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ORIGINAL RESEARCH PAPER

MEDICAL CERTIFICATES FOR EXEMPTION FROM COMPULSORY STUDY COURSE "SPORTS" AT UNIVERSITY: PROBLEMS AND SOLUTIONS

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Abstract

The study course "Sport" at Riga Technical University (RTU) is a compulsory study course, which eliminates several obstacles that students face to be physically active. However, students often submit medical certificates with conclusions on sicknesses for the exemption from sports activities, although the promotion of physical activity of the population is an essential part of chronic disease treatment. In Latvia, problems related to medical certificates for the exemption from sports activities at school have been studied, but no research has been conducted on the reasons of exemptions from sports activities among students. The aim of the study: to evaluate the content of medical certificates for the exemption from "Sport" and the information provided by the doctor to the student and sports specialist on the necessary load frequency, duration and intensity of physical activity in the cases of most common diseases, as well as the attitude of students with irregular attendance of "Sport" towards sports activities at school. Methods: scientific information source analysis, document analysis (medical certificates), surveying, mathematical statistics. The study lasted for 5 years and involved 1249 students (730 men, 519 women, age 19.2±0.7). Results and conclusions: 50% of students have submitted medical certificates to a sports specialist with conclusions on sickness for exemption from "Sport". In 34.8% of the cases the medical

certificates did not include a diagnosis. The content of medical certificates is inconsistent, it does not provide the student and sports specialist with information on the necessary load frequency, duration and intensity of physical activity in the cases of most common diseases.

Key words: *medical certificates for the exemption from study course "Sport", students' attitude towards sports activities*

Introduction

It has been scientifically proven that physical activity has a key role in maintaining good health, it is necessary for all people regardless of the age and the state of health, because it is an integral part of prevention and treatment of many diseases (Priedīte et al., 2014). Taking into consideration the reduced level of PA of the population in Latvia, the goal of the sports policy has been defined in the Sports Policy Guidelines for 2014 – 2020: To increase the proportion of the Latvian population that engage in physical or sports activities at least 1-2 times per week. Recommendations of a family doctor are an effective strategy for the promotion of physical activity in the society (Sørensen, Skovgaard & Puggaard, 2006).

The study course "Sport" at RTU (hereinafter referred to as "Sport") is included in the A part of the compulsory subject program, which eliminates several obstacles that students face to be physically active, when starting studies at the university (*Studentu un jauniešu sportošanas paradumi*, 2012; Ābele, 2014). At RTU all first-year students have sports activities twice a week. One of the evaluation criteria is the participation in "Sport". If the student has not attended sports activities due to objective reasons, a medical certificate on sickness, or another document, for example, on a business trip, participation in competition, events, etc. is submitted. Students often submit medical certificates with a conclusion on sickness with a request to excuse them from "Sport" for a long-term period.

By examining the existing information on the justification of medical certificates for the exemption from "Sport", it can be concluded that it is discussed in the Latvian society as a serious problem, because the demand for medical certificates for the exemption from sports activities at school is high among students in Latvia, this problem is regularly reported in the media (*No sporta stundām atbrīvots*, 2006; *Uz sporta stundām ar prieku*, 2006; *Siguldas novada sporta un aktīvas atpūtas attīstības stratēģija*, 2012; Strazdiņa, 2012, Smirnova, 2016). The increase of medical certificates for the exemption from sports activities is reported by sports teachers, many of whom doubt that all exemptions are justified. Students show that medical certificates for the exemption from sports activities were searched for, if

there are no real health problems, medical certificates can be easily obtained (Kondratjuka, Līsmane & Sauka, 2010; Smirnova, 2016). Doctors themselves admitted that in many cases the exemption from sports activities is not justified (Bērtule, 2013; Smirnova, 2016). The problem of exemptions from sports activities was brought up in a research conducted by the Latvian Academy of Sport Education (LASE) in 2008 (Rubana & Ābele, 2008). In 2013, this issue was highlighted by the members of the Sports Subcommittee of Saeima (Latvijas Republikas Saeima, 2013). However, the situation remains critical. In a sociological study carried out in 2014 on sports habits of the youth of Latvia, it was determined that 51% of students were exempted from activities due to sickness, injuries or disability and 7% were exempted from sports activities as such (Jauniešu sportošanas paradumi, 2014). In 2016, in the section "Issues" of the online site "YUONG LV" was noted that 46% of students received a medical certificate for exemption not to attend sports activities (Smirnova, 2016).

How justified are all the exemptions from sports activities? The situation is not that simple, as told by A. Fernāte, Professor of the Latvian Academy of Sport Education: "…If a child visits a family doctor and says that something hurts – how can the doctor say that no, nothing hurts?... However, how can the doctor discover a simulation? At the moment when the child has come to the doctor, the doctor assumes responsibility for the child. Also, if a parent says – my child is in pain, he/she does not feel good, when is the moment that the doctor can say that it is not so?... . It is a complex issue…" (Studente, 2016).

Attitude of students towards sports activities is characterized as non-attendance of the activities (Rubana & Ābele, 2008), in turn, evaluating student attendance of the compulsory sports activities, it shows their conscientious attitude towards physical activities (Tarnapolska & Bondars, 2015). However, only 50% of students in Latvia have a positive attitude towards compulsory sports activities at the university (Koroļova, 2010, Šišlova & Fernāte, 2015). When describing the essence of the attitude, in social psychology and pedagogy it is noted that attitude is opinions and beliefs that are related to experienced emotions and it is formed in operational life experience and through knowledge acquisition (Karimi, 1998; Myers, 2000, 2004; Ghanji, 2001; Špona, 2004).

The negative attitude of students towards sports is often the reason for demanding the doctor an exemption from sports activities, because very often family doctors support non-attendance of sports activities (Kondratjuka, Līsmane & Sauka, 2010), although promotion of physical activity of the population is one of the most important tasks of primary disease prevention and is essential for the treatment of chronic diseases. Family doctors, when advising their patients, should convince them about the need to lead an active lifestyle, to increase physical activity, which would provide a

significant improvement to their health. In 2014, a book was published on prescribing a physical activity prescription in a family doctor practice (Priedīte et al., 2014), which is an important contribution in the field of disease prevention. Research on the spread of medical certificates and informativity of the content for students for the exemption from sports activities in Latvia has not been performed.

The aim of the study is to evaluate the content of medical certificates for the exemption from "Sport" at the university and the information provided by the doctor to the student and sports specialist on the necessary load frequency, duration and intensity of physical activity in the cases of most common diseases, as well as the attitude of students with irregular attendance of sports activities towards sports activities at school.

Material and methods

The research lasted for 5 years and involved 1249 RTU first-year students (730 men, 519 women, aged from 18 to 25 years 19.2±0.7), who selected swimming, as swimming is selected every year by 22 – 25% of the students registered for sports activities. RTU students are provided with sports activities in various sports.

A quantitative (frequency) (Mayring, 2014) and qualitative (Bengtsson, 2016) document (medical certificate) content analysis was carried out to evaluate the content of medical certificates for the exemption from "Sport" at the University and the information provided by the doctor to the student and sports specialist on the necessary load frequency, duration and intensity of physical activity in the cases of most common diseases. Medical certificates include information on the illness and recommendations for the work regime, including information on the exemption from sports activities. The sequence of the quantitative and qualitative content analysis process of the documents (medical certificates) given to the students is reflected in Figure 1.

