

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
Language Editor:
Ieva Rudzinska

Printed and bound: “Alemande”
Print Agency
Cover projects: Nauris Brikmanis
Address: 35-6 Stabu Street
Riga, LV1011, Latvia
Phone: +371 67292825
e-mail: info@alemande.lv
website: www.alemande.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
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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>



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ISSN 1691-7669 (ISO 3297)

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Publisher's note

Dear Friends,

Welcome to the second annual edition of the *LASE Journal of Sport Science* in 2012. Every year the Latvian Academy of Sport Education (LASE) issues two editions of the Journal.

The second edition of the Journal 2012 comprises three main parts. The first part includes original research papers where young sport scientists together with host or abroad university supervisors present their original research in sport science. In the second part there are review papers which focus on practical issues of different sport science topics as didactics, management, sport policy, etc. A short communication part gives an insight on books published by LASE professors in English or Latvian with reviews by host or abroad university colleagues. At the same time we are proud of LASE new sport scientists who have defended their PhD theses in the International Promotion Council in Sport Science. Also it is a small but important part to inform society about immediate international conferences, equipment exhibitions in sport science or summer schools.

Within the framework of the Baltic Sport Science Society a new scientific journal *Baltic Journal of Sport Sciences* has been created. The first issue of the Journal will be published in 2013. The publisher is Lithuanian Sport University (Lithuania) with its publishing partners: the University of Tarty (Estonia), Latvian Academy of Sport Education (Latvia) and Lithuanian University of Educational Sciences (Lithuania). The aim of the new Journal is to improve and strengthen sport science in the Baltic States, in Europe and the world, as well as to promote better cooperation among sport universities in the Baltic region.

I express my deepest gratitude to the authors and reviewers of the manuscript and to the International Journal Publishing Commission for their great job in the preparation of the two editions of our Journal in 2012.

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

ORIGINAL RESEARCH PAPER

POSSIBILITIES OF COACH PROFESSIONAL DIDACTIC COMPETENCE DEVELOPMENT IN FURTHER EDUCATION

Monta Jakovļeva, Jānis Žīdens, Andra Fernāte

Latvian Academy of Sport Education

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

Phone: +371 67799532

E-mail: monta.jakovleva@lspa.lv, janis.zidens@lspa.lv, andra.fernate@lspa.lv

Abstract

Current situation in sport development and sport labor market in Latvia and the European Union requires learning and improvement of coaches' professional qualification in the whole life time. The aim of the study is to state the possibilities of coach professional didactic competence development in further education in Latvia. 36 participants (sports coaches), involved in the professional development program "Development of the competence of pedagogues involved in vocational education" of ESF project "Competent sports pedagogue", took part in the study. The following methods were applied: theoretical methods – the analysis of scientific literature, the analysis of education documents; empirical methods - coaches' inquiry-video observation, self-assessment of competence; data processing methods - for qualitative data processing: coding, metacoding, cluster analysis (Jaccard similarity coefficient) and interpretation implementing QSR NVivo9 software. In the framework of the research the criteria for the evaluation of coach professional didactic competence are developed, as well as its definition is formulated, coach lifelong education factors are shown as value to be taken into account when working out professional development programs. The cluster analysis enabled the creation of five groups, characterizing professional activity didactic competencies and manifesting the need for the improvement of professional didactic competence in the framework of further education.

Key words: *coach, further education, professional competence, professional didactic competence*

Introduction

Educational processes are no longer perceived unambiguously. Education today is not only teaching and learning, but also includes lifelong learning, mobility, integration, further education, self-evaluation and other areas. To build democratic education area in contemporary Europe public accountability, ability to change and improve is necessary (Fjeld, 1998; Koçe, 2001).

Further education has its own specific features; it is aimed at meeting of professional, social and personal needs. The development of competence in all of these directions has emerged as the highest attainable goal in the lifelong learning in the 21st century. Coaches constantly should develop their knowledge and skills, because the need for continuous competence improvement is the necessity of the 21st century, determined by today's ever-changing environment and labor market requirements (Dyffy, Petrovic & Crespo, 2010).

In recent decade more and more academic courses focusing on sport training aspects are offered in coach further education at higher education institutions (Lyle, 2002). Some researchers (D. Mara & E. Mara, 2011) emphasize didactic activities in the development of professional competence. Didactic competence is also mentioned in the profession standard "Sport Coach", where it is characterized as the skill to orientate and act in nonstandard situations and conditions when running trainings. But in the profession standard "Senior Sports coach" special competences of professional activity include didactic activity, which is characterized as the skill to orientate and act in nonstandard situations and conditions when planning, organizing and evaluating teaching and learning.

The structure of coach professional didactic competence includes the integrated set of knowledge, skills and attitudes necessary to plan implement and evaluate activities in the training and competition (Lyle, 2002; Lemyre & Trudel, 2004; Bales, 2007; Cote & Gilbert, 2009; Duffy, 2008). Competence development in further education is determined by knowledge and skills integration (Baartman & Bruijn, 2011) in the socio-cultural learning organization system approach (Tiļļa, 2005).

The aim of the study is to state the possibilities of coach professional didactic competence development in further education in Latvia.

Research questions:

1. What is coach professional didactic competence?
2. What are coach professional didactic competences?
3. How is the development of coach professional didactic competence realized in further education?

Material and methods

In the study 36 sports coaches (aged 25 to 75 years, professional experience from 1 year to 30 and more years, gender – 18 females and 18 males), involved in the professional development program “Development of the competence of pedagogues involved in vocational education” of the ESF project “Competent sports pedagogue” voluntarily participated in the study. The coaches under the study were involved in 17 sports: volleyball, basketball, football, floor ball, ice-hockey, tennis, chess, draughts, cycling, Nordic skiing, track and field athletics, equestrian events, artistic gymnastics, karate, free style wrestling, swimming, fitness – 11 (35%) from sports games, and 20 (65%) from individual sports, 5 participants have not given their sport.

The applied research methods were as follows: the theoretical methods were the analysis of scientific literature and the analysis of education documents; the empirical methods: coaches’ inquiry-video observation, self-assessment of competence; data processing methods – for qualitative data processing: coding, metacoding, cluster analysis (Jaccard similarity coefficient) and interpretation implementing QSR NVivo9 software.

The documents discussing the problem of coach further education: “Law on Education”, “Law on Professional Education, Profession Standard” (Sport Coach, Senior Coach) etc. were investigated and analyzed with the help of document analysis method.

In the process of further education video materials were obtained with the method of observation. In qualitative research video materials are used for the study of natural situations (Knoblauch, 2004). Footage was treated with QSR NVivo 9 software, developing codes according to the criteria for the evaluation of coach professional didactic competence (planning, organization, conducting and assessment of structural components).

Self-assessment of competence was given for completion to 36 coaches. Researching and analyzing competence self-assessments resulted in the establishment of the groups characterizing coach professional activity and working out the description of professional activity skills (how and in what situations the skill is applied) of each coach group. The results of qualitative data are based on the statistics, allowing assessing the statistical significance of the observed phenomena. Coding was carried out when analyzing the data. Qualitative data are used to study

coach professional activity in characteristic groups. The created dendograms are based on Jaccard's index, also known as the Jaccard's similarity coefficient used for the comparison of similar and diverse sample sets.

Results

1. What is coach professional didactic competence?

Taking into consideration the specifics of coach professional activity and levels of education qualification, according to some researchers (Bales, 2007; Duffy, 2008) of competence structuring theory and the qualification levels of the European Qualifications Framework (EQF) for Lifelong Learning, three levels for stating coach competence, evaluable on people activity level in definite situation have been established:

1. Professional activity in unfamiliar situations.
2. Professional activity in predictable situations.
3. Professional activity in predictable situations with the help of other specialists.

In the system of coach competence development researchers emphasize the main activities, tasks and competences necessary in professional activity.

According to various scientist (Lyle, 2002; Lemyre & Trudel, 2004; Bales, 2007; Cote & Gilbert, 2009; Duffy, 2008) insights the possibilities of the development of coach professional didactic competence within the framework of further education are defined, which includes competence in a number of scientific areas.

Coach professional didactic competence is the ability to set the aims of education, choose the appropriate methods to reach them, the ability to connect the aims of education with the means for reaching them and learning methods, the ability to identify and analyze pedagogical problems, the ability to strategically and analytically formulate the foundations of the workouts in definite situations, the ability to analyze learning situations, identifying their causes and solutions, the ability to conduct the educational process (for the development of learner and self-development), the ability to understand and operate in non-standard situations and circumstances, in the spheres of planning, organizing, conducting and assessing training work.

Considering the theory of competence structuring (Bales, 2007; Duffy, 2008) and taking as the foundation socio-cultural learning organization approach (Tiĵla, 2005) and the levels of the European Qualifications Framework (EQF) for Lifelong Learning, criteria are developed (Fig. 1.) for the assessment of professional didactic competence, consisting of coach professional activity in four structural components:

planning, organization, management and assessment, in which each of the components is characterized by three performance levels in definite situations.

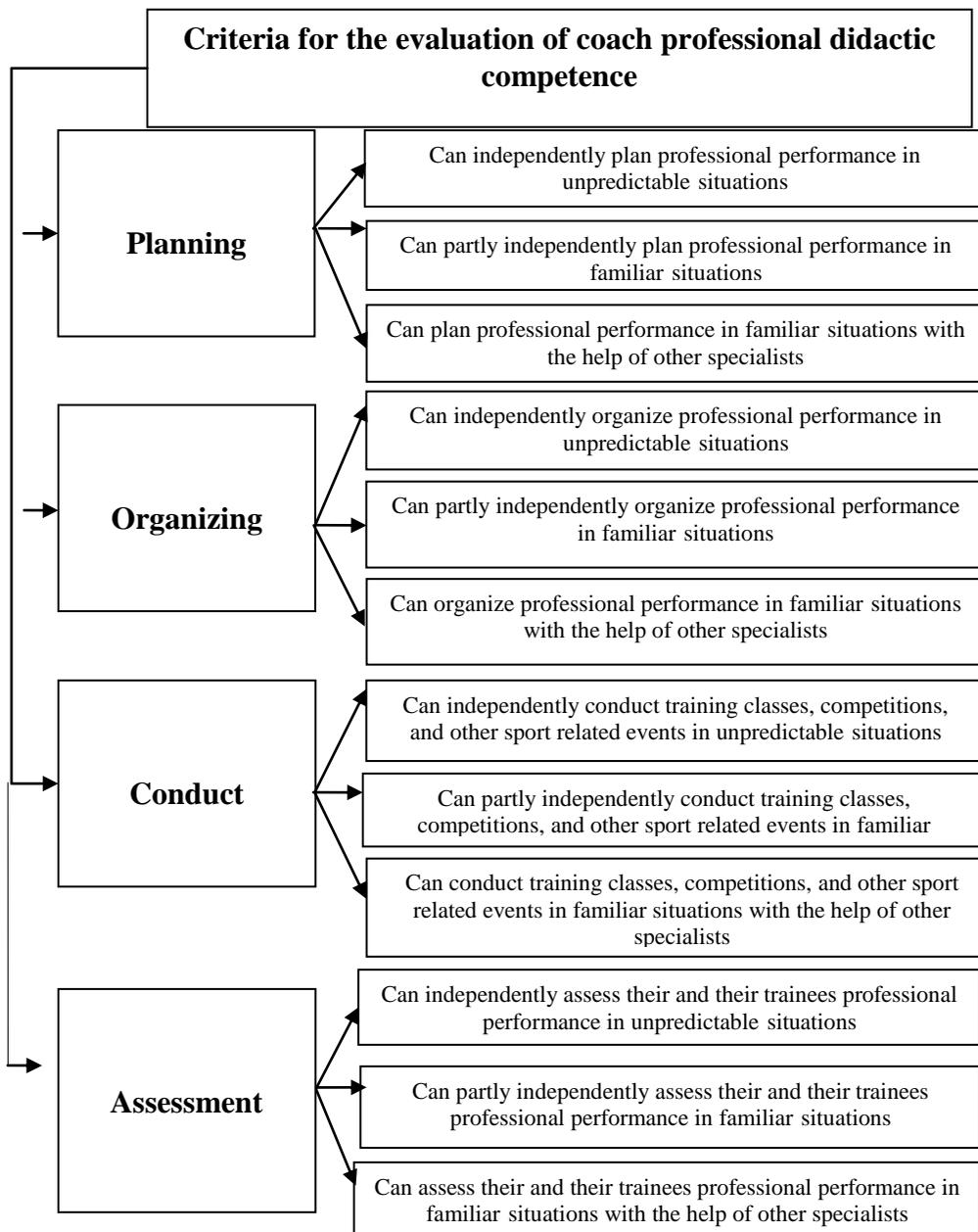


Figure 1. Criteria for the evaluation of coach professional didactic competence

2. What are coach professional didactic competences?

Five groups, characterizing coach professional performance, indicating the needs for the development of coach professional didactic competence in the framework of further education were distinguished: „*independent planner, organizer, assessor*”, „*independent planner, organizer, program developer*”, „*independent planner*”, „*independent program developer*” and „*independent assessor*”.

Group I: coach – „*independent planner, organizer, assessor*” (work experience of 4 – 6 years; place of residence – not indicated; sport: sports games).

Coaches' professional knowledge in further education develops independently, searching for information on the Internet and regularly attending various seminars.

Professional activities of a coach:

- independently plans and implements professional programs appropriate to the kind of sport;
- in collaboration with other sport specialists works out conception, program, appropriate to their kind of sport;
- organization of cooperation in professional activity is carried out partly independently, in which also other sports specialists are involved. Competitions are organized and conducted together;
- independently organizes and conducts training classes;
- independently assesses the athletes and their activities, as well as the results of the competition.

Coaches' abilities: can independently plan, organize, and assess the training and competitions.

Required development of professional didactic competence - the ability to develop training programs should be improved.

Group II: coach – „*independent planner, organizer, program developer*” (work experience 30 and more years; living – in different regions of Latvia; sport – not specified).

Coaches' professional knowledge in further education develops partly independently, searching for information in newspapers, sports magazines, as well as exchanging information and experience with other coaches.

Coaches attend seminars, organized by other sports specialists.

Professional activities of a coach:

- independently plans and implements the professional program, appropriate to their sport;

- independently creates and conducts concepts, programs, appropriate to his sport;
- independently organizes and conducts training sessions and competitions;
- partly-independently and with the support of other specialists assesses athletes and their professional activity, which is analyzed according to athletes results in competitions and tests.

Coaches' abilities – can independently plan, organize, and develop a training program.

Required development of professional didactic competence – the ability to assess the athletes and their activities, as well as the results of the competition should be improved.

Group III: coach – „*independent planner*” (work experience: 30 and more years; place of residence: different regions of Latvia; sport: individual).

The improvement of coach professional knowledge occurs with the help of other specialists.

Professional activities of a coach:

- independently plans and implements professional long-term program appropriate to their sport;
- creates concepts and conducts programs, appropriate to their sport both independently and in collaboration with other sports professionals;
- with other specialists, according to athletes' age and ability organizes and manages training activities;
- the organization of cooperation in professional activity with other specialists, mostly in the framework of seminars;
- partly-independently, as well as inviting other sport specialists assesses athletes and their activities. Competition results are analyzed with the help of video materials.

Coach abilities – can plan independently the training and competitions.

Required development of professional didactic competence – the ability to organize, conduct the training and competitions and assess the athletes and their activities, as well as the results of the competition, should be improved.

Group IV: coach – „*independent program developer*” (work experience: 7 – 18 years; place of residence: not specified; sport: not specified).

Coaches independently improve their professional knowledge. Professional activities of a coach:

- independently and in collaboration with other sport professionals plans and implements professional programs, appropriate to their sport;
- independently creates concepts and conducts programs appropriate to their sport;
- the organization of cooperation in their professional activity is partly independent, through consultations with other coaches;
- partly independently assesses their and athlete professional activity.

Coaches' abilities – can independently develop training programs.

Required development of professional didactic competence: the ability to plan, organizes, conducts the training and competitions and assesses the athletes and their activities, as well as the results of the competition, should be improved.

Group V: coach – „*independent assessor*”:

- 1) (work experience of 19 – 30 years; place of residence Riga; sport: sports games);

Coaches improve professional knowledge partly independently, exchanging information with the other coaches. Professional activities of a coach:

- partly independently plans and carries out professional program, appropriate to their kind of sport
 - together with other sport specialists creates concept and makes program appropriate to their kind of sport;
 - independently assesses their athletes and their own performance in accordance with the results in the competitions.
- 2) (work experience of 1 – 3 years; place of residence – different regions of Latvia; sport: not specified).

Coaches improve professional knowledge partly independently. Professional activities of a coach:

- plans and implements professional programs, appropriate to their kind of sport both independently and with the help of other specialists (in consultations with coaches, administration);
- creates concepts, makes programs appropriate to their kind of sport with the help of other specialists (sports specialists, executives of sport federations);
- organizes and conducts training sessions both independently and with other specialists; organizes cooperation in professional activity partially independently. Organizes competitions with the help of other coaches.

Coaches' abilities – can independently assess the athletes and their activities, as well as the results of the competition.

Required development of professional didactic competence – the ability to plan, organize and conduct training programs should be improved.

3. How is the development of coach professional didactic competence realized in further education?

In order to evaluate the learning situations in the process of further education, video observations were carried out, in the evaluation process of which five theoretically-practical activities of the further education seminar (in the framework of the professional development program “Development of the competence of pedagogues involved in vocational education” of the ESF project "Competent sports pedagogue") were analyzed.

According to socio-cultural learning organization system theory (Tijlla, 2005) learning situations were observed and coach knowledge acquisition and skills development were determined. Observation was carried out in the framework of II professional direction sports specialist integrated practical activity module. In the evaluation of the observations emphasis was laid on coach activity (in theoretical and practical parts of the seminar) in acquiring knowledge and improving skills.

Taking as the foundation learning theories (Rogers, 1969; Knowles, 1980; Lieģeniece 2002; Maslo, 2003; Tijlla, 2005), the learning situations, identifying coach knowledge acquisition, skills and competences development were observed.

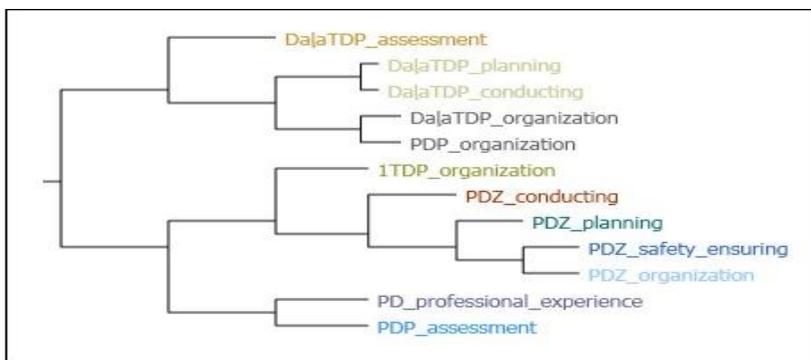


Figure 2. The dendrogram for summarizing video materials of five theoretically-practical activities of the further education seminar

The conclusion can be drawn that, summarizing all 5 five theoretically-practical activities of the further education seminar video fragments (Fig.2), it was observed that knowledge provision dominates,

organized and planned by a lecturer (*Jaccard's Coefficient* = 0.57, $p < 0.05$), but less was observed dynamic coaching skill development; such learning situations do not contribute to the development of professional didactic competence:

1. relations were observed between the outlay of pedagogue professional experience and assessment of skills with one coach skill demonstration and knowledge in planning, provided by the pedagogue (*Jaccard's coefficient* = 0.28, $p < 0.05$), in conducting classes (*Jaccard's coefficient* = 0.16, $p < 0.05$) in organizing (*Jaccard's coefficient* = 0.16, $p < 0.05$) and in securing safety (*Jaccard's coefficient* = 0.5, $p < 0.05$).

