals and has not already been published except in abstract form, preliminary report or thesis. Authors state that they are responsible for the research that they have carried out and designed; that they have participated in drafting and revising the manuscript submitted, which they approve in its contents. Authors also state that the reported article (if it involves human experiments) has been approved by the appropriate ethical committee and was undertaken in compliance with The Helsinki Declaration."

Research papers and short communications will be sent anonymously to two reviewers. Depending on the reviewers' opinion, the Editors will make a decision on their acceptance or rejection. The Editors' decision is ultimate.

Manuscript specification

Articles must be submitted in English and only to the **LASE Journal of Sport Science**.

Authors should observe the ethics of manuscript preparation (avoiding duplicate publication, inaccuracy of citations, fraudulent publication, plagiarism and self-plagiarism).

Copyright will be owned by the publisher: **LASE Journal of Sport Science**. A properly completed Transfer of Copyright Agreement must be provided for each submitted manuscript. A form is available at journal website.

Authors are responsible for the factual accuracy of their papers, for obtaining permission to reproduce text or illustrations from other publications and for an ethical attitude regarding the persons mentioned in the manuscript.

Format

Document format – Microsoft Word 97-2003 or 2007.

Page format – 210x297 mm (A4). Text – single column (font Times New Roman, letter size 12 pt), line spacing – Single, paragraph alignment – Justified, left margin – 20mm, right margin – 20mm, bottom margin – 25mm.

Style

Papers must be written in a clear, concise style appropriate to an international readership. Familiar technical terms may be used without explanation. Acronyms and abbreviations are likely to need full presentation at least once.

Content

Research or project reports, case studies of practice, action research reports, and reports on teaching practice or techniques will be accepted.

Research reports should include a description of the practical application(s) of the ideas tested, while reports of teaching practice or techniques should contain an explanation of the theoretical foundation underlying the practice or technique in question.

Material in the form of illustrations or photos is welcomed. This material should be accompanied by text clearly setting out its philosophical or practical origins or implications. All material should be clearly referenced to its sources.

The manuscripts should be arranged as follows: title page, abstract and body text

Title page should contain: title of the paper, first and last names of authors with affiliation, first and last name of corresponding authors with postal address, telephone, fax and e-mail.

Abstract (up to 250 words) consisting of the following sections: justification and aim of the study, material and methods, results, conclusions, as well as 3-6 key words, should be provided before the body text.

Body text should be sectioned into: Introduction, Material and Methods, Results, Discussion, Conclusions, Acknowledgements (If necessary) and References. In articles of others types, the text should follow in a logical sequence and headings of its particular sections should reflect issues discussed therein.

Introduction – should be short and concise; it should introduce readers into research problems addressed in the study as well justify undertaking the research and specify its aim.

Material and methods – should describe the subject of the study (in the case of human subjects data should include their number, age, sex and any other typical characteristics) and methods applied in a sufficiently exhaustive way to enable readers to repeat the experiments or observations. For generally known methods only references should be given, whereas detailed descriptions are to be provided for new or substantially modified methods.

Results – should be presented in a logical sequence in the text, tables and figures. Data collated in table and figures should not be repeated in the text which should summarize the most important observations.

Discussion – should emphasize new or important aspects of experimental results and discuss their implications. Results of own studies are to be compared with findings described in the respective domestic and international references used by the Authors.

Conclusions – should be started in points or descriptively and should be logically connected with objectives stated in the *Introduction*. Statements and conclusions not derived from own observations should be avoided.

References – following instructions for Authors on References (APA style).

Citing in-text

Following artificial text shows different types of in-text citation:

Claessens (2010) found evidence that attention will be given to multi-compartment models, such as the 3-water, 3-mineral and 4-compartment models, to assess percentage of body fat. However, Raslanas, Petkus and Griškonis (2010) noted that Aerobic physical load of low intensity got 35.1 % of total trainings time. Research on physical loading also focused on

identifying the basis of many years' research of physical activity (Bytniewski et al. 2010). According to Ezerskis (2010), "... heavy physical loads had the undulating character depending on the dynamics of workloads..." (p. 71) yet girls are more ascertained that the Track & Field training helps to develop courage.

Instructions for Authors on References (APA style)

This document describes standards for preparing the references in the APA style. The following sections give detailed instructions on citing books, journal articles, newspaper articles, conference papers, theses, web pages and others.

Please provide all the required elements in the references to your paper. Please pay particular attention to spelling, capitalization and punctuation. Accuracy and completeness of references are the responsibilities of the author. Before submitting your article, please ensure you have checked your paper for any relevant references you may have missed.