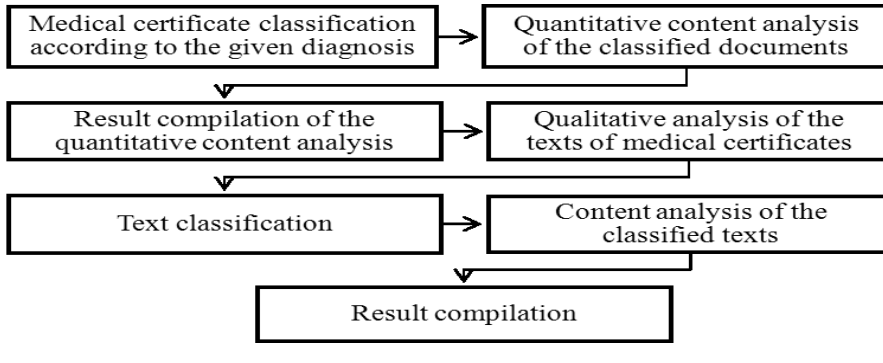

Figure 1. The sequence of the quantitative and qualitative content analysis of documents (medical certificates)

A survey was carried out to determine the attitude of students with irregular attendance of "Sport" towards sports activities at school. In the survey participated 170 RTU students (aged from 18 to 31 years (20.6±2.8)), who had a relatively large number of non-attended sports activities. The survey was carried out in April and May of the 2014/2015 academic year, it included 3 questions:

1. Did you have an exemption from sports activities for the study year at school?
2. Did you have an exemption from "Sport" for the study year at university?
3. Please evaluate your attitude towards sports activities in primary school, secondary school and high school according to the 5-point scale: 1 – very negative, 2 – negative, 3 – neutral, 4 – positive, 5 – very positive.

The following methods of mathematical statistics were used: descriptive statistics (the mean, standard deviation, frequencies, percentage) and Student's t-test.

Results

In total, during five years the students submitted 979 medical certificates for exemptions from "Sport" due to an illness. There were students who had submitted medical certificates several times during the study year: mostly 2 certificates, but there are cases when the student submited 4 – 7 medical certificates during a study year. Consequently, in the five-year period 627 from 1249 students submitted medical certificates (342 men and 285 women), or 50% of the students. During a study year 48% of male students and 56% of female students were sick. The student non-attendance of sports activities according to the number of illnesses during a study year was: 64% - once, 23% - twice, 7% - three times and 6% - four and more times.

Different diagnoses were given in the medical certificates. The descriptions of the illness in medical certificates can be divided into three groups: 1) acute respiratory viral illness, 2) other cases of illness, 3) entries without a diagnosis. In the first group 438 diagnosis (45%) were observed, which were marked with the code "J" in the International Classification of Diseases (I C D - 1 0). Most common diagnosis is "Acute respiratory viral infection (ARVI)", as well as otitis.

In the second group 200 cases (20%) of different illnesses were observed, which are far less common than those in the first group: various aches in joints, spondylosis with a pain syndrome, cephalgia, eye surgery, fractures, ligament sprains and tears, concussion, undetermined viral infection and flu, fungus, furuncle, conjunctivitis, dental inflammation,

rotavirus, congenital pathologies, heart disease, tumours, ingrown nail, myopathy, gastro-duodenitis, intestinal disorders, arthritis, urinary tract infections, and allergic dermatitis.

The third group included exemptions from "Sport" without a diagnosis (9%) and exemptions from sports activities with an entry "Illness" (26%). Most common are medical certificates with the entry „Illness", which do not provide any information to the student and sport specialist on the necessary load frequency, duration and intensity of physical activity in the cases of the relevant diseases. Consequently, in 35% of the cases of student illnesses the justification of the exemption is debatable. Especially worrying are the cases in which the exemptions from sports activities lasts for a month or longer, considerinh that the promotion of physical activity of the population is an essential part of chronic disease treatment.

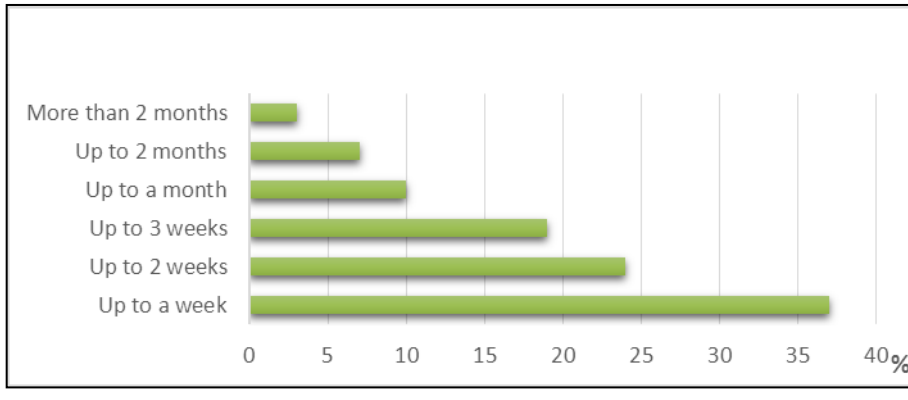

Figure 2. Duration of student illnesses and exemption from "Sport" (n=979)

All exemptions are issued for a fixed period. Two periods were indicated in the medical certificates: the time of illness, which in 90% of the cases lasts up to a week, and the time of exemption from sports activities, having various durations. Total time of illness and exemption from "Sport" was also analysed. Illnesses and exemptions from "Sport" due to an illness last from a few days up to six months (Fig. 2).

Exemptions from sport for more than a month made up 10% of all medical certificates submitted by the students. Figure 3 shows the number of most common diagnosis found for students as a percentage against the number of medical certificates in each period. The number of entry "Illness" dominates in all periods for the exemption from sports activities and practically does not decrease. The number of exemptions from "Sport" without a set diagnosis is the smallest of diagnosis during the period "Up to 2 weeks", it increases in the period "Up to a month" and is the third most common, reaching a peak in the period "More than 2 months".

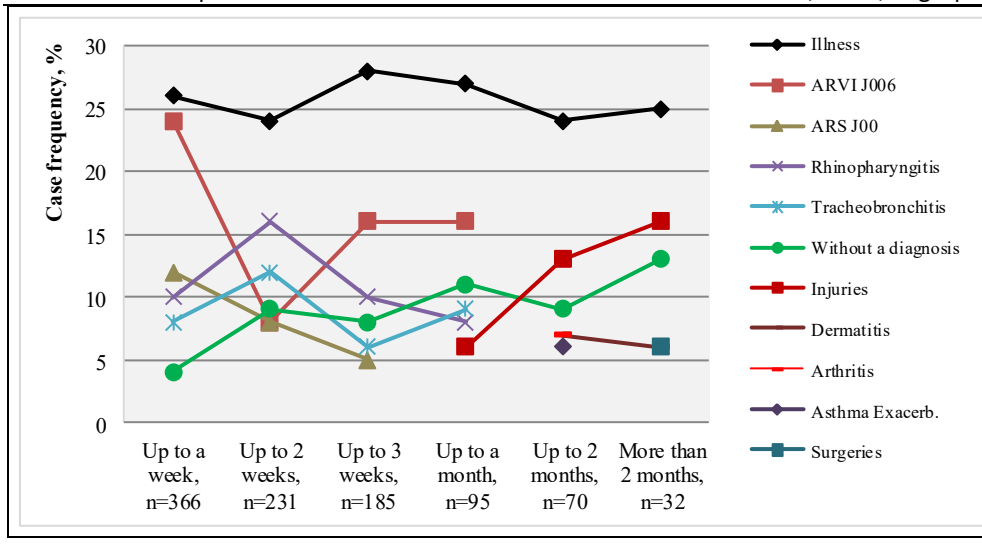

Figure 3. Number of most common diagnosis found for students during the exemption from the study course "Sport", %

Results of the quantitative content analysis show that in 9% of the cases the medical certificates issued to the students for the exemption from "Sport" do not have a set diagnosis. Exemptions without a set diagnosis are issued for different time periods, ranging from a few days up to five months: up to a week: 33 cases, up to two weeks: 22 cases, up to three weeks: 15 cases, up to two months: 10 cases and more than two months: 6 cases.

It could be considered that the exemption from "Sport" up to two weeks is most commonly recommended to the student in cases of an acute respiratory viral infection, if the doctor has not indicated a diagnosis of an illness. However, if the doctor recommends an exemption from sports activities for three weeks and more, it has to be justified, as well as the doctor has to provide information to the student and sport specialist on the necessary load frequency, duration and intensity of physical activity in the cases of most common diseases, which would contribute to the improvement of students' health.