2. relations were observed between coach partial involvement in skill demonstration and pedagogue providing knowledge in organizing skills (*Jaccard's coefficient* = 0.75, $p < 0.05$), in conducting classes (*Jaccard's coefficient* = 0.33, $p < 0.05$), in planning (*Jaccard's coefficient* = 0.2, $p < 0.05$) and in assessment (*Jaccard's coefficient* = 0.2, $p < 0.05$).

Discussion

Results from this study reflected that coaches have limited possibilities of coach professional didactic competence development in further education in Latvia, as the aims of further education programs are directed towards the further development of professional competences, but in practice teaching predominates, proved by the research results of video observation. For example, an educator mostly teaches, but not facilitates coach learning by working together with coaches in workgroups and looking for the answers on problem questions. Thus coach knowledge and skills are not integrated, but knowledge and skill integration is the precondition of the development of professional didactic competences.

The research adds to the understanding about coach professional didactic competence when acting in unfamiliar situations. In TiĶļa understanding competence as a result is manifested at the level of human being in a definite situation (TiĶļa, 2005). Jorgensen sees the grounds for the concept of *competence* in the importance of social and cultural progress, which puts very high demands on the assessment, analyzing and choosing skills and the ability to act adequately in new and unfamiliar situations. Competence becomes an expression of skill that enables people to manage and operate in social and cultural diversity, and it is developed during studies (Eichorst, 1998). The evaluation criteria of the coach professional didactic competence are grounded also on research of foreign scientists (Bloom, 1997; Santos, Mesquita, Graca & Rosado, 2010) where coaches' sport specific knowledge is emphasized related to the ability to plan and

organize activities in professional activity. Two main fields of knowledge are evaluated:

1. knowledge about training methodology (planning, management, evaluation of the training activity and competitions);
2. knowledge about coach education and management, related to learning and the ability to create effective learning environment (Lemyre, 2004).

Profession standards describe competences as the indicators of the achievement, while achievement scores describe the behavior, manifested in terms of knowledge, skills and attitudes. Taking into account results obtained and taking as the foundation scientific theories about the integration of knowledge and skills (Baartman & Bruijn, 2011), about the structuring of coach competence (Duffy, 2008; Bales, 2007), about socio-cultural approach to the system of learning organization (Tilja, 2005) scientifically substantiated criteria for the evaluation of coach professional didactic competence in the framework of further education are worked out.

To provide the possibilities of coach professional didactic competence development in further education all stakeholders: coaches, educators, employers and social partners should involve in the development of coach further education programs. The development of these programs would be based on the improvement of professional didactic competence necessary for coaches. The change of conceptions about teaching and learning is necessary when organizing the coach professional didactic competence development and it requires changes in coach further education environment, study methods and forms.

Conclusions

1. Investigating scientific insights of competence structuring theories (Bales, 2007; Duffy, 2008), four theoretically substantiated criteria have been worked out for evaluating professional didactic competence: planning competence, organizational competence, conducting competence, assessment competence, which characterize the need for the development of professional didactic competence in various learning situations:

1.1. If a coach in predictable situations with the help of other specialists can plan and organize his professional activities, form a conception and program appropriate to his kind of sport, conduct sport related activities, and assess his own and his athletes performance, he meets the requirements for the first level of professional didactic competence.

1.2. If a coach in predictable situations can partly independently plan and organize his professional activities, form a conception and program

appropriate to his kind of sport, assess his own and his trainee performance, he meets the requirements for the second level of professional didactic competence.

1.3. *If a coach in unpredictable situations can independently plan and organize his professional activities, form a conception and program appropriate to his kind of sport, assess his own and his trainee performance, he meets the requirements for the third level of professional didactic competence.*

1.4. *Evaluating coach performance, the characteristics of professional didactic competence and the development opportunities of the necessary professional didactic competence in the framework of further education can be determined.*

2. Coach self-assessment cluster analysis suggests that in further education five groups can be distinguished, characterizing coach professional performance, which indicate the needs for the development of coach professional didactic competence in the framework of further education.

2.1. Group I: coach – „independent planner, organizer, assessor”. Professional didactic competence to be developed: the ability to develop programs.

2.2. Group II: coach – „independent planner, organizer, program developer”. Professional didactic competence to be developed: the ability to assess athletes and their own professional performance.

2.3. Group III: coach – „independent planner”. Professional didactic competence to be developed: the ability to organize and conduct training sessions and competitions, assess athletes and their own professional performance.

2.4. Group IV: coach – „independent program developer”. Professional didactic competence to be developed: the ability to plan training process, conduct training sessions and competitions, assess athletes and their own professional performance.

2.5. Group V: coach – „independent assessor”. Professional didactic competence to be developed: the ability to plan training process develops programs, organize and conduct training sessions and competitions.

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INVESTING IN YOUR FUTURE



Submitted: November 22, 2012

Accepted: December 3, 2012

ORIGINAL RESEARCH PAPER

**INFLUENCE OF PARENTS' PHYSICAL ACTIVITY ON
THE LEVEL OF PHYSICAL ACTIVITY OF FAMILY
MEMBERS ON EXAMPLE OF THE GRAND PRIX
ROUND OF SOUTH-EAST POLAND RUNNING
COMPETITIONS**

Krzysztof Piech, Aneta Michałowska

Faculty of Physical Education and Sport in Biała Podlaska
University of Physical Education in Warsaw
Address: 2 Akademicka Street, 21-500 Biała Podlaska, Poland
Phone: + 48607381070
E-mail: krzysztofpiech@wp.pl

Abstract

Involvement in physical activity depends on various factors. Great importance is given to the influence of the family and other environments surrounding the man. Family creates an appropriate educational atmosphere directing human on specific actions. In undertaking research on the running events participants, it was decided to see how physically active parents affect the activity of other members of the family. In this work the method of diagnostic survey using a questionnaire was used. The participants of the running events gathered in the Grand Prix of South-East Poland in the year 2007 – 2008 were analyzed, however, results only from those who have a family with children were used. Research has shown that the participation of one of the family members in the running events motivate other family members to take an interest in physical activity. Family welcomes the interest in running one of its members. This is reflected in the fact that they are trying to support, admire, and enjoy the runner's success. What is more, running is a frequent topic of conversations at home or meeting with friends. Respondents also have a photographic documentation of their participations in running events. This is also an element that encourages to physical activity not only family, but also friends and acquaintances.

Key words: *physical activity, family, children*

Introduction

In recent years a lot of negative phenomena related to participation of children and young people in physical activity are observed. Particularly disturbing is the fact that non-participation in physical education classes is increasing. In recent years, condition of sport and recreation facilities is improving as well as the level of knowledge of teachers educated at universities. There is an increase in the possibilities of attracting young people to physical activity by increasing diversity, and knowledge about the health and educational benefits of getting involved in sport is growing. Nevertheless, we cannot take advantage of all these achievements and greater draw children and young people's attention to this phenomenon and practical involvement.

A large role in changing young people's attitudes to exercise can play in family and school, and especially the physical education teacher cooperation with parents. The role of the teacher is to present the student the unlimited possibilities and use of various forms of physical activity that can be used throughout life. Moving on the ground his family free time positive behaviors learned at school is the responsibility of the parents' former students. The role of the family cannot be here replaced by other institutions. The research undertaken in the field of physical activity in family generally concerns the impact of parents' physical activity on children's physical activity.

It is emphasized that the more active parents are their children have a better chance of a similar lifestyle in the future Drabik (1995), Bois & Sarrazin (2006), Pawlak (1998), Dempsey, Kimiecik & Horn (1993). It is also stressed that the family is the basic educational environment that cannot be replaced by any institutions (Wolańska, 1994). Although parents with older children can lose their parental authority to a teacher or a peer group, patterns of spending free time learned from the family home are permanent. Another problem that occurs much less frequently in the study of the family is the problem of the impact of children's physical activity on physical activity in family. This applies mainly to families with young children. This phenomenon is described in the work of Staniszewski (2007), Iannotti (2005), Piech (2004, 2011), Inta Bula-Biteniece (2011), and Birontiene (2012). In these studies, it is clear that the child especially in preschool can be a great animator of physical activity in the family. However, it is still a little studied phenomenon. In times of crisis there is a need for family studies of physical activity in the family, because as mentioned by the American Association for Leisure and Recreation, "the family that plays together is permanent."

Aim of the work and research questions:

The object of this interest is participation in street racing gathered in the Grand Prix of South-Eastern Poland. It was decided to examine whether it is a correct offer that meets the expectations of the participants and that motivates the rest of the family to undertake physical activity. The overall objective of the work prompts to put forward the following research questions:

1. What were the motives of practicing running and taking part in running competitions?
2. How other family members refer to the interest of the runner?
3. Do participation in running events and practicing running motivates other family members to engage in physical activity?
4. What brings to life of the respondents practicing running and participating in running competitions?

Material and methods

In this work the method of diagnostic survey using a questionnaire was used. The participants of running events gathered in the Grand Prix of South-East Poland in the year 2007 – 2008 were analyzed, however, only those who have a family with children. The questionnaire that was used in the study contains 50 questions, including 11 additional questions.

The questionnaire was distributed at the time of entry to the list of participants starting in the race. Time for a peaceful and anonymous questionnaire completion at home was provided. Collection of the questionnaires occurred during the next Grand Prix event. Studies included a total of 68 people, representing approximately 50% of all adult participants of Grand Prix running competitions. The Grand Prix of South-East Poland is a round of several running competitions at distances from 5 km to the half marathon. For research this Grand Prix was selected because in addition to the competitions for adults races over shorter distances for children are also included. This created an opportunity to participate in the running for both parents and their children. Individuals who participated in the study already have large training experience, and for many years participated in running events.

Results

Among those who have encouraged respondents to run were the parents and teachers of physical education. But the greatest impact had colleagues and friends (Fig. 1) Respondents in large part began to practice this form of physical activity after school so the high position of colleagues and friends is not surprising. During childhood the greatest impact on

forming leisure activities results from family, followed by school and in the subsequent years family and school losing its' influence and authority to the individual's peer group.

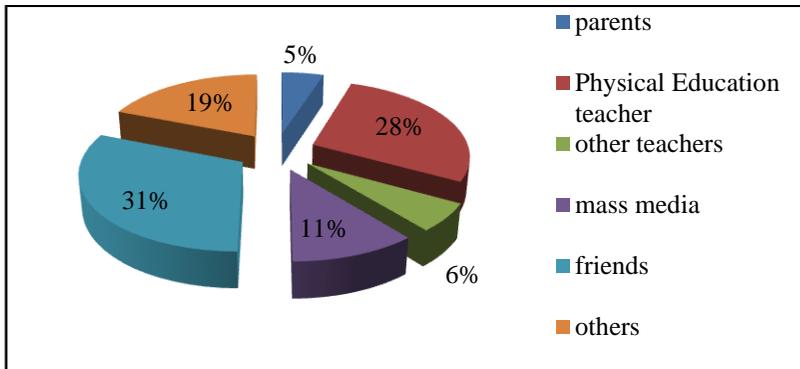


Figure 1. People encouraging individuals to practice running

Highly important is the fact that as many as 62% of respondents have a sports background. Frequently practiced disciplines are running and football. As it is seen formation of sporting habits in childhood has an impact on leisure behavior in later years. According to the survey 29% of respondents take an active part in events from 5 to 10 years, and 23% of respondents over 10 years (Fig. 2).

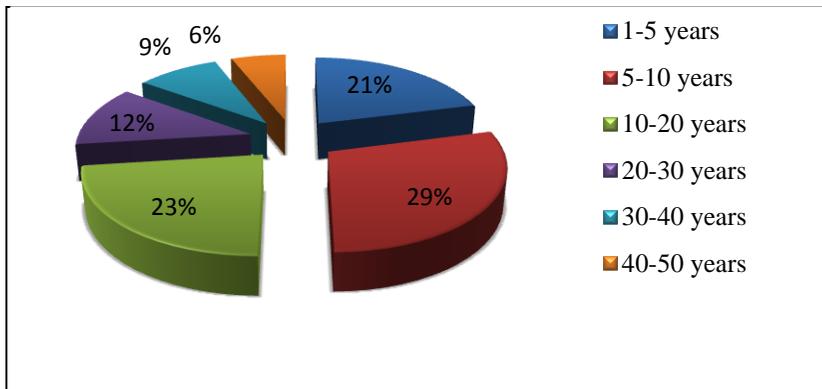


Figure 2. The period during which the subjects participated in running events

Running events in the Grand Prix already have a tradition and their organization is improving also the number of participants from year to year

increases. As a result more and more events are sponsored and adapted to the needs of the athletes, which is why the majority of respondents take part in them more than 10 times a year (Fig. 3).

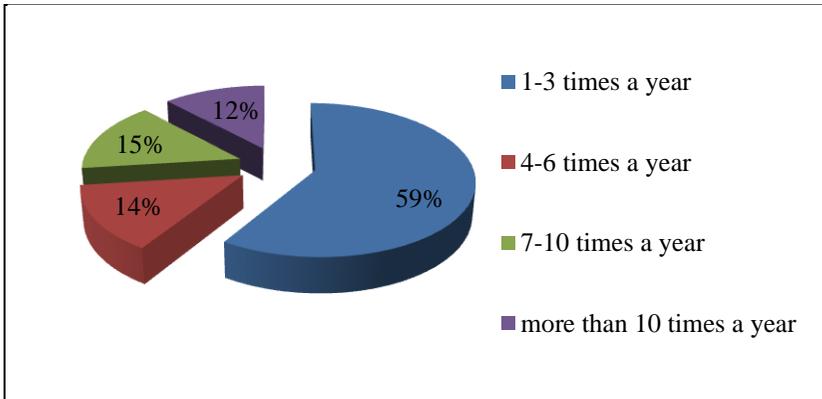


Figure 3. Frequency of participation in running events of the surveyed runners

Running races participants very often benefit from help and advice on training from his fellow runners. In addition, they also derive a lot of information of the numerous guides and books that help them prepare for the event (Fig. 4).

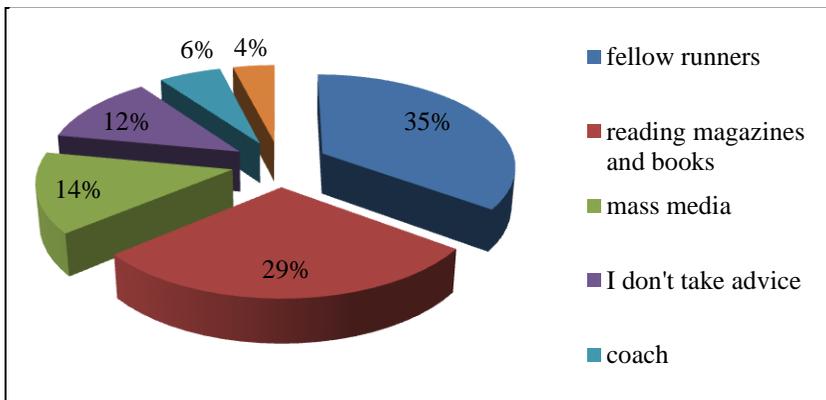


Figure 4. Sources of information on training methods

In conducting the study it was decided to see how participating in the Grand Prix events affects the activity of family members, especially their children.

The research shows that some members of the surveyed family especially children currently practiced physical activity (65%). The main physical activity disciplines that the male children were engaged in are football and running. Female children were primarily engaged in running and swimming as their choice for physical activity. Moreover, as the majority of respondents declared family members also go with them to the running events (67%). Most frequently they leave with their children. It can be said that the participation of fathers or mothers increases the willingness to participate in such events (Fig. 5).

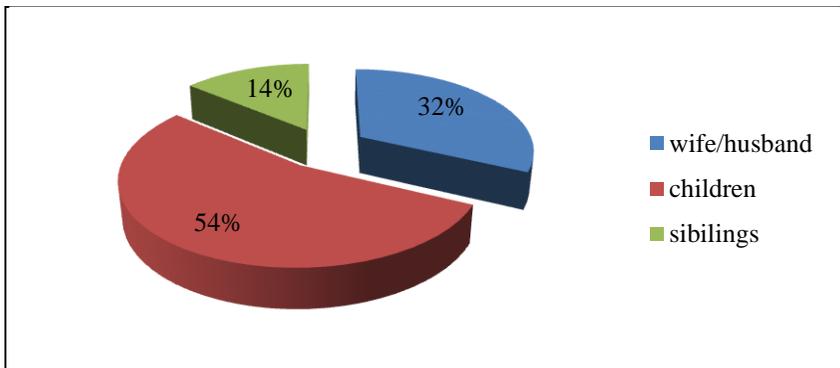


Figure 5. Participation of family members in joined trips to running events

However, looking at active participation in running events, it is seen that 38% of family members actively participate in these events (Tab. 1). The others are spectators.

Table 1

Participation in running events of family members of surveyed runners

Form of participation	Number of participants	Percentage (%)
Active participation	26	38%
Passive participation	42	62%

According to respondents, the family very positively relates to their love of running (91%). They are obviously aware of the benefits that come from running. This is shown by the fact that they support them, and experience with them their successes and failures, and above all, they are support, which they can always count on.

Practicing running makes respondents admired, supported and recognized by their friends; respondents seem to be very ambitious individuals who are able to overcome any adversity. Spouses, children and closest friends enjoy

every gained awards, cheer, support, and are frequently during the competition with them.

Running becomes an inseparable theme in the life of a runner; this is why the topic of running is discussed, both at home and during meetings with friends (Fig. 6).

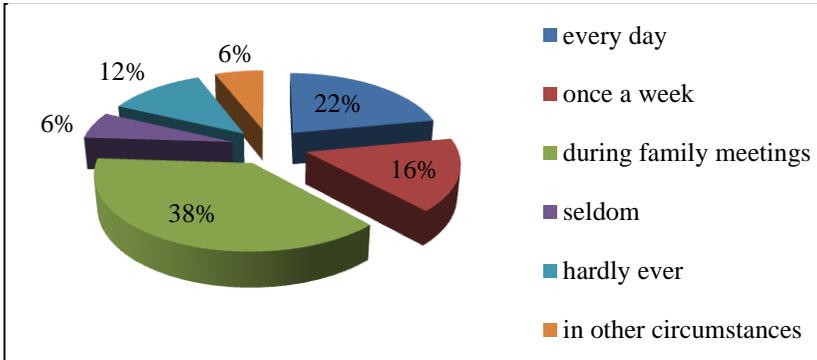


Figure 6. The frequency of talking about running

Family very warmly welcomes the running of one of the family members. In addition, this can be seen often by all members of the family who also take part in such events. In this way the family has a chance to spend a lot of time with each other and integrate.

Motives of taking part in physical activity are also interesting. In addition to health, which turned out to be the main motive a significant role also had: the rivalry with others, improving their performance, test their abilities, desire to win prizes, willingness to travel, make new acquaintance (Fig. 7).