A complete reference should give the reader enough information to find the relevant article. If the article/book has DOI number, the author should include it in the references. And most importantly, complete and correct references may allow automatic creation of active links by the MetaPress technology that we use for making the electronic version of our journal. Active reference linking is regarded as the greatest benefit of electronic publishing and it adds a lot of value to your publication.

Additional information about APA style writing is found on LASE web page: <http://www.lspa.lv/>.

Tables – should be prepared on separate pages (saved in separate files) and numbered using subsequent Arabic letters. They should be provided with titles (above). Every column in a table should have a brief heading and more extensive explanation should be given under the table, e.g. statistical measures of variability.

Figures – should be prepared in an electronic form and saved in separate files. A separate page should be provided with legends to figures, authors' names, manuscript's title, and consecutive number of figure with "bottom" or "top" identification. Photographs or other illustrative materials may be submitted in an electronic form (*.tif, *.jpg, image resolution: 300 or 600 dpi) or any other form suitable for final technical typesetting by the Editorial Office. In the appropriate places in the text consecutive numbers of tables or figures should be provided in parentheses, e.g. (Tab. 1) or (Fig. 1). Places of insertion of the illustrative material should be marked with pencil on the margin of the typescript.

General principles – the Editorial Office reserves for itself the right to correct stylistic errors and to make necessary changes (abridgements) in the text without Author's knowledge. Articles not accepted for publication are not returned. Manuscripts not prepared following *Instruction to Authors* will be sent back to Authors for revision. Galley proofs of manuscripts will be sent to Authors for proofreading. It is the Author's responsibility to return the proof within one week. Each Author will receive free-of-charge one copy of the issue in which their work appears.

Manuscripts are liable to copyright resulting from the Berne Convention for the Protection of Literary and Artistic Works and from the Universal Copyright Convention. Any part of the manuscript may be reproduced, archived nor transferred in any form without consent of the copyright owner.

Submission of manuscripts

The articles should be sent to:

Ilze Spike

E-mail: Ilze.Spike@lspa.lv

Reviewers of the articles on 2013

- Agita Ābele (Latvia)** PhD, Professor Latvian Academy of Sport Education
Miklos Banhidi (Hungary) PhD, Professor, University of West Hungary
Rolf Carlson (Sweden) PhD, Professor, Swedish School of Sport and Health Sciences
Algirdas Čepulėnas (Lithuania) PhD, Professor, Lithuanian Academy of Physical Education
Dmitriy Cherenkov (Russia) PhD, Assoc. Professor, Russian State University of Physical Education, Sport Youth and Tourism
Antonio Cicchella (Italy) PhD, Professor, University of Bologna
Leonīds Čupriks (Latvia) PhD, Professor, Latvian Academy of Sport Education
Andra Fernāte (Latvia) PhD, Assoc. Professor, Latvian Academy of Sport Education
Juris Grants (Latvia) PhD, Professor, Latvian Academy of Sport Education
Uldis Grāvītis (Latvia) PhD, Professor, Latvian Academy of Sport Education
Vello Hein (Estonia) PhD, Assoc. Professor, University of Tartu
Vladimir Issurin (Israel) PhD, Professor, Wingate Institute for Physical Education and Sport
Rasma Jansone (Latvia) PhD, Professor, Latvian Academy of Sport Education
Toivo Jürimäe (Estonia) PhD, Professor, University of Tartu
Ivars Kravalis (Latvia) PhD, Assoc. Professor, Latvian Academy of Sport Education
Jānis Lanka (Latvia) PhD, Professor, Latvian Academy of Sport Education
Artur Litviniuk (Poland) PhD, Assoc. Professor, Jozef Pilsudski Academy of Physical Education
Kazys Milasius (Lithuania) PhD, Professor, Vilnius Pedagogical University
Vahur Ööpik (Estonia) PhD, Professor, University of Tartu
Krzysztof Piech (Poland) PhD, Assoc. Professor, Jozef Pilsudski Academy of Physical Education
Inese Pontaga (Latvia) PhD, Professor, Latvian Academy of Sport Education
Inta Māra Rubana (Latvia) PhD, Professor, Latvian Academy of Sport Education
Nataliya Rubtsova (Russia) PhD, Assoc. Professor, Russian State University of Physical Education, Sport Youth and Tourism
Juozas Skernevičius (Lithuania) PhD, Professor, Lithuanian University of Educational Sciences
Jeļena Solovjova (Latvia) PhD, Professor, Latvian Academy of Sport Education
Žermēna Vazne (Latvia) PhD, Assoc. Professor, Latvian Academy of Sport Education
Jānis Žīdens (Latvia) PhD, Professor, Latvian Academy of Sport Education