The qualitative content analysis of medical certificates shows that a negative attitude towards sports activities may be the reason to ask the doctor an exemption from "Sport" and there are cases when family doctors support non-attendance of sports activities. Of all medical certificates (n=979) issued to students, such cases make up 3%. 31 cases or 36% of all issued medical certificates without a set diagnosis for the exemption from "Sport" (n=86) can be interpreted as unwillingness of the students to attend sports activities. As the most characteristic example of such cases are two medical certificates issued to students, where instead of a set diagnosis is written *"Cannot go in water"* and, thus, an exemption from pool is

recommended for up to 2 months, and where instead of a set diagnosis is written *"Cannot swim in pool"* and, thus, an exemption from activities in the pool is recommended for up to 5 months. When evaluating the medical certificates with the diagnosis „Cannot swim in pool" and the activity attendance of the student, it can be observed that in April this student attended 4 activities and one in May, while the exemption has been issued from April 1. The question is open, what is the justification for this exemption? Students who cannot swim (allergies, dermatitis, frequent colds, or another reason) may move to other sports, students are provided with the information on such a possibility at the beginning of the study year. Students also have the opportunity to choose physical activities with a reduced load, attending therapeutic exercise activities. Attention should be paid to the fact that in swimming students carry out tasks in the amount and intensity appropriate for them. Graduation of the load increase for students is strictly complied with. To increase of student motivation have been developed control assignments, so that each and every student could assess the dynamics of personal growth. The personal growth of students is not compared with others. After illnesses students are offered an eased physical activity program.

Next, the medical certificates will be evaluated, in which doctors instead of a diagnosis write "Illness", or "General illness", or "Somatic illness", or "Disease", without stating the disease code according to the International Classification of Diseases. The number of these medical certificates issued to the students is 26% of all occurring diagnosis (n=979). An exemption from "Sport" due to this diagnosis is prescribed for a period of a few days up to 6 months: up to a week – 97 cases, up to two weeks – 55 cases, up to three weeks – 52 cases, up to one month – 50 cases.

Also in the cases of the diagnosis „Illness", when the doctor recommends an exemption from sports activities for a month and more, the question about the justification of this recommendation very often is debatable. The qualitative content analysis of medical certificates with the diagnosis „Illness" shows that in 50 or 20% of the cases the negative students attitude towards sports activities may be the reason for asking the doctor an exemption from "Sport" and there are cases when family doctors support the non-attendance of sports activities. Of all medical certificates (n=979) issued to the students such cases make up 4%. Some students are issued medical certificates with the diagnosis "Illness" 3 – 4 times during the semester, allowing them not to attend sports activities for the whole semester: „*Exempt from sport 11.09. – 16.09."; „Was sick 25.–29.09. Exempt from sport 17.09. – 06.10."; Exempt from sport 17.10.2014. – 14.11.2014."* – only 6 activities remained till the end of the semester. Attention should be drawn to the dating of the certificate; its discrepancies can be found in teachers' practice as well (Smirnova, 2016).

One student submitted 7 medical certificates during the study year, which recommended her not to attend "Sport" for the whole study year: *1st semester (activities start with September 17): „26.09. Indigestion"; "03.10. – 05.10. Illness"; "08.10. – 19.10. Illness"; „16.10. – 23.11. Illness"; „07.12. Illness";* 2nd semester (starts in February): *„07.02.- 08.02. was sick", Exempt from sport 06.-15.02."* At the end of the academic year the student submitted a medical certificate for the exemption from "Sport" till the end of the academic year due to an allergic reaction to chlorine, which was issue on January 2. The certificate was submitted in May, the month when a pass must be received in the study course "Sport". Similar cases also occur; if there are set diagnosis and medical certificates create a chain of the cases of illnesses. In the previously mentioned cases in particular the family doctor should prescribe a physical activity prescription, informing the sport specialist on the activity type and load dosage to strengthen the health of the student (Priedīte et al., 2014).

At the beginning of the study year, when starting the sports activities, the student should submit a medical certificate on the state of health, where doctors indicate chronic diseases, if any. Students being sick with chronic diseases are reported by 175 medical certificates or 14% of the 1249 analysed medical certificates on the state of health of the students, which were submitted at the beginning of the study year. Most of the students with chronic diseases have musculoskeletal diseases (45%), including various stance disorders – 73%, state after a trauma – in 20%, in 6% – arthritis (n=79). 8% of the students have myopia, the nerve system diseases and internal organ diseases, but 5% have congenital pathologies and 4% have ear, nose and throat diseases. Of asthma patients (n=39, 22%), several have a moderately severe bronchial asthma. In all cases the students are allowed to participate in "Sport", especially in swimming. In some cases, there are load limitations. The evaluation of activity attendance tracking shows that students with chronic diseases regularly attend "Sport" (Fig. 4).

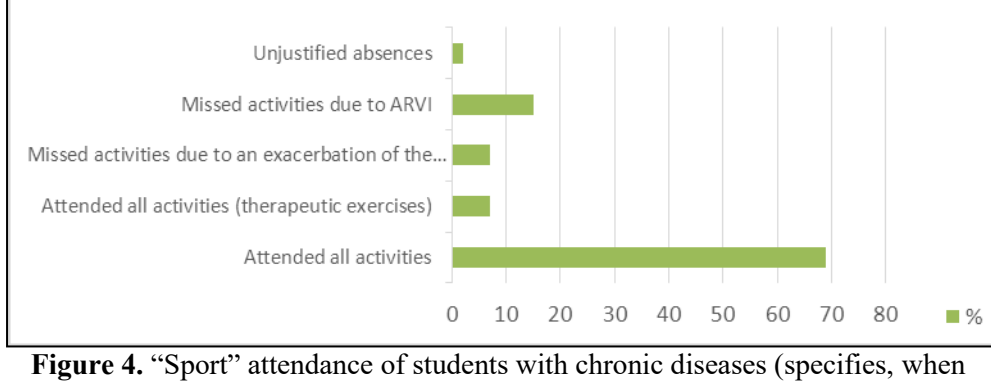

Figure 4. "Sport" attendance of students with chronic diseases (specifies, when attends, and when not) (%, n=175)

69% of students attended all activities, 7% of students moved to therapeutic exercises, the activities of which they attended without absences. 15% of students suffered from acute respiratory viral infection diseases, but only in 7% of the cases an exacerbation of chronical diseases of up to 2 weeks was observed. Only 2% of students have been absent from "Sport" without a justification.

However, in the medical certificates submitted by the students on an exacerbation of a chronic disease, in the section on the state of health of the student, it is stated that the student is practically healthy and can engage in sports. There is no entry on chronic diseases in the certificate. For example, diagnosis bronchial asthma was found in 39 students or 3% of the whole sample. Of these, an exacerbation of bronchial asthma was found in only six students (15%). For these six students, the doctor recommended an exemption from "Sport" due to an exacerbation of asthma, but the initial medical certificates show that they are healthy and the diagnosis "Bronchial asthma" was not stated in them. Consequently, in six cases, there is no certainty that the students have bronchial asthma, because this chronic disease was not indicated in the medical certificates issued at the beginning of the study year on the state of health of the student. It should be noted that only in one medical certificate it was noted that the exacerbation of bronchial asthma was caused by a viral infection.

A similar situation is also characteristic in the arthritis case. From the 13 exemption cases from "Sport" due to arthritis, the diagnosis "Arthritis" was indicated only in 5 medical certificates on the state of health of the student. Only in 2 cases the exemption from "Sport" of up to 2 weeks was issued to an acute state, when it is forbidden to engage in physical activities.

Even if the student was issued a medical certificate on exemption from "Sport" for a longer period of time without a precise diagnosis, in some certificates, the date is corrected to extend the exemption period. Cases of date correction occur 10 times out of 979 submitted medical certificates. In one medical certificate, it has been done twice. Consequently, 9 students had a corrected date set for the exemption duration in the issued certificates to extend the justification for non-attendance of the activities.