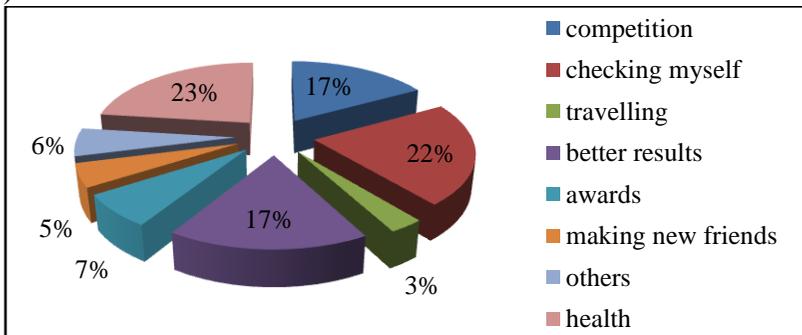


Figure 7. The most common reasons for taking part in the running events

Participants in running events reported that they gained a lot from running. Some people quickly and easily gain new acquaintance thus enlarging the circle of his friends and often stay friends for entire life. Moreover, many people learn about beautiful Polish south-east regions, which have interesting culture and natural beauty.

A lot of positive memories come from a number of running event pictures that are stored in family albums. According to research, 59% of respondents have such a photographic documentation at home. Photos are preserved for posterity and friends to be able to present their achievements in the future.

Discussion

Although there are voices that undermine the role of family in the education for instance Harris (1998), who say that everything that parents provide for the formation of a child's personality are genes, and the peer group completes the rest, but most scientists assigns family a leading role in this field. It was observed that children whose parents are active are more likely to an active lifestyle. They were six times more active than children of inactive parents. If mothers were only active then their children were twice more active than in families where the mothers were inactive. In the case of fathers activity relationship was even greater children were three and a half times more active in the families of active fathers (Moore, et al., 1991). The results show how important the issue is to provide leisure patterns from parents to children. This creates proper educational situations, builds parents authority in the eyes of children and integrates family. This should be taken into account when creating a concept for promotion of physical activity at different levels. The family should be regarded as an essential part of this system. This is an important issue because as Sas-Nowosielski (2009) research shows parents are not perceived by the surveyed young people as individuals leading an active lifestyle, do not take with them the exercise and give it a marginal place in family activities. Family education in this regard may stop this negative process. According to Sallis and Pate (2001), the stronger relationship between physical activity of parents and children can be expected when parents will not only encourage children to movement but will regularly take part in it together with the child.

Conclusions

1. The participation of one of the family members in the running events motivates other family members to take an interest in physical activity. This is reflected both in the joint running trips to events as spectators as well as the active participation in the events (67% of family

members go to event and 38% actively participate in them). This fact should be used for creating systems encouraging people to exercise.

2. Family welcomes the interest in running of one its members. This is reflected in the fact that they are trying to support, admire, and enjoy their successes. Running is a frequent topic of conversations at home or meeting with friends. It is also an element that encourages physical activity not only family, but also friends and acquaintances. Respondents also have a photographic documentation of their participations in running events.

3. Respondents point out that their interest in running arouses a positive public perception. Acquaintances and friends admire them, and are keenly interested in their achievements. This is also important to promote an active lifestyle.

4. An interesting and important is the fact that the participants of events do not focus only on running, but they do appreciate that through running they can visit an interesting region and they can make new friends. Cognitive element provides the additional value which physical activity gives the respondents. Such values should be encouraged at different stages of education. It is also important for family recreation and may encourage other family members to be active.

5. The element of competition which the participants emphasized is worth noting, although health was the most important, but the competition, improving the results and the desire to win prizes also has many supporters. It seems that it is necessary to create more similar situation when the participation is more important than excessive desire to sport. This may encourage more people to participate, those who, because of lower abilities are not participating in the events for fear of losing.

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Submitted: September 28, 2012

Accepted: December 3, 2012

ORIGINAL RESEARCH PAPER

**ATTITUDE OF SPORT STUDENTS AND EDUCATORS IN LATVIA
TOWARDS CHRISTIANITY AND CHRISTIAN SPORT MINISTRY**

Gunita Tālberga, Andra Fernāte

Latvian Academy of Sport Education
Address: 333 Brīvības Street, Riga, LV-1006, Latvia
Phone: +371 29968833, +371 67543373
E-mail: gunchitto@inbox.lv, andra.fernate@lspa.lv

Abstract

The study was carried out as a part of the research “Strategy for Starting the Movement Athletes in Action in Latvia”. Athletes in Action is a Christian sport movement supporting the idea that by having a complete understanding of a person as three part whole (physical, mental, spiritual) we can accomplish the ultimate potential in every area of life, including sport. Strategic management comprises that an environmental analysis and external factors play an important role in strategic planning. Therefore the main aim of our study was to find the attitude of sport students and educators in Latvia towards Christianity and Christian Sport Ministry. The sample consisted of 114 respondents, including students (41 male, 59 female) and educators (5 male, 9 female) of the Latvian Academy of Sport Education (LASE). Surveys were used to collect information and the gained data were statistically processed (SPSS 18).

Answers showed that there is a lack of knowledge about Biblical truth of Christianity among sport students and educators. There is an interest about Christian Sport Ministry and in general there is no statistically significant difference between the opinions of Christians and non-Christians. According to the results of self-assessment of respondents there is a deficiency of spiritual growth in the model of harmonious personality among sport students and educators in Latvia. Taking in consideration the importance of a holistic approach to accomplish the ultimate human potential, we have come to the conclusion that it is needed to continue deeper practical studies about sport and Christianity as they are fairly limited at the present moment.

Key words: *attitude, sport students and educators, Christianity, Christian Sport Ministry, harmonious personality.*

Introduction

Sport has been wrought with religion since its prime origin. The ancient Olympic Games in Greece are one generally known example of this. Young Men's Christian Association (YMCA), which was founded in 1844 in the United Kingdom, is one of the first Christian organizations who aimed to put Christian principles into practice by developing a healthy body, mind and spirit. Games as basketball and volleyball have been invented in the school of YMCA in the United States of America and YMCA also helped take these games to the world. Various other organizations focusing on Sport Ministry appeared during the 20th century, for example, Fellowship of Christian Athletes (FCA), which was founded in 1954 and Athletes in Action (AIA), founded in 1966. FCA and AIA focus on using sport to promote Christian beliefs and values. These sport ministries serve athletes, coaches and other people who are involved in sport by providing leadership and encouragement to develop their character within the sport environment so that they can demonstrate a positive influence when they are playing the game, as well as, living their lives outside of sport. YMCA, FCA, AIA and other Christian sport organizations have always emphasized the importance of developing healthy body, mind and spirit.

Various authors have been writing about the multidimensionality of the human being since the beginning of the 20th century, for example, Nee (1928), Students (1930), Covey (1989), Ginger (2000) and Purnell (2003). Since the mid-20th century humanistic psychology and its branch transpersonal psychology have been developed. Transpersonal perspectives and holistic approach to human existence are being applied in diverse fields. Today more and more researchers of sport science in Latvia acknowledge the importance of a holistic approach, for example, Fernāte (2008), Krauksts (2008), Ābele (2009).

Ginger (2000) and Purnell (2003) talk about five dimensions of human personality and the need to develop harmonious personality as a whole with all five areas of the life included - physical, intellectual, spiritual, emotional and social. To visualize this idea they use a model of five pointed star.

Materials produced by Athletes in Action describe a Total Athlete concept and teach about the need to engage the sport world in all aspects/dimensions of life (physical, mental, emotional and spiritual). It is not necessarily that an athlete who has become a Total Athlete becomes a champion in sport, but he has the ability to reach his full potential as an individual and as an athlete (The Total Athlete Workbook, 1981; Total Athlete Series, 2007).

The research “Strategy for Starting the Movement Athletes in Action in Latvia” was carried out to make the strategic plan for starting the movement of Athletes in Action in Latvia. The essential points of the approach of strategic management are answers to the questions "where are we now?", "where do we want to be?" and "how do we get there?". The research thus comprises an environmental analysis, a choice of available options, and a determining path for action and implementation. Systems thinkers Granovetter and Shrivastava have been studying how strategy is influenced by environment (social, geographical, political, cultural) and they have come to conclusion that strategy endures only if it is in compliance with internal and external environment (Kalve, 2005).

All outside factors that may affect an organization make up the external environment. As sport students are future educators and professionals of body care and well-being who will influence the society in Latvia, their attitude to Christianity and Christian Sport Ministry is a significant factor of the external environment for starting the movement of Athletes in Action in Latvia. Therefore the main aim of this study was to find out the attitude of sport students and educators in Latvia towards Christianity and Christian Sport Ministry.

Materials and Methods

The sample consisted of 114 respondents (46 male, 68 female) – bachelor and postgraduate program students (41 male, 59 female) and educators (5 male, 9 female) of Latvian Academy of Sport Education. With respect to class, 40 of the students were freshmen, 17 were sophomores, 19 were juniors and 9 of the students were seniors, while 15 of the respondents were postgraduate students. There were also 14 educators of LASE among the respondents included in the sample. Research was carried out during 2010.

Data collection method – an inquiry form consisting of 17 questions (two closed questions, five open questions and ten semi-closed questions) was created to investigate attitude of sport students and educators in Latvia towards Christianity and Christian Sport Ministry. The survey was based on theoretical findings of Ginger (2000) and Purnell (2003). Three main groups of questions with respect to the aim were stated:

- to ascertain attitude of the sample towards Christianity and comprehension of Christian teaching;
- to ascertain attitude of the sample towards Christian Sport Ministry;
- to evaluate the model of harmonious personality of the sample according to the self-assessment of the respondents.

Data processing (SPSS 18) primary and secondary mathematic statistic methods and qualitative data processing methods (coding of characteristics) were used.

Results

In summarizing the data of the inquiry we found that 35% of the respondents say that they are Christians, 41% stated that they are not Christians, while 20% were not sure about their opinion, and 4% would like to become Christians (Fig. 1).

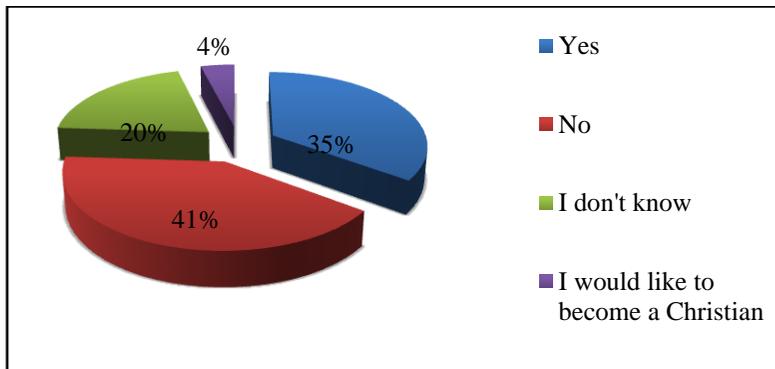


Figure 1. Answers to the question, “Do you consider yourself a Christian?”

However, in analyzing the answers to the other questions with qualitative methods we learn that there are many cultural Christians among the respondents. For example, 59% of inquired Christians cannot name the church they are attending. Deeper qualitative analysis was done according to the question “Please state three of the most important things of Christian teaching”.

It is interesting to observe that only 23% of the people who consider themselves Christians use the words Jesus Christ or Son of God to characterize the teaching of Christianity, while the central message of the Bible is about the good news of Jesus Christ and the salvation that God in His love has prepared in Christ for all people. Other interesting findings worth mentioning are that none of the respondents used the words Holy Spirit to characterize the teaching of Christianity, while the Bible teaches that one can experience the abundant and fruitful Christian life only as the result of being directed and empowered by the Holy Spirit. One will always experience defeat living the Christian life by his own effort.

By using the Mann-Whitney U-test we discovered that in general Christians and non-Christians have a similar comprehension of Christianity

– the three most often used concepts to describe the teaching of Christianity were ‘belief’, ‘God’ and ‘love’ (p value = 0,151 – 0,920 >0,01). Regarding Christian teaching, 15% of all respondents couldn't name anything to characterize it. Furthermore, we learn that 8% of all respondents, who answered that they were Christians, couldn't describe the teaching of Christianity.

Answers concerning what kind of person Christians should be or shouldn't be (for example, to be a good person, to be honest) and what kind of things Christians should do or not do (for example, to love other people, not to steal, not to kill, not to commit adultery) were merged under the concept ‘to be/not to be/to do/not to do’. This concept came in fourth place in the rank.

The message of the Gospel is not about doing good things to receive God's love, rather true Christians do good things because they are filled with the Holy Spirit as a result of experiencing God's unconditional love which is given in Jesus Christ. According to the Biblical teaching, Christianity is not about following rules, but about following God as a way of living. An opinion about Christianity as teaching what kind of person to be or not to be, what to do and what not to do, is a sign of legalism and religiousness. Analyzing the gained data of the surveys we have found no significant correlation between the concepts ‘to be/not to be/to do/not to do’ and ‘Jesus Christ/Son of God’ mentioned in the responses to characterize Christian teachings. The most often found concepts in the answers of respondents to characterize Christianity are ranked according to the frequency of their mention and presented below in Table 1.

Table 1

Concepts resulting from the qualitative analysis of the answers to the question “Please state three of the most important things of Christian teaching”

Rank	Concepts characterizing Christianity	All respondents	Christians	Non-Christians	Mann-Whitney U-test, p statistics
1.	Belief/faith/trust	39 %	36 %	37%	0,920
2.	God	32 %	28 %	35%	0,519
3.	Love	30 %	36 %	22%	0,151
4.	To be/not to be/to do/not to do	21 %	21 %	22 %	0,891
5.	I don't know	15 %	8 %	26 %	0,028
6.	Jesus Christ/Son of God	13 %	23 %	7 %	0,030
7.	Church	13 %	8 %	13 %	0,427
8.	Commandments	11 %	13 %	11 %	0,782
9.	Forgiveness	10 %	13 %	7 %	0,325
10.	Harmony	7 %	10 %	4 %	0,292
11.	Bible	7 %	3 %	9 %	0,234
12.	Confession of the sins	7 %	13 %	7 %	0,325
13.	Respect	6 %	8 %	4 %	0,516
14.	Honesty	6 %	11 %	2 %	0,117

On the basis of the data of surveys we suppose that there is more comprehension of Christianity as religion than Christianity as personal relationship with God among the respondents. Religions are based on trying to get to God through man made rules, regulations and good deeds. It is people's hopes to reach God and be made right with Him through their own efforts. Biblical teaching about God's plan for man's salvation and for being right with Him is not based on people's efforts and good works, but is based on God's love and grace for mankind in Jesus Christ paying the price and cost on the cross for all our sins (past, present and future). Only by putting our trust and faith in Jesus and in what He did on the cross is it possible for us to receive God's gift of salvation and eternal life and experience the joy of having a right relationship with God.

Our research has proved the need for Christian education in the sport world through various Christian Sport Ministries as we can observe the lack of Biblical perception of Christianity among sport students and educators in Latvia (Table 2).

Table 2

The activities which Christian Sport Ministries need to provide
(The opinion of students and educators of Latvian Academy of Sport Education)

Rank	Various activities provided by Christian Sport Ministries	All respondents	Christians	Non-Christians	Mann-Whitney U-test, <i>p</i> statistics
1.	Sport charity games	62 %	64 %	59 %	0,612
2.	Lectures and workshops about the topics connected with sport	41 %	44 %	41 %	0,833
3.	Christian sport camps	38 %	49 %	28 %	0,054
4.	Christian organized sport games	29 %	26 %	30 %	0,627
5.	Christian sport teams training and competing together	23 %	24 %	24 %	0,981
6.	Sport trainings organized by churches	19 %	18 %	17 %	0,947
7.	Christian athletes share their experience about God's work in their lives	18 %	34 %	7 %	0,001
8.	Prayers about sport world and about the people involved in sport	16 %	26 %	9 %	0,037
9.	Books and DVD about Christianity and sport	15 %	26 %	11 %	0,077
10.	Winning people for Christ by explaining Biblical truth through sport and physical activities	15 %	24 %	11 %	0,119
11.	There is no need for Christian Sport Ministry	13 %	3 %	22 %	0,009
12.	Bible studies about sport and the topics related to sport	11 %	21 %	7 %	0,057
13.	Services organized during the worldwide sporting events	11 %	15 %	9 %	0,343

It was found that 87% of respondents think that it is important to develop Christian Sport Ministry, while 13% of respondents think that it is not necessary. The three most suggested activities which Christian Sport Ministries need to provide are sport charity games (62%), lectures and workshops about the topics connected with sport (41%), and Christian sport camps (38%). In general there is no statistically significant difference between the opinions of Christians and non-Christians to this question (p value = 0,037 – 0,981 > 0,01), except an opinion about the need of Christian athletes sharing their experience about God's work in their lives (p value = 0,001). Table 2 shows the arrangement of various activities provided by Christian Sport Ministries in order of their significance in the views of students and educators of LASE. It was found that 14% of inquired students and educators have had experience of participating in Christian organized sport events as organizers, competitors or spectators, 68% have not participated in such events and 18% answered that they have not participated, but they would like to. There were 11% of all the respondents who had heard about the movement of Athletes in Action and its work.

Christian Sport Ministries emphasize the importance of developing harmonious personality while taking into consideration multidimensionality of the human being. By developing in all aspects/dimensions of life one has the ability to reach his or her full potential as a human being, including the full potential of sport performance.

The five dimension model of harmonious personality (which includes physical, intellectual, spiritual, emotional and social areas) found in the studies of Ginger (2000) and Purnell (2003) was used to evaluate how much attention sport students and educators of LASE pay to develop harmonious personality at this moment of their life. Self-evaluation was marked on the scale from 0% (I don't pay attention at all to develop myself in this area) to 100% (I pay maximum attention to develop myself in this area). We used the mean arithmetical and the mode to evaluate the answers to this question. We can observe that there is a deficiency of spiritual growth in the model of harmonious personality. Figure 2 and Figure 3 visually show that many sport students and educators are not developing harmoniously.

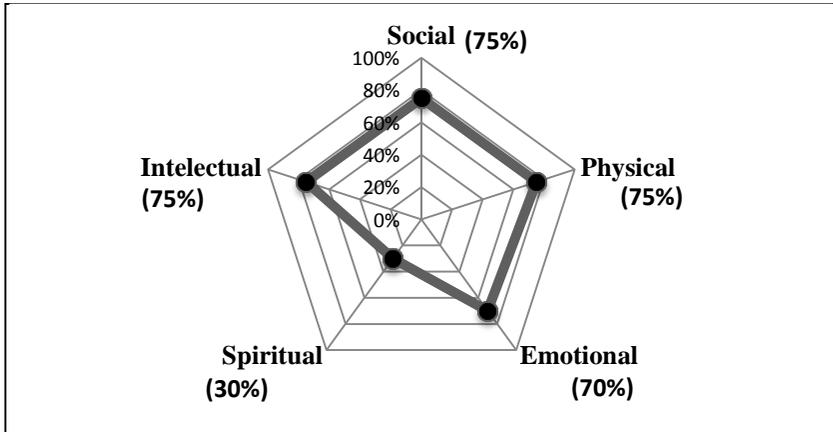


Figure 2. Self-evaluation of sport students and educators about their care of growth in all five areas of their life (\bar{x})

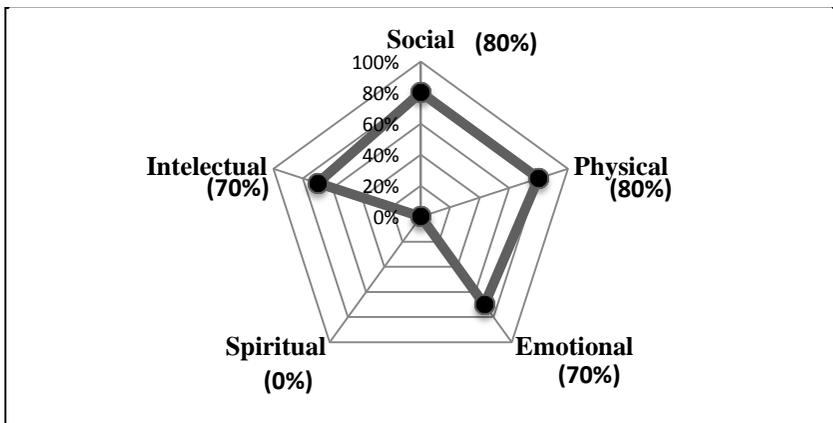


Figure 3. Self-evaluation of sport students and educators about their care for growth in all five areas of their life (M_0)

It was ascertained that regarding the care of development of intellectual, social, physical and emotional areas the mean arithmetical ($\bar{x} = 75\%$) describes the central tendency of the sample as the mode is 70% (intellectual and emotional areas) and 80% (social and physical areas), but regarding the development of the spiritual area there are extreme values and the mean ($\bar{x} = 30\%$) does not describe the real situation, as the mode is 0%.