Sometimes the medical certificate contains a questionable indication on the student's illness, because the medical certificate contains set illness dates, which exactly coincide with the dates of non-attended activities, for example: *"Was sick on 21. 23. and 28.10., 2013. Exempt from sport and swimming on these dates"*. Is it genuine, if one is sick on the 21st, 23rd and 28th, but is not sick on the 22nd, 24th, 25th, 26th, 27th? Sometimes students tell the sport specialist: "When was I absent? Name the dates. I will have a certificate." Results of the content analysis of medical certificates on

exemption from "Sport" with a contradicting content are summarized in Table 1.

Table 1

Medical Certificates with a Contradicting Content for the Exemption from "Sport"

	Nr. of students
Exacerbation of chronic diseases, if it is not mentioned in the certificate on the state of health of the student	14
Date extension (correction)	9
Certificates without a disease diagnosis, duration of up to 3 weeks and more	31
Diagnosis "Illness", duration of up to one month and more	50
Several certificates in a row, allowing not to attend activities for a long-term	16
Certificates with certain illness days, in the middle of which there are illness pauses	7
Total	126
Out of 979	13 %

Consequently, in 13% of the cases when students were issued medical certificates for exemption from "Sport" at the university due to an illness, suspicions arise regarding students' unwillingness to participate in the compulsory sports activities at the university. Overall, the results of the content analysis show that asking doctors for exemptions from "Sport" is also found among students, because to them the sports activities are compulsory. Is the demand to the doctor for a medical certificate in order to be exempted from "Sport" at the university a common habit that has been continuing since school?

Attitude of Students with Irregular Attendance of "Sport" towards Sports Activities at School

As a result of the surveying, it was determined that in the 2014/2015 study year out of the 170 surveyed RTU students 19% – 33 people were exempted from sports activities at school. At the same time 11% of the students - 18 people, noted that doctors recommended an exemption from "Sport" for the whole academic year during studies at the university and out of them 10 people or 56% were also exempted from sports activities at school starting from a semester and up to two study years. Survey results of students evaluating their attitude towards sports activities at school, where 1 point very negative, but 5 points very positive, were as follows: in elementary school – 4.16±0.09 points; in primary school – 3.78±0.09 points; in secondary school - 3.71±0.10 points.

It was concluded that the attitude of students towards sports activities at school has deteriorated over time. The attitude evaluation differences are statistically significant in both the period elementary school – primary school, because $t=5.00$ ($t>t_{0,05;170} = 1.96$), and the period elementary school – secondary school, because $t = 3.75$ ($t > t_{0,05;170} = 1.96$). The attitude evaluation difference in the period primary school – secondary school is not statistically significant,

because t=0.59 ($t < t_{0,05;170} = 1.96$), which means that the attitude in primary school and secondary school is similar and it does not significantly differ and is below the attitude evaluation in elementary school.

Overall, negative attitude towards sports activities in at least one period of school was found for 51 students or 30%. Of these, 41% were exempted from sports activities at school for up to 2 years, but 16% have an exemption from "Sport" at the university for the study year.

Discussion

From previous research it is known that 51% of students were absent from activities due to an illness, injury or disability (*Latvijas jauniešu sportošanas paradumi,* 2014), but this study showed (n=1249) that 50% of students were absent from "Sport" and submitted medical certificates on illnesses. In order not to attend sports activities, 46% of students received an exemption (Smirnova, 2016), but this research showed that in 13% of cases, when students are issued medical certificates for an exemption from "Sport" at the university due to an illness, suspicions arise on the students' unwillingness to participate in the compulsory sports activities at the university.

Study showed that 35% of medical certificates do not indicate a set illness diagnosis (n=979), which makes it difficult for sport specialists to involve students in appropriate physical activities. In 2012, in the research carried out in Kuldiga on exemptions from sports activities, was found that 48% of teachers are not informed about the diagnosis (Strazdiņa, 2012). In order to carry out the disease statistics as accurately as possible (WHO, 2011), it was decided to write a full entry of the disease diagnosis, using the code from the International Classification of Diseases (ICD-10). However, teachers do not understand these codes, which interfere with the sport teacher's efforts to engage students with health disorders in physical activities, even if they are ready to do it (Kondratjuka, Līsmane & Sauka, 2010; Strazdiņa, 2012).

This study revealed that 14% of students were found to have chronic diseases (n=1249). 45% of the cases are musculoskeletal diseases, 26% - bronchial asthma (n=175). Among the RTU students who engage in therapeutic exercises, musculoskeletal diseases occur in 60% of cases (Tarnapolska & Bonders, 2015).

During the research, it was found that in medical certificates in 10% of the cases exemptions from "Sport" were recommended for up to two months and more. Among them dominate the medical certificates with the entry in the disease diagnosis "Illness", as well as those without an indication on the disease diagnosis. Many teachers believe that in several cases the exemptions from sports activities are not justified. This was

Acknowlwdged both by the doctors themselves and by the students (Strazdiņa, 2012; Bērtule, 2013; Smirnova, 2016). Medical certificates without a set disease diagnosis can be interpreted differently. How to interpret an entry "Cannot swim", "Cannot swim in the pool" in the disease diagnosis? These are questionable entries, which are often encountered at school by sports teachers, for example, exemptions from running long distances. Such entries give the impression that the doctor writes in the certificate the information that is asked of him/her by the student (Smirnova, 2016).

Medical certificates contain conflicting information on exemption recommendation in the cases of chronic disease exacerbation, when before that at the beginning of the study year the chronic disease was not indicated in the certificate on the state of health of the student. Such exacerbations are more common in medical certificates with disease diagnosis "Bronchial asthma" and "Arthritis". In several cases these exemptions last for a month and more.

Long-term exemptions from physical activities in cases of asthma and arthritis are contrary to the recommendations of sports doctors. Asthma patients have to improve their physical fitness, because quite often it is insufficient (Priedīte et al., 2014). However, doctors often exempt from the sports activities, indicating that physical load promotes asthma exacerbations. In the case of arthritis, it was noted that "Physical activity is an integral part of treatment for patients with osteoarthritis…" (Priedīte et al., 2014, p. 20). However, doctors sometimes exempt from sports activities due to arthritis for up to 2 months.

It was found that the attitude of students towards sports activities at school deteriorated over time. It is a general trend in research on attitude towards sport education and physical activities – growing older, the attitude of students towards sports activities deteriorates (Subramaniama & Silverman, 2007). 19% of the surveyed students (N = 170) were exempted from sports activities at school, in 30% of the cases was determined the negative attitude of students towards sports activities at school, of which 16% of students took out an exemption from "Sport" at the university, which indicatedthat the request for a medical certificate for an exemption from "Sport" at the university is a consequence of such an action during school. It is known that by promoting positive attitude towards sport education and physical activities, it is possible to seriously affect health in the long term (Subramaniama & Silverman, 2007). Teens with the best attitude towards physical activities 5 – 10 years later have a weekly activity higher by 30-40% than those with a negative attitude (Graham, Sirard & Neumark-Sztainer, 2011). Family doctors, when consulting their patients that are students, should try to convince them about the need to lead a healthy lifestyle, increase physical activities, which would make a significant improvement to their health, rather than support the non-attendance of

sports activities. As well as in medical certificates and also as a means of communication with the cooperation partner - sport specialist in physical activity promotion, it would be necessary to indicate the provided information, so that it would be possible to organize physical activities in accordance with the state of student health.

Our results are encouraging and should be validated in a large cohort of students and pupils. Future research should focus on the efficacy of family doctors, students, pupils and the promotion sports specialist communication to increase physical activity.

Conclusions

As a result of the quantitative content analysis of medical certificates (n=979) on student exemption from the study course "Sport", it was found that the content of medical certificates included: among the diagnosis indicated by doctors, the most common entry was "Illness" - 254 times (26%), but 86 medical certificates did not contain a diagnosis (9%). 87% of the students were sick 1 – 2 times, but 13% of students: 3 and more times during a study year.