Discussion

The results of our research are in agreement with previously made studies affirming that a significant part of the population in Latvia are cultural Christians who consider themselves Christians according to the traditions of family or stereotypes of society (Krūmiņa-Koņkova & Tēraudkalns, 2007). A public opinion survey in 2005 stated that 48% Orthodox believers, 47% Roman Catholics and 38% Lutherans in Latvia do not read the Bible. Furthermore, it is observed that the amount of those Christians who do not read the Bible is increasing (SKDS Opinion Survey 2003, 2005). These studies could explain the reason of the lack of Biblical perception of Christianity among sport students and educators in Latvia.

The results of the research carried out by Isidori, Ābele, Taddei and Maulini (2010) shows value priorities in the views of Latvian and Italian sport science students. During the research students had expressed differentiated support or negation towards statements evaluated in interval scale (from +2 to -2) relating to 10 personal value groups. Later an algebraic addition of the scores obtained was made according to the interval scale to define the supported or negated body values' model. It was found that sport science students from Italy and Latvia consider religious values the least important. There is a considerable difference observed in the results of the evaluation of religious values: - 7,9 point average among Latvians and 5,4 point average among Italians. It is interesting to observe that from 10 personal value groups only the evaluation of religious values is below zero. Here we could draw parallels with the results of our research where deficiency of spiritual growth in the model of harmonious personality is observed.

We agree to the pedagogical point of view which is stated in the research of Isidori, Ābele, Taddei and Maulini that all the body values are important and for this reason there are no values more or less important for education, because they always express the multidimensionality of the human being. We also agree that a lack of values in any of the dimensions can obstruct a correct moral development of human beings. The Bible clearly reveals that those nations who turned away from God spiritually, later ended up with a moral defeat of the nation as a result.

Our research has lead to the conclusion that it is needed to develop Christian Sport Ministries. As well as we agree to the opinion of Isidori, Ābele, Taddei and Maulini that it is important to develop curriculum in the sport universities focusing on growth in all dimensions of personality through the use of specific teaching programs and didactical tools.

Conclusions

Our investigation defined the following facts:

- On the basis of the data of surveys we suppose that there is more comprehension of Christianity as religion than Christianity as personal relationship with God among the respondents because only 23% of all inquired people who consider themselves Christians use the concepts Jesus Christ or Son of God to characterize the teaching of Christianity. Analyses of answers have showed that there is a lack of knowledge about Biblical truth of Christianity among sport students and educators in Latvia.

- It was found that 87% of inquired sport students and educators of LASE think that it is important to develop Christian Sport Ministry, but 13% of respondents think that it is not necessary. In general there is no statistically significant difference between the opinions of Christians and non-Christians about the most needed activities to be provided by Christian Sport Ministries.

- According to the results of self-assessment of respondents there is a deficiency of spiritual growth in the model of harmonious personality among sport students and educators in Latvia.

- Our research has led to the conclusion that it is needed to develop Christian Sport Ministries in Latvia. As well taking in consideration that students are future educators and professionals of body-care and well-being in Latvia, we think that further practical research is needed to develop study programs in Latvian Academy of Sport Education to give students an opportunity to comprehend the multidimensionality of human being and the importance of a holistic approach to ensure the well-being of people.

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Submitted: May 5, 2012

Accepted: November 12, 2012

ORIGINAL RESEARCH PAPER

CORRELATION OF BASKETBALL PLAYERS' PHYSICAL CONDITION AND COMPETITION ACTIVITY INDICATORS

Uldis Grāvītis, Jānis Rimbenieks, Andris Rudzītis
Mārtiņš Kozlovskis, Mārtiņš Rozenbergs

Latvian Academy of Sport Education

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

Phone: +371 67543449, +371 29282890, +371 29463866,

Fax: +371 67543480

E-mail: uldis.gravitis@lspa.lv, parenti@inbox.lv

Abstract

We failed to find any research about whether physical condition affects the indicators of a basketball player's competition activity, and if yes, then to what extent; whether there is direct correlation between the indicators of a basketball player's physical condition and his shooting accuracy in a game, as well as the number of obtained and lost balls by him.

Aim of the research: to investigate correlation of basketball players' indicators of physical condition and competition activity.

Male basketball players aged 21-25 years participated in the research. On the pre-game day all basketball players were tested. Players' heart rate was interpreted with the scientific device Omega M. A computer gave conclusion about a player's degree of tension, as well as the degree of adaptation to physical loads, the readiness of the body energy provision system, the degree of the body training and the psycho-emotional condition, as well as the total integral level of sports condition at the given moment. On the next day of the competition calendar game the content analysis of the competition technical recording was made to compare the player's whose physical indicators were lower performance with his average performance in the whole tournament. Altogether 80 cases have been analysed when a player having lower physical condition indicators participated in a game.

All in all the players having lower indicators of physical condition in 80% of cases competition activity results were lower than their average performance in the tournament. The Pearson's rank correlation coefficient also shows a close connection between the indicators of physical condition and competition activity ($r=0.687$; $p<0.01$), in comparison to a player's average performance during the whole tournament.

Basketball players' indicators of physical condition have close correlation ($r=0.687$; $p<0.01$) with the indicators of competition activity. The results of physical condition test obtained with the help of the device Omega M can be used to anticipate basketball players' performance of their competition activity.

Key words: *physical condition, competition, basketball player*

Introduction

The indicators of basketball players' competition activity (shooting accuracy, obtained balls and as the number of personal fouls that opponents get against the players of our team) are often different for the same players in different games. Coaches and players themselves explain it as the changes of physical condition. We failed to find any research about whether physical condition affects the indicators of a basketball player's competition activity, and if yes, then to what extent; whether there is direct correlation between the indicators of a basketball player's physical condition and his shooting accuracy in a game, as well as the number of obtained and lost balls by him.

There is a lot of research concerning basketball players' competition activity and its development including problems in training young basketball players (Buseta, Mondoni, Avakumovic, & Killik, 2000; Rudzitis & Gravitis, 2006). There are also many researches about basketball players' physical conditioning in basketball (Crust, 2002; Mackenzie, 1997, 2003; Davis, 2000; Trancred, 1995; Stein, 2010). Different training methods to improve physical condition have been researched (Beashel & Taylor, 1996, 1997; Davis, 2000; McArdle, 2000; Bizley, 1994; Galligan, 2000). However, interrelation between physical condition and competition activity results has not been studied.

Russian researchers, having investigated heart rate variety, have developed practical recommendations for the evaluation of one's physical condition (Bajevskis, Ivanovs & Ribkina 1999; Mihailovs, 2000; Jarilovs, 2001). Substantiating on these researches, the device Omega M (Bajevsky, Ivanov & Ribkina, 1999) has been worked out and applied practically when testing athletes and also astronauts' physical condition in definite time period.

Aim of the research: to investigate correlation of basketball players' indicators of physical condition and competition activity.

Materials and methods

Players' heart rate was interpreted with the scientific device Omega M. Electronically analyzing applying modern information technologies, a

computer gave conclusion about a player's degree of tension, as well as the degree of adaptation to physical loads, the readiness of the body energy provision system, the degree of the body training and the psycho-emotional condition, as well as the total integral level of sports condition at the given moment. These five basketball players' indicators of physical condition were expressed in per cent with 100% as complete readiness. The total evaluation of physical condition was expressed using five degree point system: 5 points were given if at least four of five indicators were on 70% level. If the basketball players' total evaluation in points was four and less, it was considered as quite low physical condition. A player received four points if two of five indicators were lower than 70%.

Male basketball players aged 21 – 25 years participated in the research. On the pre-game day all basketball players were tested. On the next day of the competition calendar game the content analysis of the competition technical recording was made to compare the player's whose physical indicators were lower performance with his average performance in the whole tournament. Altogether 80 cases have been analysed when a player having lower physical condition indicators participated in a game.

When studying the basketball players' present level of physical condition before each game by applying high technology medical equipment OMEGA C, along with the total body condition also separate parameters of the condition were examined.

They are as follows: the adaptation level of a basketball player's body to physical load, the level of being trained, the level of supply of power, and psycho-emotional condition.

Each of these parameters of body condition can probably affect a basketball player's competition results, as well as the quality of different game element execution.

From competition parameters the following are being researched: the accuracy of two point shots, three point shots and the foul shots, the number of rebounds in a game, as well as the number of personal fouls that opponents get against the players of our team.

Each of these parameters of competition activity can be affected by one or several parameters of the body condition level.

As the criterion for the indicator evaluation of the quality of the competition activity was taken player's average performance during all tournaments. Were evaluated those players whose indicators of physical condition were lower before the game.

Comparing the data the Pearson's rank correlation coefficient was calculated.

Results

The participants' parameters of competition activity show a great variability from game to game. For example, the accuracy of two point shots is from 76.2% to 40.9%, and in the parameters of three point shots there is similar variability: from 42.8% to 11.1%. The accuracy of the foul shots is a little bit more stable – from 76.5% to 51.3% (Fig. 1).

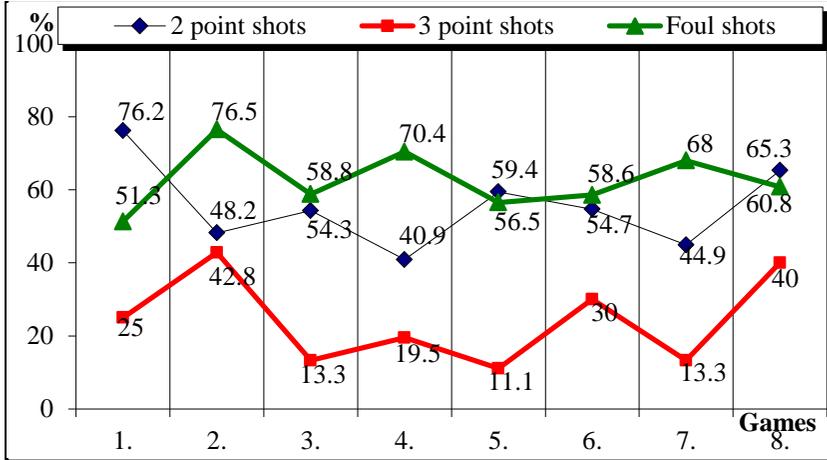


Figure 1. The parameters of shot accuracy

The number of rebounds, as well as the number of opponents' personal fouls what shows a player's activity in offense are slightly more even parameters. The number of rebounds in a game is from 49 to 32 balls, but the number of opponents' personal fouls in a game is from 27 to 11 (Fig. 2).

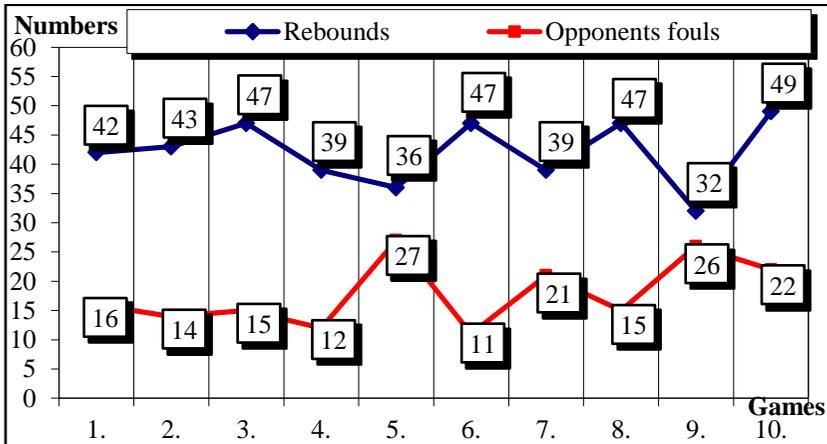


Figure 2. The parameters of competition activity

Also the parameters of physical condition change from day to day. So, the parameter of the body adaptation load is from 99% to 37%, the parameters of the body being trained change from 100% to 57%, the parameters of the body supply of power are from 98% to 43%, but the parameters of the basketball players' psycho-emotional condition are not stable, too, being from 99% to 36%.

The parameter of the total athletic condition, definitely, is quite different when comparing one game to another – from 99% to 48% (Fig. 3).

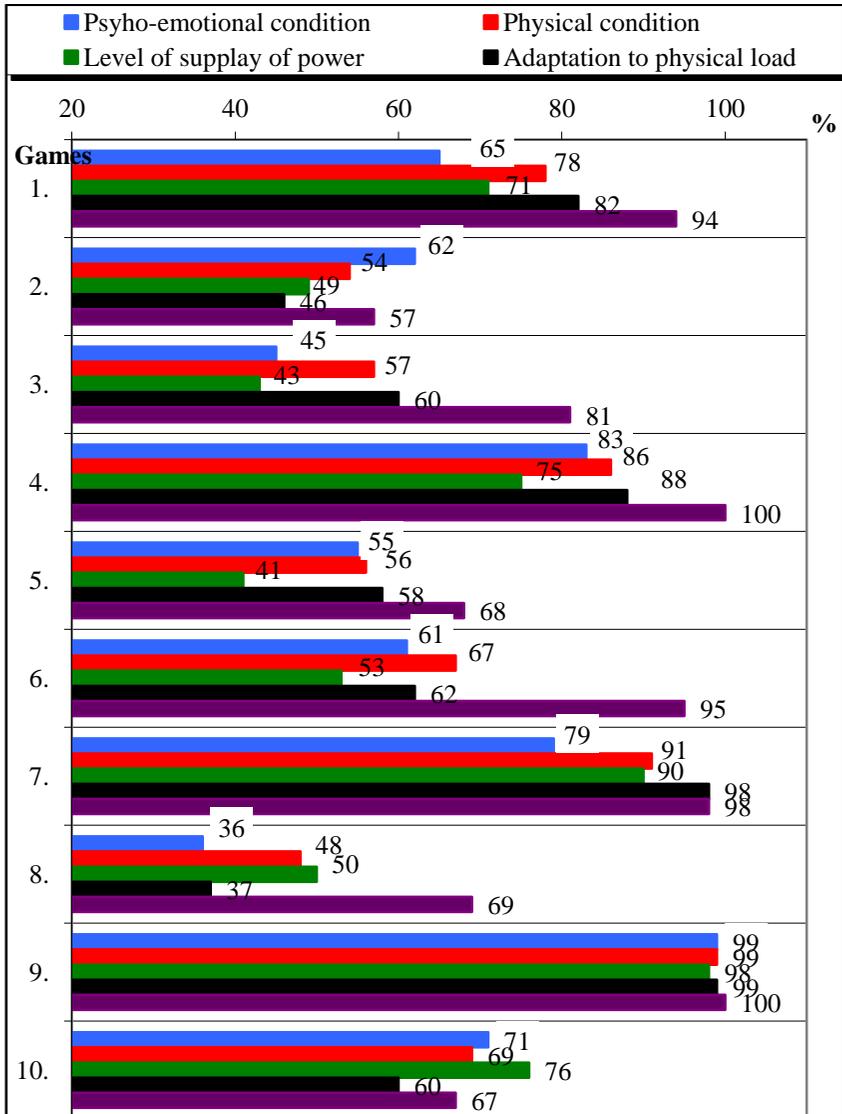


Figure 3. The parameters of physical condition

The only parameter that correlates with the parameters of physical condition in total was the accuracy of shots. All in all the players having lower indicators of physical condition in 80% of cases competition activity results were lower than their average performance in the tournament. In 2.5% of the cases the players' having lower indicators of physical condition performance in competitions was in the level of their average indicators, but in 17.5% of the cases the players' indicators were better than their average performance in the tournament (Fig. 4).

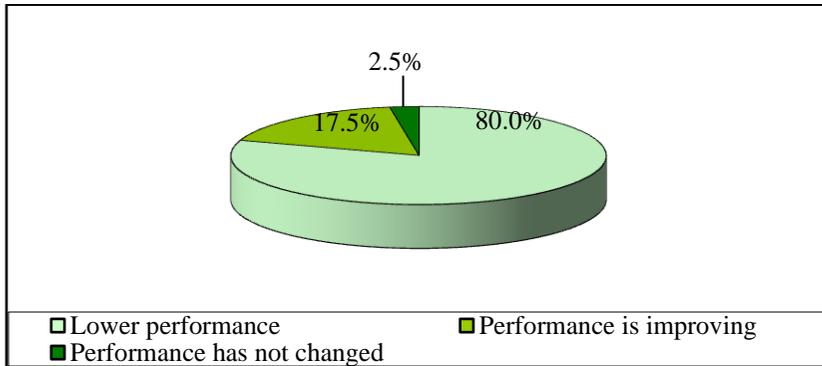


Figure 4. Evaluation of the basketball players' competition activity

The Pearson's rank correlation coefficient also shows a close connection between the indicators of physical condition and competition activity ($r=0.687$; $p<0.01$), in comparison to a player's average performance during the whole tournament.

Discussion

The evaluation of the basketball players' competition activity performance consisted of seven different indicators, each of them showed different value changes depending on the level of different physical condition indicators. Similar thoughts have been expressed by Beashel and Taylor (1997), Chillious (2010). However, in our research we failed to find significant results about which physical condition indicators – the adaptation to physical load, level of the organism training degree, condition of the body energy provision system or psycho-emotional system – has a direct effect on players' accuracy of various shots and the number of the obtained or lost balls in a game. There is a clear tendency that physical condition parameters affect essentially the shooting accuracy. This opinion has been shared by different authors (Guidelines for coaches, 2000), also by Chillious (2010). In the research the question about the correlation of free throw accuracy and psycho-emotional condition remained on the level of hypothesis. There are

authors who connect precision of free throw with psychological readiness, training. (Guidelines for coaches, 2000; Chilliou, 2010), but there are sports scientists who pay more attention to physical conditions when talking about precision of free throw (Crust 2002; Kambouris, 2011; Mackenzie, 1997; Tancred, 1995). In this study with not so many stated cases significant results of the correlation of these two indicators have not been obtained. The research is being continued.

Conclusion

Basketball players' indicators of physical condition have close correlation ($r=0.687$; $p<0.01$) with the indicators of competition activity.

In 80% of cases lower physical condition players show indicators of their technical proficiency which are lower than their average proficiency level.

The results of physical condition test obtained with the help of the device Omega M can be used to anticipate basketball players' performance in their competition activity.

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Submitted: April 6, 2012

Accepted: November 12, 2012

ORIGINAL RESEARCH PAPER

THE REVIEW OF HIGH PERFORMANCE WOMEN TRACK CYCLISTS OF 3 KM TEAM PURSUIT RACE TRAINING PROCESS FOR EUROPEAN CHAMPIONSHIP 2012

Linās Tubelis

Lithuanian University of Educational Sciences
Address: 39 Studentu Street, Vilnius LT-08106, Lithuania
Phone: +370 68654207
E-mail: direktorius@losc.lt

Abstract

Track cycling competitions are very popular on a worldwide level. Track cyclists' training for competitions has its own specifics. During the latter four-year Olympic training cycle Lithuanian women track cyclists achieved high results in World and European Championships, became champions and prize-winners. The intention of the research was to reveal specific features of women cyclists training as well as the level of physical and functional powers in separate intensity zones, and this would serve as model characteristics for training high performance women track cyclists. The aim of our research was to reveal high performance women track cyclists' of 3km team pursuit race training and preparedness changes before participation in European Championship 2012. The subject of the research was three high performance women track cyclists, who had won European Championship 2012 in 3km pursuit race event. We had analyzed athletes' physical development, the level of physical powers in various intensity zones, functional capacity of respiratory and blood circulation systems and its changes on the last stage of training for European Championship. Women track cyclists were analyzed before alpine training camp in September, 2012 and after it, when two weeks left to European Track Cycling Championship 2012. Our researches revealed that most physical development indices were stable, but muscular mass as the main motions generator fluctuated significantly in single athletes. Indices of physical and functional capacity had improved and corresponded to the level of world elite women athletes. We believe that positive changes in analyzed athletes' physical and functional powers during pre-competition period were determined by the programme for cyclists' training in pre-competition mesocycle that was designed professionally, basing on the of analysis of the results and conclusions formed and implemented; and

naturally it conditioned great performance in European Championship 2012.

Keywords: *women track cyclists, power and training program.*

Introduction

Cycling sport is one of the most complex sport disciplines for its content because the variety of intensity and duration of physical loads is particularly wide. Women cyclists have to compete in track cycling, road bicycle racing, and mountain bicycle racing categories in various distances – sprint, individual time trial, team time trial or group racing, etc. (Vaitkevičiūtė & Milašius, 2011).

Track cycling competitions are very popular on a worldwide level and this is determined by variety of disciplines planned in a program. Cyclists' training for competitions has its own specifics. During the latter four-year Olympic training cycle Lithuanian women track cyclists achieved high results in World and European Championships, became champions and prize-winners.

Track cyclists' training gets significant researchers' attention (Neumann, 1992; Hoppler, 1997; Jeukendrup et al., 2000; Milašius et al., 2005; Dadelienė et al., 2008) but changes in physical and functional powers during yearly and four-year Olympic cycle is not analyzed at full extent. Though there is more information on high performance road cyclists' functional capacity level (Bason, 2001; Funendu-Garcie et al., 2000; Lucia et al., 2002; Pontaga & Konrads, 2009). Similarly some analytic works are written about cyclists' technical and tactical preparedness. That is why, aiming to receive possibly as much objective criteria under which could be easier optimizing cyclists' training process and preparedness recordings, it is relevant to analyze the peculiarities of Lithuanian high performance women track cyclists' training for the major international competitions as well as changes in physical and functional powers during various training periods.

It is anticipated for this research to reveal specific features of women cyclists' training process, also to indicate the level of physical and functional powers in separate intensity zones. This would contribute as model characteristics in training women cyclists of high performance.

The aim. To reveal high performance women track cyclists' of 3km team pursuit race training and preparedness changes before participation in European Championship 2012.

Research subject. Three high performance women track cyclists (D1, D2, D3), who had won European Championship 2012 in 3km pursuit race event.

Research object. Physical load adaptations on women track cyclists in the last stage before major competition (European Championship), indications of physical and functional powers and its changes.

Material and methods

There was carried out analysis of documents and reports on performed physical load and on combining physical load with followed recovery as well as establishment and evaluation of cyclists' somatic and physiometric physical development indices. There were estimated indices of height, body mass, muscular mass, fat mass (Juocevičius & Guobys, 1985), hand power, and vital lung capacity (VLC). Also there was carried out analysis of physical powers level in various intensity zones, functional capacity of respiratory and blood circulation systems and its changes in the last stage of training for European Championship.

When establishing physical power indices, single muscular contraction power (SMCP) (Bosco et al., 1983) and anaerobic alactic muscular power (AAMP) (Margarita et al., 1966) with applied step ergometry method was measured. 10s test on veloergometer for preparedness evaluation was also employed. Glycolytic power was established with 60s veloergometer test on maximum exertion.

Aerobic capacity was analysed with gas analyzer Oxycon mobile 781023-052 when executing physical work on veloergometer and registering lung ventilation (LV), pulse rate (PR), absolute and relative oxygen consumption (VO_2) values, and oxygen pulse (OP) indices as well as recording working power at anaerobic threshold (AT) and critical intensity limits (CIL).

Functional capacity of blood circulation system was evaluated by establishing PR when lying, in orthostasis, when executing standard physical load with followed 60s recovery as well as under established Roufier index (RI) (Scherrer, 1973). Blood pressure and haemoglobin (Hb) blood concentration were measured as well.

Women cyclists were analysed before alpine training camp in September, 2012 and after it when two weeks were left to European Track Cycling Championship 2012.

Results

Physical and functional powers (Tables 1 – 6) of three women cyclists listed in subject describing section were analyzed when planning participation in European Track Cycling Championship 2012 and planning training camp in September. After estimating those indices, the four-microcycles program for women cyclists training on alpine conditions was

formed. The goals of the first introductory microcycle were adaptation to alpine conditions, increasing anaerobic alactic power on short-duration work, and maintaining aerobic capacity without exceeding anaerobic threshold.

During second microcycle athletes were increasing their special preparedness. On the first day they were riding on fixed speed for approximately 110min with 10 times of 15 – 25s speeding-up up to reaching 95% of anaerobic threshold. On the second day they trained maximum oxygen consumption at the limit of critical intensity, i.e. for 8min were riding up to reaching 95% of maximum oxygen consumption, repeating it up to 6 times and reaching lactate blood concentration up to 8mmol/l. On the third day athletes were on recovery and their only physical activity was exercising. The fourth day was assigned to activating glycolytic reactions when executing 30 – 120s work of maximum intensity with lactate blood concentration increasing up to 14mmol/l. On the fifth day cyclists trained their aerobic and creative phosphate capacity for 2 times executing 30 min duration work at anaerobic threshold limit with 10 – 15s speeding up on maximum intensity every 5min. On the sixth day they trained maximum oxygen consumption at critical intensity limit, i.e. 6 times for 6min were riding up to reaching 98% of maximum oxygen consumption leading up to 10mmol/l lactate blood concentration. On seventh day cyclists were on recovery after given physical loads.

The third seven-day microcycle went with lower physical loads and during the fourth six-day microcycle cyclists took special physical loads of very high extent. On the first day they trained maximum oxygen consumption by repeatedly executing 5 min duration work for five times up to reaching 98% of maximum oxygen consumption and increasing lactate blood concentration up to 11mmol/l. On the second day they were riding for 4 times for 20min at the limit of anaerobic threshold and every 5min were executing speeding up on maximum exertion. On the third microcycle day we gave cyclists to recover after physical loads and on the fourth day they trained maximum oxygen consumption and glycolytic powers. Cyclists accomplished 1, 2, 3, 2, and 1min duration work on maximum exertion thus raising lactate blood concentration up to 14mmol/l. On the fifth day athletes were riding for 80min with 10 – 15s speeding up on maximum exertion and on the sixth day they trained special powers. Cyclists trained maximum oxygen consumption and activated glycolytic reactions with 3min work for 3 times reaching up to 100% oxygen consumption and lactate blood concentration increasing up to 14mmol/l.

After implementing one-mesocycle program and after athletes came back from alpine sports camp to Lithuania their physical and functional powers were analyzed again aiming to establish organism response to physical loads that were assigned under the program during the training camp.

We established that body mass of all analysed cyclists had increased. This increase was determined by the growth of muscular mass whereas fat mass had a tendency to decrease and in athlete D3 it amounted only 4,6 kg. Hand power of all analysed athletes had increased as well as vital lung capacity (Table 1).

Table 1

Indices of cyclists' physical development and muscular-fat mass proportion

Cyclists	Investigation	Height (cm)	Body mass (kg)	Hand power (kg)		VLC (l)	Muscular mass (kg)	Fat mass (kg)
				R	L			
D1	I	174.5	62.0	50	40	4.7	34.4	7.5
	II	174.5	65.0	53	43	4.8	36.7	8.6
D2	I	163.0	55.5	40	38	4.1	31.1	7.1
	II	163.0	58.0	44	42	4.4	32.7	7.1
D3	I	168.0	59.0	45	43	4.1	33.7	5.6
	II	168.0	61.5	48	48	4.4	35.7	4.6

When evaluating alternation of short-duration working power indices (Table 2), improvement tendency of those indices was observed. SMCP as well as absolute and relative AAMP indices in all athletes were higher after training camp. Athlete's D1 indices of SMCP and AAMP should be considerably addressed. Absolute value of SMCP reached even 1765 W and AAMP – 1096 W.

Table 2

Indices of cyclists' single muscular contraction power (SMCP) and anaerobic alactic muscular power (AAMP)

Cyclists	Investigation	SMCP		AAMP	
		W	W/kg	W	W/kg
D1	I	1738	28,04	985	15,88
	II	1765	27,16	1096	16,86
D2	I	1127	19,61	794	14,31
	II	1331	22,94	864	14,90
D3	I	885	15,00	937	15,88
	II	1091	17,75	971	15,78

When testing athletes with specific, to this sport discipline characteristic methods, i.e. assessing their 10s and 60s working power indices on veloergometer, we established sufficiently significant growth of specific working power needed for athletes of this sport discipline and for this event. Athletes' maximum instantaneous working power when executing 10s duration work on veloergometer increased in more than 200 W and this amounted up to 18 percentage points. Power indices when executing 60s duration work on maximum exertion on veloergometer grew none the less significantly (Table 3).

Table 3

Indices of cyclists' work on veloergometer

Cyclists	Investigation	Power (W)					
		10s			60s		
		max	W/kg	vid.	W/kg	vid.	W/kg
D1	I	1243	2.10	862	13.90	490	7.90
	II	1458	22.42	937	14.40	529	8.14
D2	I	1028	18.70	735	13.37	404	7.35
	II	1245	21.46	8,12	14.00	441	7.61
D3	I	1168	19.80	768	13.02	440	7.45
	II	1426	23.38	875	14.40	470	7.70

When evaluating testees' indices of cardiovascular system capacity (Table 4), we established that cyclists' D1 and D2 Roufier index, that before alpine training camp had positive values, after second testing was registered in minus values; in athlete D2 it was - 1,2. Indices representing athletes' organism reaction to standard physical loads improved as well. Athlete's D3 Roufier index and indices of reaction to standard physical loads varied slightly. Changes in athletes' haemoglobin blood concentration require attention. This index value improved in all athletes.

Table 4

Indices of cyclists' pulse rate at rest, when taking orthostatic vital signs, when executing standard physical loads and in 1 min recovery, blood-pressure and haemoglobin blood concentration

Cyclists	Investigation	RI	PR (t/min)			PR after load (t/min)		Blood pressure	Hb (g/l)
			Lying	Standing	Standing, when decreases	After load	After 60s		
D1	I	4.4	56	98	94	113	80	120/70	145
	II	- 0.8	44	78	68	104	56	100/60	164
D2	I	1,2	48	70	52	112	52	100/60	146
	II	- 1.2	48	80	64	106	52	110/70	163
D3	I	0.0	42	81	70	106	56	110/70	147
	II	0.4	52	100	80	110	56	110/70	175

Table 5

Indices of cyclists' aerobic capacity at the limit of critical intensity

Cyclists	Lung ventilation (l/min)	PR (t/min)	VO _{2max} (l/min)	VO _{2max} (ml/min/kg)	Oxygen pulse ml/t	W
D1	116	174	3.86	61.2	22.18	380
D2	134	187	3.51	61.0	18.77	360
D3	136	185	3.99	66.5	21.50	350

Table 6

Indices of cyclists' aerobic capacity at the limit of anaerobic threshold

Cyclists	Lung ventilation (l/min)	PR (t/min)	VO ₂ (l/min)	VO ₂ (ml/min/kg)	Oxygen pulse (ml/t)	W
D1	71	158	3.11	49.3	19.68	280
D2	62	170	2.59	45.0	15.23	240
D3	67	168	3.00	56.0	17.80	250

After testing cyclists as the alpine training camp in September, 2012 was finished and after analyzing received data, the final stage two-microcycles program for the major competition was formed. On the first day cyclists trained aerobic powers, on the second day – aerobic powers at the limit of anaerobic threshold and creatine phosphate powers, on the third day – glycolytic powers. The fourth day was assigned for recovery after physical loads. On the fifth day athletes trained aerobic powers, on the sixth day – aerobic and creatine phosphate powers, on the seventh day – glycolytic powers. One day of rest went before starting second short-duration microcycle.

The second microcycle started with activation of aerobic and creatine phosphate reactions. On the second day glycolytic organism reactions were activated. The third day was assigned for rest, fourth and fifth days – for activating all needed powers without exceeding 10 mmol/l limit of lactate blood concentration and the sixth day was for participating in the competition.

Discussion

Researchers have revealed that particular physical development and physical capacity indices in women track cyclists of 3 km pursuit race event fluctuated significantly during pre-competition mesocycle. Most physical development indices were stable, but muscular mass as the main motions generator (Milašius et al., 2005; Dadelienė et al., 2008) fluctuated significantly in single athletes. This could be related with athletes'

work in trainings during separate training stages, applied means and methods.

Correlation researches in previous works demonstrated that muscular mass changes have relation with changes in power. This is supported by results of prior researches on various specialization women cyclists (Tubelis et al., 2009) as well as by researches of indices of different sport disciplines athletes (Pečiukonienė & Dadelienė, 2003).

Analysed women cyclists' indices of physical and functional capacity varied positively and were on sufficiently high level. Pursuit race cyclists' indices of physical and functional capacity corresponded to the level of world elite women athletes (Lucia et al., 2002).

We consider that positive changes in analysed athletes' physical and functional powers during pre-competition period were determined by professionally, under the basis of the analysis results and of the conclusions drawn, and implemented program for cyclists' training in pre-competition mesocycle; and naturally it conditioned great performance in European Championship 2012.

Conclusions

Physical and functional powers of analyzed women track cyclists of 3 km pursuit race had been improving during the pre-competition mesocycle and reached the level leading to the best results in the European Championship 2012;

Aiming for special(10s – 60s duration) physical working capacity growth it is purposeful during trainings to increase athletes' muscular mass by adequately combining physical loads with followed recovery; such muscular mass growth is one of the factors that determines the increase of short-duration working capacity;

Prepared and adapted program for training track cyclists of 3km pursuit race in pre-competition mesocycle is efficient: athletes gained optimal physical and functional powers and won the European Championship 2012;

Prepared and adapted program for training track cyclists of 3km pursuit race in pre-competition mesocycle and athletes' indices of physical and functional powers can be used as example (model) for high performance women track cyclists training.

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Submitted: November 22, 2012

Accepted: December 3, 2012

ORIGINAL RESEARCH PAPER

EVALUATION OF ECONOMY AND MECHANICAL EFFICIENCY IN DISTANCE RUNNING**Edgars Bernāns, Jānis Lanka**

Latvian Academy of Sport Education

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

Phone: +371 67543423, mob.: +371 26128518, fax: +371 67543480

E-mail: edgars.bernans@lspa.lv, janis.lanka@lspa.lv**Abstract**

Determination of running economy by analyzing physiological and biomechanical factors was the aim of this study. Five male distance runners ($n=5$) were tested during three kilometers run on treadmill with individually adapted running velocity, according to their submaximal level of intensity. While running at a constant velocity, runners had significant changes in their physiological indicators. Their heart rate increased linearly, while blood lactate concentration level continuously varied during the run ($\alpha < 0.05$). There was a reliable positive correlation found between these two physiological factors ($n=57$, $r=0.616$, $\alpha < 0.05$). The indicators of step length and frequency varied inversely ($\alpha < 0.05$). Runners having lower heart rate level together with less significant changes in the variety of other indicators, had a higher level of running economy ($\alpha < 0.05$).

Key words: *running economy, mechanical efficiency, anaerobic threshold, physiological factors, biomechanical factors*

Introduction

In endurance sport, the level of performance very often depends on spending less metabolic energy by doing the same mechanical work - realizing more economical and efficient movements and other factors. Scientists are putting their effort to determine the influence of numerous factors that effect running economy. A big number of research have been done by studying the problem of movement economy and efficiency. A complex and largely unsolved issue is how to establish relationship between mechanical work and metabolic energy expenditure (Svedenhag, 2000; Zatsiorsky, 2002).

From one side endurance is affected by biochemical and physiological factors, but from the other side there are many biomechanical factors which require the same level of attention, including technique and

tactics (Utkin, 1989). This necessitates for scientists to combine these factors in the research process. From this, complex point of view, it is possible to provide an opportunity to go into the problem of running economy. For example, it is well known that a runner should avoid unnecessary movements, muscle contractions and reduce metabolic energy expenditure, but at first, there is a need to determinate them. A 1% improvement in the world – class 10km running makes 16s improvement of the result. It shows that even a small improvement in efficiency (1% or less) can have an important effect on the running race result (Williams, 1990).

Through years scientists have done a difficult job to measure and substantiate statistically factors that influence running economy, but still there remain a lot of factors that we can not be completely sure about on scientific basis.

Material and methods

Five male distance runners ($n=5$), aged 22 – 29 years, body weight 53.4 – 83.2kg, and heights between 171.2 – 191.0cm and with a training experience more than 5 years, were tested in 3km submaximal intensity running on treadmill (Table 1).

Table 1
Characteristics of runners ($n=5$)

Subject	Age (years)	Height (cm)	Weight (kg)	v_{submax} ($\text{m}\cdot\text{s}^{-1}$)
S1	26	191.0	83.2	4.30
S2	23	171.2	53.4	4.30
S3	24	184.4	69.7	4.58
S4	22	185.7	82.2	4.72
S5	29	188.5	76.0	4.72

Runners did a 10min long warm up before the test, which included 5min of running and 5min of warm up exercises (runners could choose the pace of running and types of exercises according to their warm up habits).

To determinate running velocity at anaerobic threshold (v_{submax}), runners performed a progressive exercise test. They were running at a velocity that was gradually increased by $0.5\text{km}\cdot\text{h}^{-1}$ every 2min (the initial velocity was adapted individually). Blood lactate concentration was measured at the end of every 2min time interval, before the increase of running velocity. Running was continued until the blood lactate concentration reached a level close to $4.0\text{mmol}\cdot\text{l}^{-1}$, such a lactate concentration can be considered as appropriate for anaerobic threshold ($\text{La}_{\text{submax}}$) concentration level. After determination of v_{submax} , the actual running velocity was firstly increased by $0.5\text{km}\cdot\text{h}^{-1}$, and after that decreased

at an equal value. The aim of this manipulation was to ensure that lactate concentration does not exceed the La_{submax} level at actual velocity and for sure does it after the increase.

Runners had a 10min long resting period after testing the running velocity at an anaerobic threshold. They did a 5min long low intensity running (with individually adapted velocity) and 5min of resting without running. The blood lactate concentration was measured after the resting period and compared to measurements made before testing. None of runners needed a longer resting period – for all of them the blood lactate concentration was approximately at the same level as the initial one.