In 35% of the cases the medical certificates did not provide any information to the student and sport specialist about the necessary load frequency, duration and intensity of physical activity in the cases of specific diseases.

The research results show that 13% of students tried to avoid participation in sports activities, asking the doctor for a certificate for an exemption from them, consequently, this problem is topical not only in school, but also at university, and it is related to the negative attitude towards sports activities at school. Overall, negative attitude towards sports activities in at least one period of school was determined for 51 students or 30%. The research should be continued to determine the reasons for the negative attitude of the students towards sports activities.

References

1. Ābele, A. (2014). Studējošās jaunatnes dominējošā sporta darbības motivācija. [Dominant Motivation for Sports Activities of Studying Youth]. *Humanitārās un sociālās zinātnes.* Nr. 22, RTU Izdevniecība, 80.-85.lpp.
2. Bērtule, A. (2013). Puse atbrīvojumu no sporta stundām nav veselības stāvokļa dēļ. [Half of the Exemptions from Sports Classes are not Due to the State of Healt]. Retrieved May 26, 2016, from: http://www.lsm.lv/lv/raksts/latvija/zinas/puse-atbriivojumu-no-sporta-stundam-nav-veseliibas-stavoklja-del.a55355/
3. Bengtsson, M. (2016). How to plan and perform a qualitative study using content analysis. *NursingPlus Open, Volume 2,* 8-14, Retrieved June 17, 2016, from: http://www.sciencedirect.com/science/article/pii/S2352900816000029

4. Carcamo-Oyarzun, J., Wydra, G., Hernandez-Mosqueira, C., Martinez-Salazar, C. (2017). *Attitudes towards physical education: Degrees of importance and conformance among schoolchildren in Chile and Germany. An intercultural comparison*. Retos, 32, 158-162. Retviered March 14, 2017 from: https://www.researchgate.net/publication/313869423
5. Ghanji, H. (2001). *Social psychology*, Hedaiat publication, Tehran, Iran
6. Graham, D.J, Sirard, J.R., Neumark-Sztainer, D. (2011). Adolescents' attitudes toward sports, exercise, and fitness predict physical activity 5 and 10 years. *Preventive Medicine, 52, 130-132.*
7. *International statistical classification of diseases and related health problems*. – 10th revision, edition 2010, Volume 2. (2011). WHO. Retrieved May 24, 2016, from: http://www.who.int/classifications/icd/ICD10Volume2_en_2010.pdf
8. Karimi, Y. (1998). *Social psychology,* Virayesh publication, Tehran, Iran, 1998.
9. Kondratjuka, I., Līsmane, L., Sauka, M. (2010). Atbrīvojumi no sporta stundām: problēmas un risinājumi. [Exemptions from sports classes: problems and solutions] *Latvijas Ārsts, Nr. 10., pielikums "Sports veselībai,"* 10. – 13. lpp. Retrieved May 24, 2016, from: http://www.vsmc.gov.lv/wp-content/uploads/2013/04/Atbrivojumi-no-sporta-stundam.pdf
10. Koroļova, I. (2010). *Studentu un vidējo profesionālo iestāžu audzēkņu aptauja.* [Students and Vocational Education Students Survey Results.] Rīga: LU FSI. Retrieved May 23, 2016, from: http://www.fsi.lu.lv/userfiles/Aptaujas_rezultatu_atskaite.pdf
11. *Latvijas jauniešu sportošanas paradumi.* (2014). [Sporting habits of Latvian youth]. Rīga, TNS, 29 lpp. Retrieved May 23, 2016, from: http://www.izm.gov.lv/images/statistika/petijumi/35.pdf
12. Mayring, P. (2014). *Qualitative content analysis: theoretical foundation, basic procedures and software solution.* Klagenfurt, 143 p. Retrieved June 28, 2016, from: http://nbn-resolving.de/urn:nbn:de:0168-ssoar-395173
13. Myers, D. G. (2004). *Exploring Psychology.* Fifth Edition, Worth Publisher.
14. Myers, D.G. (2000). *Psychology, (6th Ed.).* Worth Publishers.
15. No sporta stundām atbrīvots. (2006). [Exempted from Sports Activities] Retrieved October 22, 2016, from: http://www.tvnet.lv/egoiste/attiecibas/69414-no_sporta_stundam_atbrivots
16. Priedīte, I. S., Lāriņš, V. Sauka, M. Selga, G. Kalniņa, L. Krievkalns, J. Artjuhova, L. (2014). *Fiziskās aktivitātes receptes izrakstīšana ģimenes ārsta praksē.* [Physical Activity Prescription in a Family Doctor Practice].Rīga, VSMC. 119 lpp.
17. Rubana, I.M., Ābele, A. (2008). Skolas vecuma bērnu attieksme pret sporta stundām, sporta stundu apmeklējums un daži veselības indikatori. [School-Age Children Attitude Towards Physical Education, Attendance of Sports Classes and Some Health Indicators]. *RTU zinātniskie raksti, Humanitārās un sociālās zinātnes.* Rīga, 8. sēr., 14. sēj., 81.-88.

18. *Siguldas novada sporta un aktīvas atpūtas attīstības stratēģija*. (2012). [The Sports and Active Recreation Development Strategy of Sigulda]. Retrieved October 22, 2016, from: http://siguldassports.lv/7-notikumi/243-apstiprinata-siguldas-novada-sporta-un-aktivas-atputas-attistibas-strategija
19. Smirnova, N. (2016). *Man ir zīme! Kāpēc skolēni neiet uz sporta stundām.* [I have a doctor's note! Why school-age children do not attend sports classes]. Retrieved October 29, 2016, from: http://www.young.lv/lv/man-ir-zime-kapec-skoleni-neiet-uz-sporta-stundam/
20. Latvijas Republikas Saeima (2013). *Sporta apakškomisijas deputāti aicinās IZM risināt jautājumu par skolēnu atbrīvojumiem no sporta stundām.* [Members of the Sports Subcommittee will invite MoES to resolve the question regarding school-age children exemptions from sports classes.] Retrieved October 29, 2016, from:http://www.saeima.lv/lv/aktualitates/saeimas-zinas/20891-sporta-apakskomisijas-deputati-aicinas-izm-risinat-jautajumu-par-skolenu-atbrivojumiem-no-sporta-stu
21. Sørensen, J.B., Skovgaard, T. & Puggaard, L. (2006) Exercise on prescription in general practice: A systematic review, *Scandinavian Journal of Primary Health Care,* 24:2, 69-74, DOI: 10.1080/02813430600700027, Retrieved May 29, 2016, from: http://www.tandfonline.com/doi/pdf/10.1080/02813430600700027?needAccess=true
22. LR MK. (2013). *Sporta politikas pamatnostādnes 2014.–2020.gadam (informatīvā daļa)* [The Sports Policy Guidelines for 2014 – 2020.] *(Rīkojums Nr. 666).* Retrieved October 25, 2016, from: http://www.lpkomiteja.lv/lpk/wpontent/uploads/2014/01/IZMPamn_121213_sports.pdf
23. Strazdiņa, N. (2012). Fiziskās aktivitātes visiem skolēniem. [Physical Activity for all Students]. Retrieved October 20, 2016, from: : http://www.nadija.lv/pedagogija/313-fizsks-aktivittes-visiem-skolniem.html
24. Studente, L. (2016). Sporta stundas – vērtējums un atbrīvojums. [Sports Classes – Evaluation and Exemption]. Retrieved October 29, 2016, from: http://m.lvportals.lv/visi/skaidrojumi?id=283025
25. *Studentu un jauniešu sportošanas paradumi*. (2012). [Student and Youth Sports Habits]. Pētījuna-socioloģiskās aptaujas analītiskais noslēguma ziņojums. Rīga: LASS. Retrieved October 25, 2016, from: http://www.izm.gov.lv/images/statistika/petijumi/20.pdf
26. Subramaniama, P.R., Silverman, S. (2007). Middle school students' attitudes toward physical education. *Teaching and Teacher Education,* 23, 602-611.
27. Šišlova, E., Fernāte, A. (2015). Studentu attieksmes pret obligātajām fiziskajām aktivitātēm izmaiņas studiju procesā. [Changes of Students Attitude towards Compulsory Physical Activity in Study Process]. *Humanitārās un sociālās zinātnes.* Nr. 22, RTU Izdevniecība, 26.-36.lpp.
28. Špona, A. (2004). *Audzināšanas process teorijā un praksē.* [The Process of Upbringing in the Theory and Practice]. Rīga: RaKa, 190 lpp.
29. Tarnapolska, R., Bonders, V. (2015). Studentu attieksmes pret ārstnieciskās vingrošanas nodarbībām pedagoģiskais vērtējums. [Pedagogical Evaluation