After the resting period runners performed 3 kilometers long running on a treadmill at a previously determined velocity. Testing was started with a 1min long run up, where every 15s running velocity was gradually increased by $1.0\text{km}\cdot\text{h}^{-1}$. The aim of this manipulation was to provide that runner gradually reaches his level of running velocity and the level of physiological and biomechanical indicators according to the anaerobic threshold.

Heart rate monitor (Polar CS 600, Finland) was used to register the heart rate (HR_{submax}) data during the whole running time. Mean value of heart rate in each running minute was taken into account and plotted in graphs.

During the whole testing, blood lactate concentration was measured during the last 10 – 15s of each running minute. The measurements were made with Biosen C – line (Germany) apparatus.

Two video cameras were used to analyze the number of steps, step frequency (SF_{submax}) and length (SL_{submax}). One video camera were placed from the behind and the other from the right side of the runner. The values of total step count in each running minute were taken into account and plotted in graphs. The value of step frequency was determined per each running minute. An equation was used to determine the step length:

$$SL_{\text{submax}} = D / NS_{\text{submax}}$$

where: SL_{submax} – step length, D – distance and NS_{submax} – number of steps. A formula was used to determine the level of running economy:

$$HRV_{\text{submax}} = HR_{\text{submax}} / 60 \cdot v$$

where: HRV_{submax} – heart rate value, HR_{submax} – heart rate and v – running velocity. The values of HRV_{submax} was calculated according to each minutes average HR_{submax} and plotted in the graphs.

Results

Results of data analysis are presented in Table 2. Detailed results of all tested physiological and biomechanical indicators are described in text and shown in figures.

Table 2

Results of data analysis ($\alpha < 0.05$)

		S1 (n=12)	S2 (n=12)	S3 (n=11)	S4 (n=11)	S5 (n=11)
HR_{submax} (b·min ⁻¹)	$\bar{x} \pm s_{\bar{x}}$	160 ± 3	177 ± 2	178 ± 3	170 ± 1	169 ± 2
	s	9	7	8	5	7
	S%	5.6%	4.2%	4.7%	2.9%	4.2%
La_{submax} (mmol·l ⁻¹)	$\bar{x} \pm s_{\bar{x}}$	2.53 ± 0.09	3.80 ± 0.18	3.66 ± 0.27	3.06 ± 0.12	2.61 ± 0.12
	s	0.32	0.63	0.88	0.39	0.41
	S%	12.8%	16.5%	24.1%	12.8%	15.8%
SF_{submax} (s·min ⁻¹)	$\bar{x} \pm s_{\bar{x}}$	180 ± 0.5	170 ± 0.5	161 ± 0.5	179 ± 0.5	182 ± 0.5
	s	2	1	2	1	2
	S%	1.0%	0.9%	1.2%	0.4%	0.9%
SL_{submax} (cm)	$\bar{x} \pm s_{\bar{x}}$	144 ± 0.42	152 ± 0.38	171 ± 0.60	158 ± 0.20	156 ± 0.41
	s	1.47	1.30	1.99	0.66	1.35
	S%	1.0%	0.9%	1.2%	0.4%	0.9%
HRV_{submax}	$\bar{x} \pm s_{\bar{x}}$	11.51 ± 0.19	12.68 ± 0.15	13.57 ± 0.19	13.37 ± 0.11	13.33 ± 0.17
	s	0.65	0.53	0.63	0.38	0.56
	S%	5.6%	4.2%	4.7%	2.9%	4.2%

In table: $\bar{x} \pm s_{\bar{x}}$ – standart error of mean, s – standart deviation (SD), S% - coefficient of variation (CV), b·min⁻¹ – beats per minute, s·min⁻¹ – steps per minute.

The values of HR_{submax} linearly increased during the entire time of running test for all runners (Figure 1). Significant HR_{submax} increase was determined in the very beginning of 3km running test. In the very end of running test, there was a tendency of HR_{submax} stabilization (approximately at last 2 – 3min). The mean values of HR_{submax} are presented in Table 2.

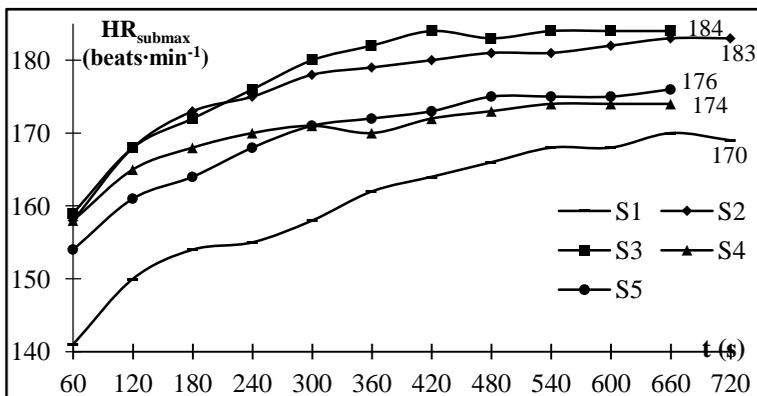


Figure 1. Dynamics of heart rate

While HR_{submax} values gradually increased, values of lactate concentration (La_{submax}) continuously varied during entire running time (Figure 2). Coefficient of variation (CV) values for HR_{submax} were in the range from 2.9 to 5.6% ($\alpha < 0.05$), whereas CV values for La_{submax} were in the range from 12.8 to 24.1% ($\alpha < 0.05$). Those were the highest CV values in this study. The mean values of La_{submax} are presented in Table 2.

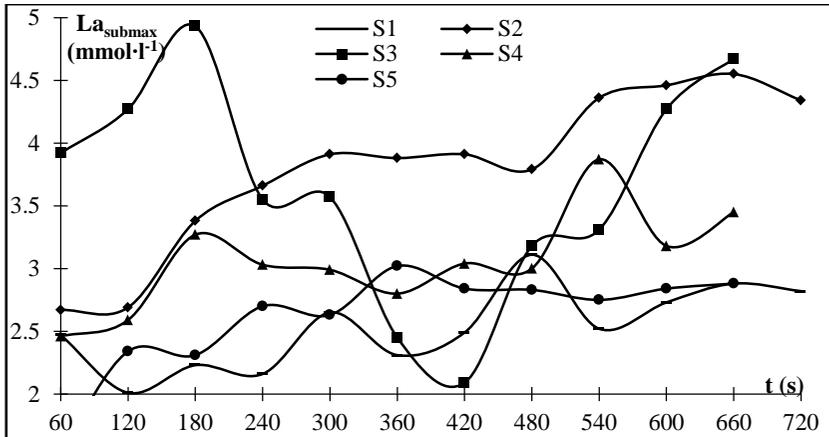


Figure 2. Dynamics blood lactate concentration

There was a reliable positive correlation ($n=57$, $r=0.616$, $\alpha < 0.05$) found between the average HR_{submax} and La_{submax} (Figure 3). Regression equation between HR_{submax} and La_{submax} for tested runners: $HR_{\text{submax}} = 146.25 + 7.8329 \cdot La_{\text{submax}}$.

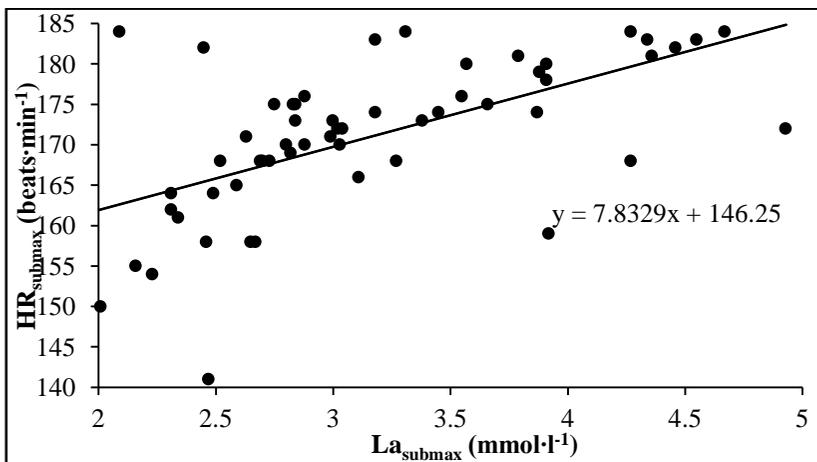


Figure 3. Relationship between heart rate and lactate concentration values

Dynamics of step frequency are shown in Figure 4. Values of SF_{submax} were continuously varying during the entire running time. CV values were in the range from 0.4 to 1.2% ($\alpha < 0.05$).

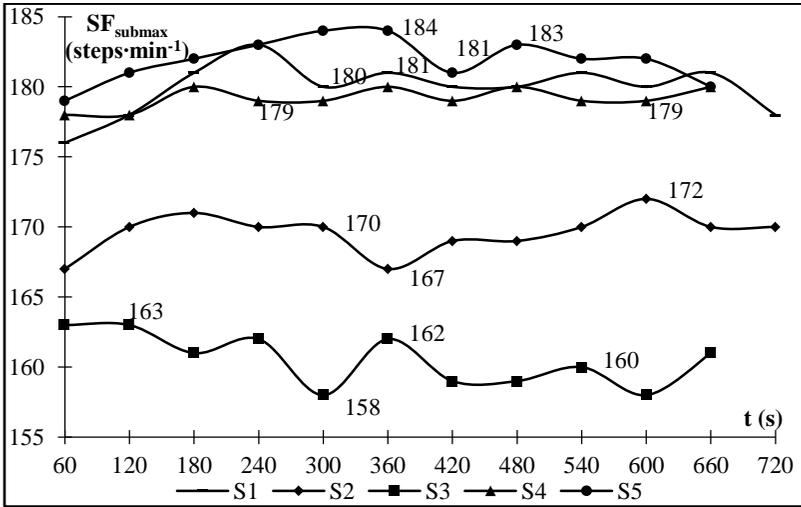


Figure 4. Dynamics of step frequency

Dynamics of step length is shown in Figure 5. Values of SL_{submax} were continuously varying during the entire running time. CV values were in the range from 0.4 to 1.2% ($\alpha < 0.05$). In this study there was no reliable correlation found between runners SL_{submax} and their height ($\alpha > 0.05$) at submaximal intensity of running, see data in Table 1 and Table 2.

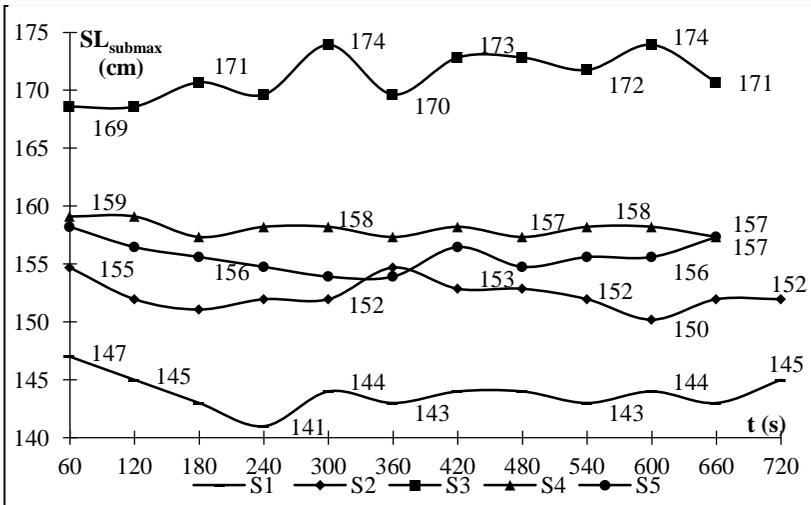


Figure 5. Dynamics of step length

Values of SL_{submax} and SF_{submax} varied inversely. An example of SL_{submax} and SF_{submax} values fluctuation is shown in Figure 6. In the beginning of testing this runner (S3) had greater SF_{submax} values, but during the 3km running, he decreased his step frequency and increased step length. Other runners of the study showed opposite tendency.

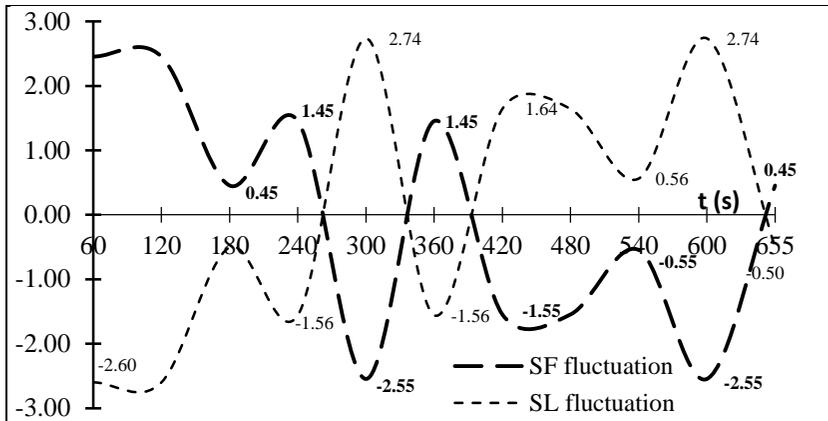


Figure 6. Example of step frequency and step length fluctuation in running test (in relation to mean values)

There was a weak negative correlation found between SF_{submax} and HR_{submax} ($n=57$, $r=-0.491$, $\alpha<0.05$). Also weak, but positive correlation was found between SL_{submax} and HR_{submax} ($n=57$, $r=0.482$, $\alpha<0.05$). A stronger correlation was found between La_{submax} and SF_{submax} ($n=57$, $r=-0.556$, $\alpha<0.05$), but it was weaker between La_{submax} and SL_{submax} ($n=57$, $r=0.351$, $\alpha<0.05$). According to this study, it means that insignificant changes in step length or frequency do not have a statistically significant influence on heart rate or blood lactate concentration.

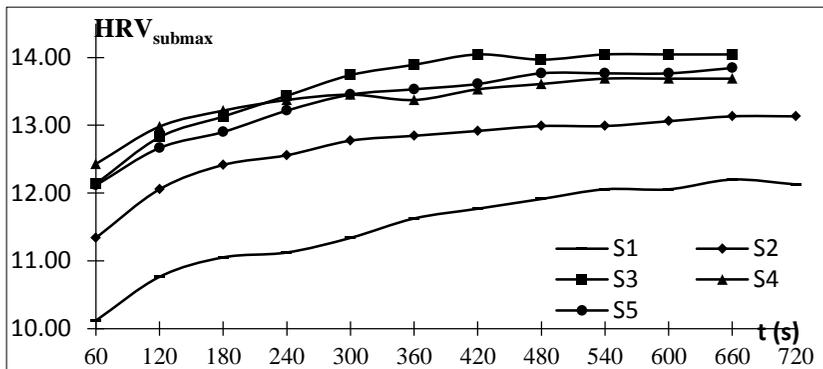


Figure 7. Dynamics of heart rate value

Indicators of HRV_{submax} were increasing during the entire time of running test (Figure 7). Greater HRV_{submax} increase was in the very beginning, and similarly with HR_{submax} values, there was a tendency of HRV_{submax} stabilization in the very end of running test. CV values were in range from 2.9% to 5.6% ($\alpha < 0.05$).

Discussion

Five male athletes were chosen to participate in the study. The number of subjects was not sufficient to substantiate statistically and make conclusions which can be interpreted to a greater group of runners or population. As step length and frequency are one of the most studied issues according in running and walking, the aim of this study was not to provide sound conclusions, but to find a different way of investigation which can be useful for future studies. Studying the effect of running velocity on external mechanical power output, Fukunaga (1980) showed how the step length and frequency changed during the running at different velocity by testing 8 sprinters. So this and other similar research shows that even from a small number of subjects it is possible to obtain enough data also for quantitative analysis.

There are some issues that can be discussed according to the testing protocol of this study. At first, it was the progressive exercise test to determinate the level of anaerobic threshold ($La=4.0 \text{ mmol}\cdot\text{l}^{-1}$) and the corresponding running velocity (v_{La4}) for each runner (Shepard, 2000). One of the aims was to spend less running time for each of five runners and minimize the recovery time before the 3km running test. There was a standartized testing protocol which was addapted for this testing. Entire running time was reduced by skipping the part of testing aerobic threshold. So the individually chosen initial running velocity is one of the issues under discussion. There is no sound information if this manipulation made any significant changes or mistakes determinating the level of anaerobic threshold. And if it does, then how?

There were some problems identified while testing the running velocity at anaerobic threshold. Testing results showed that none of the runners had a $4.0 \text{ mmol}\cdot\text{l}^{-1}$ lactate concentration level at anaerobic threshold. So there was a necessity to determinate the running velocity and lactate concentration at submaximal level of intensity (v_{submax}), that is described in methods of this study. From one point of view different running v_{submax} between the runners makes the results incomparable. But from the other side, it gives an opportunity to compare runners who are running with intensity according to their submaximal level.

Next discussion issue is the length of time intervals (2min) and the increased running velocity of each of them ($0.5\text{km}\cdot\text{h}^{-1}$). In this kind of study the length of time interval is an important factor to be exact in determining anaerobic threshold. Two minutes long time interval gave runner an opportunity to adapt to actual running velocity. It also gave the researcher enough time to determine and estimate the tendency of lactate concentration dynamics. In this study a one minute long time interval, was not long enough for both of the reasons. Similar tests in cycling are showing that 2 – 5min long time intervals are widely used (Neumann, 2000). The running velocity increase by $0.5\text{ km}\cdot\text{h}^{-1}$ was found appropriate for this study. There would definitely be a difference in tested running v_{submax} for all of the runners, if the running velocity during the testing were increased every 2min for example by 0.3, 0.4 or $1.0\text{km}\cdot\text{h}^{-1}$. But there is no information obtained experimentally if it would be significant in this kind of study. It would also make the testing longer in terms of time, what could cause a higher fatigue level and extend the recovery period. As the runners are not adapted for treadmill running, a gradual running velocity increase is important to reduce the learning effect. Of course, sport - specific conditions for testing would be useful, as there is a lack of correlation between energy cost of running on the track and the treadmill even for high level runners, suggesting a lack of adaptation to treadmill (Dal Monte et al., 1989). So it is important to keep in mind the fact that the use of treadmill may have an influence on results and the interpretation of them should be done according to the experiment conditions (Williams, 2000).

There are several issues to discuss according to the 3km running test. At first, the run up period which was one minute long and where the running velocity was increased by $1.0\text{km}\cdot\text{h}^{-1}$ every 15s. This was a try to start the 3km running test, when the runners are running already at their v_{submax} and their physiological and biomechanical indicators also have reached the submaximal level. The values of $\text{HR}_{\text{submax}}$ indicators showed, that the run up period probably was not long enough in terms of time. In context of this study it is difficult to define exactly, how long it should be, because $\text{HR}_{\text{submax}}$ values increase during more than a half of the entire running time. So there is a need to do more research and obtain a suitable length of run up period.

The measurements of biomechanical and physiological indicators were made every minute of 3km running. This approach gave an opportunity to collect number of data which was suitable for data analysis. There was also a technological reason to collect data every minute because it is possible to measure blood lactate concentration every 30s (or even more

frequently), but it makes it impossible to analyze them during the run. It is a discussion issue, if two times more lactate concentration data would make it possible to complete some more conclusions.

There was one more thing to add about lactate concentration measurement. While the measurement was taken, for a short time runners increased their step frequency (and decreased step length). The video analysis showed that it was a periodic mistake which can make significant changes in the results. It can happen if the test leader does not make the measurements exactly at the same time and also if it takes more or less time to complete the measurements.

An overall issue to discuss, is if the 3km distance was long enough for this kind of study. As the results showed, it could be useful to increase the length of running distance. For example, a longer running time (and distance) would show the continuous tendency of HR_{submax} dynamics. Probably showing also if it is a matter of adaptation or the run up period, as mentioned before. A 5km long distance was used to determinate relationship between running technique efficiency and energetic potential (Miura et al. 1973). This and other examples are showing that 3 – 5km long distances can be acceptable for this kind of study. From a five kilometres long running distance, it would probably be possible to obtain some more data, which could make a greater background for more proper interpretation of the results.

The analysis of the results of the study showed some unexpected trends. The values of HR_{submax} were increasing, while values of La_{submax} continuously varied during the run. It was expected, that both of the indicators would keep constant as the v_{submax} did. There was a positive reliable correlation found between those values, despite of different characteristics in dynamics. It is a discussion issue if this correlation probably could be apparent or not. There is a necessity to verify these factors in future studies and also find an explanation for the dynamics of these indicators.

There were no significant changes in the biomechanical indicators. There was a tendency to decrease SL_{submax} and increase SF_{submax} during the running. Exception was runner S3, who had an opposite tendency. It can be acceptable to explain this tendency with a different fatigue compensation mechanism or probably as a coincidence.

A formula was used to evaluate running economy (described in methods). The formula shows, which runner has a higher economy values according to heart rate at actual running velocity.

Through decades scientists are studying the problem of running economy, but it is not solved completely. This study was an attempt to do it in a slightly different form in relation to methods used and subjects chosen.

Conclusions

The physiological analysis showed, that the values of heart rate increased and values of lactate concentration continuously varied during the three kilometres running test.

The biomechanical analysis showed, that the values of step length decreased, but the values of step frequency increased during the three kilometres running test.

Insignificant changes in step length or frequency do not have a statistically significant influence on heart rate or blood lactate concentration.

Runners having lower heart rate level together with less significant changes in the variety of other physiological and biomechanical indicators, had a higher level of running economy.

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INVESTING IN YOUR FUTURE



Submitted: May 11, 2012
Accepted: November 12, 2012

REVIEW PAPER

INDICES OF ELITE FEMALE BIATHLETES' AGE AND BODY COMPOSITION**Natalja Kočergina, Algirdas Čepulėnas**

Lithuanian Sport University

Address: 6 Sporto Street, LT 44221 Kaunas, Lithuania

Phone: +370 37302674, +370 68584246

Fax: +370 3724515

E-mail: kocergina@gmail.com; a.cepulenas@lkka.lt**Abstract**

The process of training elite female biathletes for many years is closely linked to optimal age limits aiming at seeking individual sports results of the highest level. Factors characterizing biathletes' athletic fitness also include anthropometric data. Research aim was to analyze age and body composition indices of elite female biathletes who took places 1-10 in 2012 World Biathlon Championship. Research methods applied were as follows: literature review, analysis of the documents of the International Biathlon Union (IBU) and the protocols of 2012 World Biathlon Championship, bibliographic data of elite biathletes (Biathlon^{2, 3, 4}). Were calculated the following body mass indices: Body Mass Index (kg/m^2), Kettle Index (g/cm), relative body height and body mass index [height – (body mass + 100)] in relative units. Were analyzed age and body composition indices of biathletes who took places 1–3, 4–10 and 1–10 in individual events in 2012 World Biathlon Championship. Results. The age of biathletes who won medals in individual events in the World Biathlon Championship was 25.8 ± 1.5 years, while the average age of biathletes who took places 4–10 was 27.0 ± 1.5 years. The height of biathletes medal winners was 166.20 ± 1.7 cm, while the height of those who took places 4–10 was 168.3 ± 0.9 cm. Body mass of medal winners was 57.3 ± 1.6 kg, their body mass index (BMI) was 20.7 ± 0.3 kg/m^2 , their Kettle index was 344.4 ± 6.6 g/cm . Conclusion. Body composition indices of biathletes medal winners and those who took places 4–10 could be interpreted as the model ones and they should be taken into consideration while programming perennial training of elite biathletes.

Keywords: *biathlon, world championship, age, height, body mass, Body Mass Index, Kettle Index.*

Introduction

Anthropological studies show that body composition of athletes in different sports is different (Claessens et al., 1994; Norton et al., 1996; Olds, 2001; Ягелло, Ткачук & Ягелло, 2003; Bunc, Vávra & Levora, 2005; Подригало, Галашко & Лозовой, 2007; Ягелло & Крушенский, 2008). In different sports athletes' height, body mass and their components have a different effect on competition activities (Berg & Forsberg, 1992; Timakova, 1996; Wilmore & Costill, 2004; Čepulėnas, 2006; Подригало, Галашко & Лозовой, 2007; Larson & Henriksson-Larsén, 2007; Psotta et al., 2009).

Specificity of a sport also affects changes in body composition indices (Norton et al., 1996; Wilmore & Costill, 2004). In different sports body composition indices are specifically related to sports results (Norton et al., 1996; Подригало, Галашко & Лозовой, 2007; Larson & Henriksson-Larsén, 2008; Psotta et al., 2009).

Planning athletic training of elite athletes is linked to prediction of optimal age limits aiming at achieving the best individual sports results (Wilmore & Costill, 2004; Платонов, 2004). In biathlon sports mastery is highly dependent on sliding speed, accurate and fast shooting (Hoffman et al., 1992; Cholewa et al., 2005; Carlson, 2011). High sports mastery is affected by athletic and technical fitness, functional capacity, age and years of sports experience (Rundel & Szmedra, 1998; Cholewa et al., 2005; Преображенцев, 2007; Psotta et al., 2009; Carlson, 2011).

Skiing technique and sliding speed in the distance depend on body composition indices (Ingjer, 1991; Berg & Forsberg, 1992; Timakova, 1996; Mahvod et al., 2001). Shooting results depend on athletes' mental fitness, shooting technique, sports experience and age (Manfredini et al., 2002; Cholewa et al., 2005; Vickers & Williams, 2007; Carlson, 2011).

Physical working capacity and body function indices of biathletes are related to the ration of body mass and their components (Rundell & Bacharach, 1995; Bunc, 2001; Bunc Vávra & Levora, 2005; Psotta et al., 2009). The problem of interaction of biathletes' age and their sports results is particularly relevant while planning biathlete training in Olympic four-year cycles. The indices of elite biathletes' age, height body composition and their interaction with their sports results have not been adequately studied and thus the problem remains relevant.

Research aim was to analyze age and body composition indices of elite female biathletes who took places 1–10 in 2012 World Biathlon Championship.

Materials and methods

Research methods applied were as follows: literature review, analysis of the documents of the International Biathlon Union (IBU) and the protocols of 2012 World Biathlon Championship, bibliographic data of elite biathletes (Biathlon^{2,3,4}). We calculated body mass indices: Body Mass Index (kg/m^2), Kettle Index (g/cm), relative body height and body mass index [height-(body mass +100)] in relative units.

We also analysed the indices of the best biathletes in 2012 World Biathlon Championship in Ruhpolding. According to the results achieved in individual events in the programme, the biathletes were divided into three groups: places 1–3; places 4–10 and places 1–10. The data obtained were processed using Microsoft Excel 2003 programme. Were obtained arithmetic means (\bar{x}) and standard deviations ($\pm\text{SD}$).

Results

In 2012 World Biathlon Championship in Ruhpolding, the majority of medals in the individual events were won by elite biathletes from Germany, Belorussia, Norway and France (Table 1). The majority of places 1–10 were taken by athletes from France and Russia.

Table 1

Indices of age and body composition of national team biathletes who took places 1–10 in the World Biathlon Championship ($\bar{x} \pm \text{SD}$)

National team	The number of places in individual events			Indices of age and body composition for biathlete who took places 1–10						
	Places			Age (years)	Body height (cm)	Body mass (kg)	Body mass index (kg/m^2)	Kettle index (g/cm)	Height – (mass + 100) in relative units	
	1–3	4–10	1–10							
Germany	2	2	4	24.3±0.5	174.0±12.7	59.5±5.0	20.2±0.5	341.9±3.5	14.5±7.8	
Norway*	2	2	4	30.0	164.0	57.0	21.2	347.6	7.0	
Belorussia*	2	1	3	24.0	168.0	58.0	20.6	345.2	10.0	
France	2	6	8	26.0±1.4	165.0±4.2	54.5±0.7	20.1±0.8	327.4±8.4	10.5±3.5	
Russia	1	6	7	27.3±5.1	167.7±5.1	60.7±6.7	21.1±1.1	361.3±29.5	7.0±2.0	
Sweden	1	3	4	27.3±0.5	172. ±0.7	58.5±0.7	19.7±0.1	339.1±2.7	14.0±0.6	
Finland	1	–	1	29.0	171.0	58.0	19.8	399.2	13.0	
Slovakia*	–	3	3	27.0	180.0	70.0	21.6	388.9	10.0	
Poland	–	1	1	26.0	158.0	51.0	20.4	322.8	7	
Italy	–	1	1	33.0	164.0	52.0	19.3	317.1	12	
USA2	–	1	1	28.0	166.0	58.0	20.1	349.4	8	

* The places taken belong to one female biathlete.

In the individual events in the World Biathlon Championship, the medals were won by eight biathletes, and their age was 25.8 ± 1.5 years, and

the age of biathletes who took places 1 – 10 ($n = 17$) was 26 ± 1.0 years (Table 2). The age of biathletes from German national team who took places 1–10 was 24.30 ± 0.5 years, the age of biathletes from French national team who took places 1 – 10 was 26.0 ± 1.4 years, and from Russia – 27.3 ± 5.1 years (Table 1). The most successful biathlete from Italy was 33 years old; the best biathlete from the USA was 28 years old. Biathletes medal winners were slightly younger than those who took places 4 – 10 (Table 2).

Table 2

Indices of age and body composition of biathletes who took places 1–3, 4–10 and 1–10 in individual events in the World Biathlon Championship ($\bar{x} \pm SD$)

The places taken by biathletes	Age (years)	Body height (cm)	Body mass (kg)	Body mass index (kg/m^2)	Kettle index (g/cm)	Height – (mass + 100) in relative units
Places 1–3 in all distances ($n = 8$)	25.8 ± 1.5	166.2 ± 1.7	57.3 ± 1.6	20.7 ± 0.3	344.4 ± 6.6	8.8 ± 0.7
Places 4–10 in all distances ($n = 16$)	27.0 ± 1.5	168.3 ± 0.9	58.6 ± 0.9	20.7 ± 0.2	347.5 ± 4.0	9.7 ± 0.7
Places 1–10 in all distances ($n = 17$)	26.4 ± 1.0	167.2 ± 0.5	57.9 ± 0.5	20.7 ± 0.3	346.0 ± 2.8	9.3 ± 0.5
7.5 km sprint						
Places 1–3	25.0 ± 1.0	164.3 ± 4.0	56.3 ± 1.5	20.9 ± 0.5	342.8 ± 3.0	8.0 ± 2.6
Places 4–10	26.1 ± 2.1	168.7 ± 6.7	59.0 ± 6.3	20.7 ± 1.0	349.0 ± 24.8	9.7 ± 2.8
10 km pursuit races						
Places 1–3	24.0 ± 1.0	168.3 ± 3.5	59.7 ± 4.7	21.0 ± 0.8	354.2 ± 20.8	8.7 ± 1.5
Places 4–10	27.4 ± 3.3	166.9 ± 5.0	57.4 ± 3.4	20.6 ± 1.1	344.1 ± 16.6	9.4 ± 4.1
15 km individual start races						
Places 1–3	26.7 ± 3.5	166.3 ± 5.9	56.7 ± 2.5	20.5 ± 0.7	340.6 ± 7.1	9.7 ± 3.8
Places 4–10	28.9 ± 3.2	168.7 ± 6.0	59.6 ± 6.9	20.9 ± 1.2	352.4 ± 29.4	9.1 ± 2.8
12.5 km mass start races						
Places 1–3	27.3 ± 3.8	165.7 ± 4.7	56.3 ± 2.1	20.5 ± 0.7	340.0 ± 7.2	9.3 ± 3.2
Places 4–10	25.4 ± 1.0	$168. \pm 9.5$	58.3 ± 6.3	20.4 ± 1.0	344.5 ± 21.5	10.6 ± 4.9

In different distances, the age of biathletes medal winners did not differ much. Younger biathletes medal winners were in 10km pursuit races (24.0 ± 1.0 years), and the oldest biathletes medal winners were 12.5km mass start races (27.3 ± 3.8 years). Biathletes who took places 4 – 10 in 15km races were slightly older than their counterparts who took the same places in sprint and 10km pursuit races.

The highest national team biathletes who took places 1 – 10 were those from Germany ($174.0 \pm 12.7\text{cm}$), and the shortest were those from France ($165.0 \pm 4.2\text{cm}$, and their body mass was $54.5 \pm 0.7\text{kg}$) (Table 1).

Russian biathletes who took places 1–10 in the individual events were heavier than biathletes in other national teams. Their body mass was $60.7 \pm 6.7\text{kg}$, their body mass index was $21.1 \pm 1.1\text{kg}/\text{m}^2$, and their Kettle

index was $361.3 \pm 29.3\text{g/cm}$. The body height and body mass indices of biathletes medal winners in different distances did not significantly differ. The shortest and the lightest biathletes who won medals participated in 7.5 km sprint races. It should be noted that the body mass, Body Mass Index and Kettle Index of biathletes who took places 4–10 in sprint and 12.5 km mass start races were slightly higher than those for biathletes who won medals in the same distances (Table 2).

Relative body height and body mass index [height – (body mass + 100)] was from 8.0 ± 2.6 to 9.7 ± 3.8 relative units for medal winners. German and French biathletes who took places 1–10 were particularly light because their relative body height and body mass indices were respectively 14.5 ± 7.8 and 10.5 ± 3.5 relative units.

Discussion

The range of age for biathletes medal winners in the individual programmes in all distances was from 24.0 ± 1.0 years to 27.1 ± 1.8 years. The youngest medal winner was the French 23-year-old bronze medalist in 15km and 12.5km mass start races. The oldest medal winner was the 30-year-old Norwegian who won gold medals in 15km and 12.5km mass start races. We suggest that the optimal age for biathletes to demonstrate best results (win medals) is 23 – 30 years. In the Olympic Games of 1992 and 1994 the age range of biathletes medal winners was 24 – 29 years; in 1998 it was 25–33 years (Фомин, Смирнова & Гаясова, 2000). The age of elite biathletes does not particularly differ from the age of elite cross-country skiers. In the individual skiing races in 2010 Vancouver Olympic Games, the mean age of skiers – medal winners was 28.3 ± 2.4 years (Чепуленас, Кочергина & Статкявичене, 2011). Biathlon demands good physical fitness and good technical fitness for skiing and shooting as well as good psychological and tactical preparedness, and high level of complex fitness demands during 8 – 12 years of systematic and tensed training (Rundell & Bacharach, 1995; Rundell & Szmedre, 1998; Choleva et al., 2005). Biathletes under 22 years of age experience difficulties in winning medals at the highest level competitions.

The height of all biathletes who won places 1–10 in individual events was $167.5 \pm 6.1\text{cm}$ (Table 1). The tallest biathlete (180cm) represented Slovakia national team. The height of biathletes – medal winners was similar to that of skiers – medal winners ($168.9 \pm 4.1\text{cm}$) at Vancouver Winter Olympic Games (Чепуленас, Кочергина & Статкявичене, 2011).

Body mass and its components affect the speed of sliding while skiing, but the effect is different in different places on the track (Bergh &

Forsberg, 1992; Larson & Henriksson-Larsen, 2008). On the carved terrain or climbing the hill, low body mass positively affects the speed of sliding; however, athletes with bigger body mass reach higher speed while descending down the hills or skiing on the smooth track (Bergh & Forsberg, 1992; Larson & Henriksson-Larsén, 2008). Energy consumption while sliding on the skis depends on the body mass (Ingjer, 1991; Timakova, 1996; Mahvod et al., 2001).

It is very important for athletes that their body mass indices matched their aerobic possibilities (Ingjer, 1991; Timakova, 1996). Relative oxygen consumption (ml/kg/min) for athletes with lower body mass is higher compared to that of athletes with bigger body mass (Bergh & Forsberg, 1992; Larson & Henriksson-Larsen, 2008). When sliding, the upper parts of the body (the strength of arms, back and abdominal muscles) are of great importance (Bilodeau, Roy & Boulay, 1995; Gaskill et al., 1999; Головачев, Кузнецов & Чурикина, 2000; Феофилактов, Зимирев & Селуянов, 2007). Body mass, power indices and aerobic abilities of the body are extremely important as they affect the speed of sliding on the skis (Hoff, Helgerud & Wisloff, 1999; Hoff, Grand & Helgerud, 2002; Osteras, Helgerud & Hoff, 2002).

It has been established (Larson & Henriksson-Larsén, 2008) that in the skiing race body mass negatively correlates ($r = -0.648$) with skiing results, but the mass of the arms positively correlates ($r = 0.636$) with the speed of sliding on the carved terrain. The fat body mass has a negative effect on the results (Niinimaa, Dyon & Shephard, 1978).

The muscle strength of the upper part of the body and the arm muscle mass are important factors affecting the speed of sliding in biathlon as biathletes slide with rifles in their hands, and extra weights as well as strength indices are very important.

The body mass of biathletes – medal winners in the world championships was 57.3 ± 1.6 kg, body mass index – 20.7 ± 0.3 kg/m², Kettle index – 344.4 ± 6.6 g/cm. Compared to their height, the body mass of biathletes was not big because the relative body height and body mass index [height-(body mass +100)] was 8.9 ± 0.7 relative units. Body mass indices of biathletes medal winners and those who took places 4 – 10 did not essentially differ. Body mass of all biathletes who took places 1 – 10 ($n = 17$) in the individual programmes was 57.9 their Body Mass Index reached 0.5kg, their body mass index reached 20.7 ± 0.3 kg/m², Kettle index – 346.0 ± 2.8 g/cm, the relative body height and body mass index was 9.3 ± 0.5 relative units.

The body mass indices of biathletes medal winners were slightly lower than those of skier medal winners at the Vancouver Winter Olympic Games (2010). The body mass of skier racers was 61.3 ± 3.1 kg, their Body Mass Index reached 21.55 ± 1.9 kg/m² (Чепуленас, Кочергина & Статкявичене, 2011). Research literature (Psotta et al., 2009) contains evidence that in biathlon, the body mass of elite athletes is low and very low body mass is a positive factor for endurance. In biathlon it is very important to develop strength in arms without increasing body mass, biathletes' body mass should be optimal. The indices of biathletes' age, height, body mass, given in this study, can be considered as the role models for elite biathletes seeking high sports mastery.

Conclusions

We found no significant differences in the indices of age, height and body composition for biathletes who took places 1 – 3 and 4 – 10 in individual events in the World Biathlon Championship.

The age range of biathletes medal winners was from 24.0 ± 1.0 to 27.3 ± 3.8 years. The body mass of biathletes was optimal; their body mass index ranged from 20.5 ± 0.7 to 21.0 ± 0.8 kg/m².

Elite biathletes' indices of age, height and body mass could be interpreted as optimal, and they should be taken into consideration while programming perennial training of elite biathletes.

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REVIEW PAPER

**FAIR PLAY AND MORAL EDUCATION OF/THROUGH
CONSCIENCE****Miloš Bednář**

Faculty of Physical Education and Sport
Charles University in Prague
Address: José Martího 31, 162 52 Praha 6, Czech Republic
Phone: + 420 724119024
E-mail: milbed@volny.cz

Abstract

Aim: to recognize the role of conscience in our decision-making procedure and to encourage educators not to give up an appeal to consciences of their pupils, students or trainees.