30. of Students' Attitude towards Classes of Therapeutic Exercise]. *Humanitārās un sociālās zinātnes.* Nr. 25, RTU Izdevniecība, 37.-44.lpp.
31. *Uz sporta stundām ar prieku.* (2006). [To Sports Classes with Joy]. Retrieved October 19, 2016, from: http://www.tvnet.lv/egoiste/attiecibas/69348-uz_sporta_stundam_ar_prieku

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ORIGINAL RESEARCH PAPER

DETERMINATION OF SOCIAL SKILLS SPECIFIC TO DANCESPORT DANCERS

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Abstract

The contemporary society pays extraordinary attention to the development of socially oriented personality. Such kind of personality development is mainly based on various social skills. The paradigm of life-long learning emphasizes that such circumstances as age, place, environment, and etc. should not be considered as obstacles for the development of social skills. Therefore, it can be assumed that social skills might be developed in various environments; sports environment can be considered as a possibility. Recent researches on social skill development show the existence of scholarly research in the area. Accordingly, this research aims at determination of social skills specific to dancesport dancers. To accomplish the research aim, the questionnaire survey was provided. Two groups of respondents participated in the research: 1. dancesport dancers; 2. non-dancers. The research enabled the determination of differences in the structure of social skills specific to dancesport dancers and non-dancing people. The main differences were observed in manifestation of such social skills as interaction, communication, and emotional skills. Moreover, the skills of social cognition were more evident in dancers' group. The research enabled to determine the impact of sports environment on social skill development. Based on research results it might be recommended for people achieving to develop social skills later to engage in dancesport activity. This research considered dancesport dancers as a homogenous group of people. Future researches could analyze the differences in various age groups, genders; moreover, the impact of different dancing programs on the development of social skills might be studied as well.

***Keywords**:* dancesport, social interactions, social skills.

Introduction

In recent years, scientists are paying considerable attention to person's social skills as a background of social competence. Social skills are highly related to person's ability to manage social situations, effectively solve various social problems, successfully adapt to rapidly changing environment, influence this environment or even change it. Social skills are essential for a person achieving to adapt to certain social situations (Hall, Coats, Smith, 2005); express oneself and understand others (Colombero, 2004), maintain relationships and avoid conflicts (Sukhodolsky, Butter, 2007).

One of the most important fields of social life is sports; moreover, sport is one of the main measures for health maintenance and enhancement, which determines good mood and working efficiency – people stream for excellence in their sporting activities (Šimkus, Pilelienė, 2010). Sports as an activity has many different facets: it can be individual, interactive, or even artistic. In this framework, dancesport could be considered as an ambivalent activity which provides an opportunity for a sportsman of experiencing not only physical activity, but also emotional arousal.

The popularity of dancesport during past decades is growing. It could be considered as one of the most popular in the field of the artistic sports. According to a famous philosopher and art critic Charles Lalo, art performs five fundamental functions: 1) entertainment (art and creativeness are inseparable from a game: a person watching a work of art purportedly digresses from the real life, conceives the peace of mind and soul); 2) cathartic (related to the purification of passions, disposal of negativities); 3) technical (art is considered as a kind of spiritual technique; moreover, every branch of art expresses its spiritual technique differently); 4) life perfecting (art emphasizes various forms of individual and collective life making them ideal; provides people with the examples of positive behavior); and 5) life intensifying (when a person understands the works of art, it influences his / her feeling and perception of the wide reality). The dance helps in realizing dancers' potential, it enables dancers' self-education, makes them feel emotionally satisfied, also, body movements are being trained and developed; encompassing all the latter elements, the idea of the dance is being expressed (Ušpurienė, Čepulėnas, 2011). It can be stated that dance affects its creator and spectator in a very particular manner. According to the individual's sensitivity, sensation of aesthetics, the power of art and its impact might manifest in a different manner. The spirit and energy of the dance, expressed by the performer's feelings and emotions affects the

people around. During the latter interaction, various social skills are obtained.

Achieving to substantiate this phenomenon, this study endeavors to answer the question: what social skills are specific to dancesport dancers? The research object is social skills; therefore, the research aims at the determination of social skills specific to dancesport dancers.

During the research, to reach the aim scientific analysis and synthesis are performed to establish the types of the social skills for further study. The questionnaire survey is provided to determine the social skills specific to dancesport dancers.

Theoretical substantiation

Social skills are highly associated with the ability of orienting and adaptation in various sociocultural environments as well as the ability of managing and influencing situations, solving problems. Developing of social skills enhances person's self-confidence, enables more smooth communication, helps in maintaining interpersonal relationships, and enables to act more purposefully in social situations (Raudeliūnaitė, 2009). Social skills are gained in interaction with other people and are stimulated by social goals (Witt, Ferris, 2003). The major part of social interaction is based on one's communication reflected by the skills of communication. The other substantial part of social skills is related to one's emotions which evoke in conditions of social interaction. Accordingly, it becomes an important task to reveal the essence of one's social activities in terms of their goals determining the singleness of social interaction. In the conditions of social interaction, people are faced with the necessity of having the sufficient social skills to manage it; otherwise, the individual faces difficulties in reaching the goals in social activity.

Social skills are evident in many areas of social behavior: the development of social relationships (communication) and collaboration, problem solving, creative usage of social skills in various activities. The quality of social behavior and social situations' management depends on one's ability to apply social skills in latter situations. Social skills determine the social interactions in personal goal achievement processes, conditioning the positive relationship with others maintenance under any circumstances (Rubin, Rose-Krasnor, 1992). Consequently, the communication potential (the need for communication), communication activity and initiation, emotional relation with the partner of communication, and personal satisfaction with communication itself become very important. Gresham (2002) relates the quality of social skills to person's ability of initiating the interaction as well as with the adequate response reaction to the behavior of others. This testifies that the variety of social skills and the

ability of their proper application are the determinants of one's successful social activity. Thereby this also testifies the complexity of social interaction.