Methods: Our methodology is philosophical, involving conceptual analysis, comparison and the application of the outcomes to sports practice.

Results: The field of sports proved itself as a proper area for maturation of our consciences and it can play an important role in the topical ethical reflections. The main role was found in a fair play movement, if examples of both good and bad conscience are used.

Conclusions: Power of fair play movement is based on dealing with conscience experiences, having at its disposal a lot of examples concerning conscience of athletes, which are suitable for pedagogical utilization – three of them with a strong charge are presented at the last part of the study.

Keywords: *conscience, fair play, moral education, sports ethics*

Introduction

Since the time of Blais Pascal we know that “the heart has its reasons of which the reason knows nothing” (Pascal 2002, § 277) ... We think that being reminded of this wisdom in connection with the movement of fair play is quite apt – perhaps using a milder variant, where the reason *knows not so much*. Analytically speaking, there are two “orders” in human life, two structures standing side by side: *ordo amoris* and *ordo rationis*, the order of the heart and the order of the reason. Both orders are joined in a very special organ – *conscience*.

This connection is also hidden in its Latin etymology (*con-scientia*): *con-* (“with” or “together”) accepts the reign of the reason (*-scientia*), but

also opens a certain sphere of the unknown, a non-measurable and logically (with logos!) ungraspable realm of transcendence.

Let us therefore focus on CONSCIENCE, the keyword of ethics, about which philosophy, psychology and other humanities have also something to say. All these disciplines will, quite exceptionally, serve us as “auxiliary sciences” for educational purposes.

Methods

We are persuaded that our approach to the topic joined with “conscience” must be interdisciplinary, using outcomes of philosophy, ethics, history, sociology, psychology, theology and pedagogy.

Our methodology is predominantly philosophical, involving conceptual analysis, comparison (especially conscience with ethos) and the application of the outcomes to sports practice.

The first part of our study uses also methodology of history with a special application to the “history of notions”, analysing the notion of “conscience” and following its maturation both in history and in personal development. At the end a special selection of the most influential theories (those of Martin Heidegger and Viktor Frankl) was transformed into basis of the further reflections of ours.

Short history of the notion “conscience”

We cannot avoid a quick historical excursion – also because of the fact that there could be a certain parallel between the relationship of the moral development of an individual and the ethical maturation of a society on the one hand, and the relationship of ontogenesis and phylogenesis at the biological level on the other hand.

The first person to have had a certain awareness of this peculiar ethical authority was probably Socrates. Yes, it is his famous *daimonion* – he still understood it in a completely

heteronomous manner, as the voice of God. From our current understanding of conscience it differs in its radius of operation; it worked “before” (the action), as a consultant prior to any major decision – we are talking about *conscientia antecedens*. Later, the radius of operation of conscience was extended to “after” (the action) – now we are also talking about *conscientia consequens*. This was further developed particularly in the New Testament. The broad variety of epithets, by which conscience is differentiated, testifies to the sophistication of its doctrine: ranging from “weak” to “strong” it may be bad, tainted, ashamed, unsure, purified and clear, intact, proving, responsible, heart penetrating and, last but not least, also good.

Gradually, conscience was increasingly seen as a personal human instrument, autonomously (Cicero, Seneca). In Seneca's famous sentence: "Shame may restrain what law does not prohibit"¹ the use of "conscience" as a stronger ethical instrument (stronger than shame) suggests itself. Besides these philosophical considerations the expression "conscience" has developed in its moral form in the common vernacular speech. This can be proved perhaps by the most interesting ancient statement about conscience in the form of a folk saying "Conscientia mille testes" – conscience (is like) thousands of witnesses. Yes, conscience may have the same effect as a crowd (*mille* was also a vague expression denoting any large number) of witnesses.

The concept of conscience was comprehensively analyzed by Thomas Aquinas in the 13th century. We should give credit to this medieval rationalist for realizing that there was also a share of an irrational, transcendental component in it.

As far as current approaches are concerned, the path is paved with names like Kant, Hegel, Schopenhauer and Nietzsche in the field of philosophy and Freud or Jung as representatives of psychology – let us translate the achievements of their reflections into a concurrent discourse and have a closer look only at Heidegger's approach, as a representative of philosophy, and that of Frankl, that is from a psychologist's point of view.

Martin Heidegger regards conscience as a key to an authentic life (see Heidegger 1962, especially § 54-60). He sees conscience as a "voice" that tells us to be ourselves. A common view of conscience as a "voice" deepens throughout the analysis of specificity, the *calling* of this "voice" (*Gewissenruf*). It is an alarming call and a direct urge; but, paradoxically, it deploys an unexpected means of expression – *silence* (!) For Heidegger, the call of conscience is one that silences the chatter of the world, brings me back to myself and interrupts the "talking" in the zone of "*das Man*"². Heidegger refers to the concept of this special zone of human life in explaining inauthentic modes of existence, in which people, instead of truly choosing to do something, do it only because "That is what one does" or "That is what people do". Thus, "*das Man*" is not some measurable entity, but rather an amorphous part of social reality.

¹ Used in the drama "The Trojan Women" (Troades) III, 334.

² There is no exact English translation. It is often translated as "the They" or "People" or "Anyone" but is more accurately translated as "One". The Czech philosopher Jan Patočka presented own interpretative translation: *the anonymous public*, which seems more comprehensible.

“Talking” is one of features of inauthentic life according to Heidegger. How well we know this “talking” or rather “idle talking” that so often obscures the underlying problem or masks our own shortcomings – both in the cognitive and ethical sphere. Students often refer to this using the expression “doubletalk”...

To listen to the call of conscience and understand it equals “wanting to have a conscience” (**Gewissen-haben-wollen**), which implies a return to ourselves from the inauthentic immersion in the homely familiarity of everyday life, from the world of “*das Man*”.

The final phase of the decision-making procedure, which is the only path that leads us to an authentic life orientation, is an adequate response to the calling of conscience, which is based on our resoluteness (*Entschlossenheit*). Only this enables us to “unlock” our very own potency. We can therefore see that Heidegger’s conscience does not chastise, condemn, encourage, warn, advise, it does not even provide specific information – it “only” provides us with a chance to understand its calling and to opt for an authentic life – or to (inauthentically) “negotiate” with it and thus deceive it/ourselves.

Heidegger’s complicated analyses have been somewhat pedagogically simplified here - we dealt with them in more details in (Bednář 2009, 59 and 154-155).

Viktor Frankl is our most inspirational authority in the field of psychology, where ethics frequently seeks its allies. Despite the fact that the key word of his life is *logos* (mostly in the role of a “meaning” or “sense”, in relation to human life), conscience plays an important part in his theoretic (and therapeutic) system. He refers to conscience as a “pre-reflective ontological self-understanding” or “the wisdom of the heart” (Frankl 1975, 39).

He often refers to it as an *organ of meaning* (!) Yet: “...meaning must be found and cannot be given” (Frankl 1975, 112). It is the leading rule also for his *logotherapy*, a special type of psychotherapy.

Provided that there is an active conscience, he sees strength in it, which encourages man to a (lifelong) search for meaning, fighting so against the risk of “existential vacuum” (Frankl’s prevalent metaphor). A *watchful* conscience in Frankl’s conception also leads to authenticity and to the resistance against the instance of fate.

Conscience in Frankl’s interpretation is intuitive and highly personalized. It refers to a real person in a real situation, and cannot be reduced to simple “universal laws”. It must be lived. We can thus see that Viktor Frankl ascribes a more significant role to conscience than Martin

Heidegger does – for our further reflection and pedagogical activity its connection with the *meaning of life* is of no small challenge.

Formative aspect

If we consider an appropriate influence on still immature conscience, there is an *indirect effect through ethos of different societies* (a) and a *direct effect of pedagogy* (b) on the agenda.

Ad (a)

For our purposes we can define the ethos as a collective conscience of a sort, concentrated into a form of declarations of basic principles, creeds or “professions of faith”. For example, the principles of fair play are the ethos of sports. These principles can be elaborated into *codes of ethics*.

The analyses of the relationship of conscience and ethos were performed by Arno Anzenbacher, the Austrian philosopher and theologian (see Anzenbacher 1992, ch. 5.1.3). Schematically, in his view, the “communication” between these two ethical authorities is such that ethos has an “evident” power to influence conscience, e.g. by forming it, “supplying” it with standards, principles and moral rules.

Conscience can, however, besides accepting, also opt for distance and in some cases influence ethos, e.g. by destabilizing it or changing its dynamics. The leverage (pressure) of ethos, however, is stronger and thus only a really ripe personality can transform some ethos.

What does this mean for sports practice and theory? As teachers or theorists, educators or trainers, we perform a role of distributors or mediators, who should convey the positive elements from the ethos of various sports organizations, sport disciplines or Olympism, as well as to highlight the examples of positive actions initiated by a mature conscience.

Ad (b)

I would first like to dispel certain scepticism that we have often encountered either as teachers or sports practitioners. This stems from a feeling that especially in the adolescent or post-adolescence period we have no chance whatsoever to influence the conscience of our students or trainees, as we suppose that this had been already formed or rather, deformed. However, theoretical knowledge, and, thankfully, also practice, often proves the opposite. At the theoretical level we can draw encouragement from the works of Jean Piaget or Lawrence Kohlberg. The three known levels of moral development according to Kohlberg (see Kohlberg 1971 and his later works) are at their highest one (post-conventional morality, based on respect for universal principles and the

demands of individual conscience, which become the decisive factor in our decision-making ability) planned out for the “young adulthood”, that is approximately the age from 20 to 30 and many of his followers even believe that this level cannot be reached before the age of 25. Waldorf education comes to the same conclusion (based on Steiner’s well-known 7-year division into periods of human life), adding that the role of education and help with the orientation in moral experiences and incorporating them into right proportions is the most successful between 14 and 21 years of age and then the torch should be gradually passed on self-education³.

There certainly is a chance of positive influence (a “training of conscience”); it is just about being able to use it. Moreover, we believe that a well “trained” conscience is sensitive to ethical issues and moral values or dilemmas and within the process of self-education (as a component of spiritual development) in fact matures for the rest of the life.

Sports context

Let’s have a closer look at the *sports context* of what had been discussed in our analyses of conscience. We will connect this to the facticity of *getting to experience* conscience, where sports subculture or experience pedagogy can manifestly contribute to the formulation of general conclusions.

Conscience experiences, which are often in sports, could become a good educational tool due to their concreteness. It is paradoxical, and powerful at the same time, that this type of experience cannot be escaped...

It should be noted that we can gain personal experience even from the activities of a *foreign* conscience (causing our dislike, aversion, antipathy, consent or admiration), which can even lead (under ideal circumstances) to *catharsis*, which can open the door to authentic life. However, it is obvious that an experience that would reach possibly as far as personal existential maximum, can occur only in the case of our *own* experience.

Relevant situations in sports are more concentrated in time or have a very short period of time available. It requires well “trained” conscience, a conscience that is flexible and prepared to respond despite being limited by time. Only one example:

Triathlete Jaroslav Brynda obtained the main Czech Fair Play Award in 2002. Being in the second place at the National Academic Championship at the time, he stopped to help an injured rival (leading at that time) instead of racing on and gaining the gold medal. The third triathlete did not

³ These findings were published especially by Bernardus Lievegoed (see especially Lievegoed 1997).

want to help and pushed ahead towards a “brilliant victory”... When the injured triathlete was taken to the hospital, our “hero” raced on and finished second.

In a later reflection of this act he described the process of decision-making and said that “there was no time to think” (yes – one second might have been available) and that “it” was “in him”, as a result of the family upbringing. Could this have been anything else but an act of a mature conscience?

A bad conscience can produce very powerful experiences associated with self-accusation based on a feeling of guilt or twinges of conscience or with the loss of the original (moral) integrity. It can also produce experiences ranging from “being torn” or blame oneself. A wealth of empirical material can be supplied by mountaineering, such as the case of Joe Simpson and Simon Yates from the Peruvian Andes described in the book “Touching the Void” (Simpson 1997, 1988¹). Joe broke his leg during extremely hard descent and so handicapped he lost his footing some time later and the fall was stopped only thanks of the rope in Simon’s hands. There was no possibility for Joe to climb up. He described this situation in his book: “There was no chance of Simon hauling me up. It would have been extremely hard with a solid belay. Sitting in the snow seat, it would be suicidal to attempt it.” (Simpson 1997, 96). And Simon decided (after an agonizing period of about one hour) not to commit suicide and cut the rope... Can we imagine terrible dilemma he had to solve? Some can argue that cutting the rope as “the powerful symbol of trust and friendship” should never occur in his mind, others can say that it was simply a matter of survival, something he was forced to do. Can his act be vindicated on the basis of (positive) result⁴? Can we judge him? The whole story (with a lot of additional moral dilemmas) gives us a perfect material for ethical lessons.

Athletes are also familiar with the harrowing state of conscience after their “excommunication” from the team or the sports community in general (e.g. after repeated doping offenses). Being branded as somebody whose success is achieved via unfair methods is also a difficult burden to bear for a long time, even under a protective wall of cynicism. The doping case of an American sprinter Marion Jones is more than pregnant example here and has features of the ancient tragedy: fame and fall, denial and confession guilt, punishment, prison, tears, hypocrisy and repentance... and pricks of conscience, undoubtedly.

⁴ Both climbers were finally saved – Joe after many incredible adventures with combination of his iron will and lucky chances (yes, we can speak about miracle). Emmanuel Hurych analysed the story from the pragmatic approach (accentuating results more than purposes) and as well from other points of view – see Hurych (2012).

Results and discussion

It seems that modern sport have gone more likely through a creation of its own norms, rules, controlling principles and ethos – the phenomenon of conscience is only seen as occasional glimpses. Even Scott Kretchmar, the author of the “bible” of philosophy and ethics of sports (Kretchmar, 2005) does not take the notion of conscience into account in his work and prefers other approaches. We gain negative results of research after relevant sources in the other sports literature as well.

Yet we judge that above analysed cases have power to support our thesis about importance of both experiencing and reflecting of conscience. It is just sport that keeps creating new situations, when athletes are close to their limitations (in all aspects of human being) or even “over the edge”. Such situations often have their ethical relevance and thus require adequate solutions. It turns out that learnt patterns of behaviour (e.g. based on habits, codes of ethics etc) are not sufficient and that more flexible instruments are needed. Codes, rules, norms or behaviour shaped by fear of punishment or sanctions are not enough even for troubleshooting of modern sport. The situation calls for a direct development and education of conscience. It is also effective, as “*conscientia mille testes*” - mature consciences could save us a lot of arbiters and supervisors.

Conclusion

As educators we have a special privilege – the privilege of *responsibility*... We live inside Fink’s antinomy⁵: we educate, without being fully educated ourselves (let’s note, realistically, that we will never achieve the end of the indefinite process), so each of us is a *homo educans and homo educandus*⁶ at the same time. We should never become knights of the sorrowful countenance; our own deeds should never differ from what we preach.

Let’s finish, however, in an optimistic fashion: If we can also understand conscience as a *meeting point of love and law*, let’s populate this newly created area with such education that leads to a synthesis of love and law, and to application both *fair play principles* and a *pedagogic eros* into practice.

⁵ Eugen Fink, the German phenomenologist (1905-1975), elaborated six antinomies (dilemmas) of education – see Fink (1992, 16 ff).

⁶ A basic anthropological paradigm for Fink: a man has a (lifelong) task to form his life and the only means is education; it is an act of both giving (educans) and receiving (educandus); yet the latter needs our open manner. See Fink (1978, 63).

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Submitted: June 19, 2012

Accepted: November 12, 2012

SHORT COMMUNICATION

Review of Inta Bula-Biteniece, Rasma Jansone and Krzysztof Piech book "Child and sports at pre-school"



Content of the book provides insights in important issue of theory and practice of sports pedagogy: pre-school sport teacher and parent equal cooperation targeted to promote children purposeful self-development through family sport, which is a topicality of contemporary family pedagogy and sport pedagogy. The authors provide theoretically justified recommendations in the organization of physical activities for the promotion of children harmonious development through family sport at preschool age.

Educational content of the Book provides possibility for every reader to understand physical activities as fundamental value at preschool age, because sufficient physical activities are the basis for child successful growth, harmonious development and health. Physical activities secure child first psychomotor progress, brain and cognitive development, as well as promote the autonomy and social skills.

Specialists will be able to put into practice not only holistic school sports didactics, but also gain ideas from the examples of good practice in Poland. In the Chapter on educated and physically active family parents can find advice on how to ensure physical activities necessary for child. The investigation "Children physical activities together with parents in Riga parks" in its turn will encourage parents to reflect how to promote on daily basis child physical activities supportive action.

This is the first such collaborative effort in Latvian, serious theoretically substantiated and practical book for both existing and future health professionals and parents in promoting harmonious children development in the framework of holistic approach.

Andra Fernate
PhD, Asoc.Professor
Latvian Academy of Sport Education

CURRENT NEWS



Latvian Academy of Sport Education

LASE 5th PhD and Master Student Scientific Conference
"Theory and Practice in Sport Science"
March 14, 2013 Riga, Latvia

LASE 65th Student Scientific Conference
April 4, 2013 Riga, Latvia

6th Baltic Sport Science Conference
April 23-25, 2013 Riga, Latvia

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



29th SELL Student Games
Latvia, Riga
May 24-26, 2013

We wish to inform you of the 2013 SELL Student Sports Games which will be staged in Riga during May 24-26, they are an extensive student sports event, which originated from the Nordic and Baltic Country Student Olympics and take place in one of the member countries (Finland, Estonia, Lithuania, Latvia) every year.

The international scientific conference "Students, Sports, Lifestyle" will be taking place concurrently with the sports events – we invite those interested to apply.

Information on the SELL Student games: www.sellgames2013.eu

CONGRATULATION



We congratulate **Luīze Ventaskrasta**, the doctoral of student studies of the Latvian Academy of Sport Education, with the defence her Thesis “Adapted Physical Activities in Pedagogical correction for hyperactive (having ADD/ADHD Manifestations) primary school pupils” (Sport Science) at the Latvian Academy of Sport Education on February 21, 2012. Supervisor Prof. V.Lāriņš.

PhD Luīze Ventaskrasta is a lecturer in the Department of Sport Medicine in Latvian Academy of Sport Education. Since 2010 she is a physiotherapist in “Aqua fitness”, Ltd.



We congratulate **Uģis Ciematnieks**, doctoral student of the Latvian Academy of Sport Education, with the defence of his Thesis “Effect of Local Vibrostimulation on Strength Expressions” (Sport Science) at the Latvian Academy of Sport Education on January 17, 2012. Supervisor Prof. L. Čupriks.

PhD Uģis Ciematnieks is a lecturer in the Department of Heavy Athletics, Boxing and Wrestling in Latvian Academy of Sport Education.

Thesis developed with ESF support under project “*Support for Sport Science*” No. 2009/0155/1DP/1.1.2.1.2/09/IPIA/VIAA/010 programme of work „Human resources and Employment” 1.1.2.1.2. sub activity „*Support for Doctoral Study Programme realization*”

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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.

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Inta Bula-Biteniece

Latvian Academy of Sport Education

Brivibas gatve 333 Riga, Latvia, LV-1006

Phone: +371 67543412, fax: +371 67543480

E-mail: inta.bula-biteniece@lspa.lv

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