Jurevičienė et. al. (2012) indicate the following structural elements of social skills:

1. Skills of Interaction. According to Canney and Byrne (2006), skills of interaction encompass the skills of managing and controlling interpersonal interactions. Accordingly, social interaction manifests through the influence of those communicating with each other;
2. Skills of Communication. Latter skills are associated with the initiation and maintenance of the verbal and non-verbal contact (Canney, Byrne, 2006); social expressiveness (Jurevičienė et. al., 2012); flexibility and adaptability (Rubin, Martin, 1994); and conflict-resolution (Jurevičienė et. al., 2012). The more complex forms of communication skills manifest in the form of skills of maintenance of interpersonal relationships (Zins et al., 2004). In line with the skills of communication, the researchers often analyze the skills of collaboration (activity planning, organization and evaluation); skills of involvement in group's activities, initiation, recognition of individual and group differences (Goleman, 2001); however, the skills of participation are often analyzed independently;
3. Skills of Participation. The skills of participation are related to one's operating in a group (Cornish, Ross, 2004). Jurevičienė et al. (2012) emphasize that the skills of participation have to be considered as a very complex construct encompassing cognitive and emotional skills.
4. Emotional skills. Emotional skills (Canney, Byrne, 2006; Rubin, Martin, 1994) manifest in various activities of communication and participation. Emotional skills can be classified into self-awareness (Goleman, 2001), self-evaluation (Raudeliūnaitė, 2007), also, emotional expressiveness which helps to positively disclose oneself to others (Malinauskas, 2004). The social skills which help people to act properly are called self-control (Goleman, 2001); when we try to understand the others, we apply the skills of emotional sensitivity (Malinauskas, 2004). Emotional expressiveness and emotional sensitivity are considered as the core skills of communication enriching and exhilarating verbal and non-verbal communication (Jurevičienė et. al., 2012). Emotional expressiveness reflects one's ability to express emotions in understandable and acceptable way for others. Emotional sensitivity enables to recognize other people's emotions; whereas emotional control helps controlling and regulating emotional states and their non-verbal expression as well as dissembling one's emotional state and

avoiding spontaneous emotional burst (Malinauskas, 2004). Emotional skills manifest in two different ways: (1) they help individual to understand him- / her-self and tackle the emotions, manage oneself in communication and participation in common activities; (2) enable to understand the partners of communication or common activity.

5. Skills of Social Cognition. The skills of social cognition (Cavell, 1990; Vaugh, Hogan, 1990) determine the quality of one's social behavior (communication, participation in various activities). As the foundation for latter skills the knowledge of social norms guiding the behavior (the cognitive level) can be considered. The skills of social sensitivity help in decoding of social signals (the perception of social signals), evaluating the situation (skills of social situation evaluation) comparing it with the knowledge of social norms (skills of cognition of social norms), making decisions about the behavior suitable in particular situation and solving problems (skills of decision-making) (Jurevičienė et. al., 2012). Both the knowledge of social norms and practical orientation to them in different social situations require a high level of emotional and social intelligence. The skills of social cognition reflect one's orientation in social life, understanding of the logics of interpersonal relationships, other people-related expectations, and the control of expectations-correspondent behavior.

The most relevant in the structure of social skills are the skills of communication, which are highly related to the skills of social cognition and emotional skills; moreover, the skills of communication manifest in visible forms of behavior through the abilities of managing interactions and control (Jurevičienė et. al., 2012). Communication induces the development of all other social skills: enables acquiring socially acceptable behavior and manners to express emotion, controlling one's behavior and emotions, constructively solving problems and enhancing interpersonal relations. The scientific analysis highlights the complexity of the construct of social skills as being the background for the success of one's overall social activity.

The social skills manifest by the ability to send and interpret verbal and non-verbal (body language, mimics, and emotions) information, as well as to control the quality of the communication (Malinauskas, 2004). The "package" of the components of social skills is individual for each person; moreover, it determines differences in social adaptation and social behavior. Matson (2009) explains social skills as learnt situation or its context-specific behavioral skills (initiating interaction, communicating, reacting to one's behavior, etc.). Social skills enable person to expect some social acceptance; the lack or deficit of social skills enables to treat a person as an object for education.

Materials and methods

Research organization. The empiric research in this paper is provided achieving to answer the research question: what social skills are specific to dancesport dancers? To answer the question, the questionnaire survey is provided with two groups of respondents: dancesport dancers and non-dancing people group.

The questionnaire was based on the literature review to reflect the manifestation of five basic social skills (some of them were divided into sub-groups): Interaction; Communication (Verbal contact; Non-verbal contact; Interrelation; Social expressiveness; Flexibility, adaptability; Conflict-resolution); Participation; Emotional skills (Self-awareness; Self-evaluation; Emotional expressiveness; Self-control; Emotional sensitivity); and Cognition (Social sensitivity; Decision-making). Finally, 15 latent variables were established and 58 statements were formulated to reflect them. The statements were provided for respondents' evaluation in 5-point Likert-type scale to assess the extent of their agreement / disagreement. At the end of the questionnaire, the question determining the gender of the respondent was provided. The research was done in summer of 2015. The questionnaire was in Lithuanian and the respondents were Lithuanian citizens; 116 dancesport dancers (58 men and 58 women) and 116 non-dancing people (56 men and 60 women) participated in the research. All the respondents were over 18 years old.

IBM SPSS Statistics V.20 software package was used for data processing. *Reliability of the results.* To measure the quality of the questionnaire and the suitability of data for further analysis, the data distribution was tested using the tests of normality (the Kolmogorov-Smirnov Test and the Shapiro-Wilk Test) and the reliability analysis was performed as well. All the results were found to be distributed not normally (the p values are obtained below 0.05, the data significantly deviate from a normal distribution); all the Cronbach's Alpha coefficients (for all the 15 latent variables) were obtained higher than 0.7, displaying the reliability of the constructs (according to Nunnally (1978), a score of more than 0.7 is considered reliable); therefore, the internal consistency reliability was achieved (Grigaliūnaitė, Pilelienė, 2014) (see Table 1).

Table 1

Scale reliability

Latent variable	Cronbach's Alpha	Number of items	Manifest variables
Interaction	.875	8	INTER1; INTER2; INTER3; INTER4; INTER5; INTER6; INTER7; INTER8
Communication / Verbal contact	.702	4	VCA1; VCA2; VCA3; VCA4
Communication / Non-verbal contact	.722	3	NVCA1; NVCA2; NVCA3

Table 1 continuation

Communication / Interrelation	.726	2	INTERR1; INTERR2
Communication /Social expressiveness	.896	3	SEX1; SEX2; SEX3
Communication / Flexibility, adaptability	.756	4	FLEX1; FLEX2; FLEX3; FLEX4
Communication / Conflict-resolution	.861	4	CONF1; CONF2; CONF3; CONF4
Participation	.820	5	PART1; PART2; PART3; PART4; PART5
Emotional / Self-awareness	-	1	EMOSA
Emotional / Self-evaluation	.724	4	EMOSE1; EMOSE2; EMOSE3; EMOSE4
Emotional / Emotional expressiveness	.748	3	EMOEX1; EMOEX2; EMOEX3
Emotional / Self-control	.785	5	EMOSC1; EMOSC2; EMOSC3; EMOSC4; EMOSC5
Emotional / Emotional sensitivity	.705	2	EMOSEN1; EMOSEN2
Cognition / Social sensitivity	.808	6	COGSJ1; COGSJ2; COGSJ3; COGSJ4; COGSJ5; COGSJ6
Cognition / Decision-making	.702	4	COGDM1; COGDM2; COGDM3; COGDM4

After substantiating the data reliability, in the next section the data analysis is provided.

Results

For the research result analysis, evaluation means for every single statement provided by both groups of respondents were calculated; also, mean differences were calculated and Mann-Whitney U test was applied to support or reject the null hypothesis that two samples come from the same population.

Analysing the respondents' evaluations of the statements reflecting the skills of interactions, the means of evaluations were obtained statistically significantly different for three statements out of eight. The research results indicated that dancesport dancers' social skills of interaction are more evident in such actions as focusing attention on the companion (INTER1), making a defence (INTER2) and yielding others' a point (INTER3) (see Table 2).

Table 2

Differences between groups: The skills of interaction

Parameter		INTER1	INTER2	INTER3	INTER4	INTER5	INTER6	INTER7	INTER8
Non-dancers	Mean	3,19	3,84	3,14	4,59	3,86	4,29	3,9	3,43
Dancers	Mean	3,74	4,1	3,63	4,72	4,16	4,47	4,16	3,76
Total	Mean	3,47	3,97	3,38	4,66	4,01	4,38	4,03	3,59
Mann-Whitney U		5113	6107	5103	6648	6152	6540	6261	5746
Wilcoxon W		11899	12893	11889	13434	12938	13326	13047	12532
Z		-3,287*	-1,284	-3,332*	-0,222	-1,205	-0,421	-0,969	-2,014*
Asymp. Sig.(2-tailed)		0,001	0,199	0,001	0,825	0,228	0,674	0,333	0,044

*$p < 0,05$.

The construct of the skills of communication is very complex and consists of six sub-groups; each sub-group was assessed by a particular set of statement. The analysis of the results highlighted that dancesport dancers can be characterised by more evident social skills of verbal contact maintenance (VCA), as well as maintenance of a non-verbal contact (NVCA) (see Table 3). Based on the research results it can be indicated that for dancesport dancers it is easier to talk, to start a conversation, to be polite during the conversation; moreover, dancers are more prone to hold an eye-contact, to maintain an appropriate personal space, to pay attention to companion's body language.

Table 3

Differences between groups: The skills of verbal and non-verbal communication

Parameter		VCA1	VCA2	VCA3	VCA4	NVCA1	NVCA2	NVCA3
Non-dancers	Mean	3,57	3,05	3,03	2,47	3,57	3,17	3,28
Dancers	Mean	3,67	3,31	3,31	2,95	4,12	3,67	3,83
Total	Mean	3,62	3,18	3,17	2,71	3,84	3,42	3,55
Mann-Whitney U		6359,000	5741,000	5658,000	4752,000	4461,000	5166,000	4800,000
Wilcoxon W		13145,000	12527,000	12444,000	11538,000	11247,000	11952,000	11586,000
Z		-0,768	-2,043*	-2,218*	-4,128*	-4,872*	-3,208*	-3,972*
Asymp.Sig.(2tailed)		0,443	0,041	0,027	0	0	0,001	0

*p < 0,05.

The research results indicate that there is no difference between the two groups in terms of maintenance of interpersonal relationships (INTERR) and communicational skills of social expressiveness (SEX) (see Table 4). It can be stated that engaging in dancesport does not affect the development of latter skills.

Table 4

Differences between groups: The skills of interrelation and social expressiveness

Parameter		INTERR1	INTERR2	SEX1	SEX2	SEX3
Non-dancers	Mean	3,93	3,59	4,36	4,29	4,16
Dancers	Mean	3,95	3,68	4,53	4,47	4,33
Total	Mean	3,94	3,63	4,45	4,38	4,24
Mann-Whitney U		6668	6350	6579	6551	6487
Wilcoxon W		13454	13136	13365	13337	13273
Z		-0,133	-0,804	-0,363	-0,416	-0,544
Asymp. Sig. (2-tailed)		0,894	0,421	0,716	0,677	0,586

Based on the obtained results, it can be stated that dancesport dancers can be characterised as having more developed communicational skills of flexibility (adaptability) (FLEX); however, any differences between the two groups in terms of skills of conflict-resolution (CONF) were not observed (see Table 5). Social flexibility and adaptability were assessed based on evaluations of such activities as: capability of asking the necessary information; ability to adapt to the unknown environment; ability to

acknowledge one's superiority; also self-confidence in communication with unknown people or in new situations.

Table 5

Differences between groups: The skills of flexibility (adaptability) and conflict-resolution

Parameter		FLEX1	FLEX2	FLEX3	FLEX4	CONF1	CONF2	CONF3	CONF4
Non-dancers	Mean	2,88	1,84	2,72	2,16	4,41	3,9	4,41	3,93
Dancers	Mean	3,17	2,83	3,12	2,91	4,55	4,09	4,55	4,09
Total	Mean	3,03	2,34	2,92	2,53	4,48	3,99	4,48	4,01
Mann-Whitney U		5538	3056	5298	3977	6612	6378	6596	6408
Wilcoxon W		12324	9842	12084	10763	13398	13164	13382	13194
Z		-2,457*	-7,510*	-2,943*	-5,602*	-0,283	-0,727	-0,336	-0,672
Asymp. Sig. (2-tailed)		0,014	0	0,003	0	0,777	0,467	0,737	0,502

*p < 0,05.

Further analysis of the research results indicated that dancesport dancers cannot be characterised as having more expressed social skills in terms of skills of participation (PART). Evaluation means of all the five statements reflecting the latter social skill were similar and no statistically significant differences were observed (see Table 6).

Table 6

Differences between groups: The skills of participation

Parameter		PART1	PART2	PART3	PART4	PART5
Non-dancers	Mean	4,33	4,34	4,28	3,71	3,76
Dancers	Mean	4,47	4,47	4,43	3,81	3,86
Total	Mean	4,4	4,41	4,35	3,76	3,81
Mann-Whitney U		6587	6606	6566	6383	6422
Wilcoxon W		13373	13392	13352	13169	13208
Z		-0,323	-0,287	-0,37	-0,71	-0,624
Asymp. Sig. (2-tailed)		0,747	0,774	0,711	0,478	0,533

The construct of emotional skills is also very complex. To analyse this construct, five sub-groups of statements were provided. The results enable to conclude that social skills of self-awareness (EMOSA), self-evaluation (EMOSE) are more typical for dancesport dancers that for non-dancing people. Also, a manifestation of higher emotional expressiveness was observed in the group of dancesport dancers in terms of expressing their feelings by gesture and mimics (see Table 7). According to the research results, dancesport dancers can be characterised by better expressed social skills in such areas as: recognising their feelings, naming own strengths and weaknesses, being confident in own possibilities, maintening self-esteem, viewing themselves more positive.

Table 7

Differences between groups: The emotional skills of self-awareness, self-evaluation, and emotional expressiveness

Parameter		EMOSA	EMOSE1	EMOSE2	EMOSE3	EMOSE4	EMOEX1	EMOEX2	EMOEX3
Non-dancers	Mean	2,64	3,09	2,98	3,36	3,1	4,08	3,93	3,83
Dancers	Mean	3,03	3,48	3,48	3,78	3,45	4,13	4	4,13
Total	Mean	2,84	3,28	3,23	3,57	3,28	4,1	3,97	3,98
Mann-Whitney U		5236	5402	5057	5730	5760	6576,5	6496	5387,5
Wilcoxon W		12022	12188	11843	12516	12546	13362,5	13282	12173,5
Z		-3,086*	-2,790*	-3,472*	-2,033*	-1,946	-0,352	-0,567	-2,993*
Asymp. Sig.(2tailed)		0,002	0,005	0,001	0,042	0,052	0,725	0,571	0,003

*p < 0,05.

Analysing the manifestation of emotional skills of self-control (EMOSC), it is more evident in the group of dancesport dancers in two dimensions (out of 5). According to the research results it can be stated that for dancesport dancers it was easier to express compassion, constructively react to critics and remarks, also, in cases of the emergence of difficulties this group was better motivated to manage them (see Table 8). However, the research results indicated that there were no statistically significant differences between dancers and non-dancing people in terms of emotional sensitivity (EMOSEN).

Table 8

The emotional skills of self-control and emotional sensitivity

Parameter		EMOSC1	EMOSC2	EMOSC3	EMOSC4	EMOSC5	EMOSEN1	EMOSEN2
Non-dancers	Mean	3,86	3,51	3,43	3,63	3,79	3,94	3,96
Dancers	Mean	3,97	3,66	3,66	4,02	4,05	3,97	3,99
Total	Mean	3,91	3,58	3,54	3,82	3,92	3,96	3,97
Mann-Whitney U		6434	6349,5	5964	5204	5718	6609	6611
Wilcoxon W		13220	13135,5	12750	11990	12504	13395	13397
Z		-0,605	-0,787	-1,615	-3,202*	-2,140*	-0,269	-0,276
Asymp. Sig. (2-tailed)		0,545	0,431	0,106	0,001	0,032	0,788	0,783

*p < 0,05

During the analysis of the results obtained for the social skills of cognition, two sub-groups of skills were established: social sensitivity (COGSJ) and decision-making (COGDM). The respondents' evaluations indicated that dancesport dancers were statistically significantly more socially sensitive: differences between evaluation means emerged in three categories (out of six). However, no statistically significant differences in the skills of decision making were observed between the two groups (see Table 9). It can be stated that dancesport dancers more easily find the common topic for conversation with a companion, they pay more attention to social norms; moreover, they are more aware that the actions often have consequences.

Table 9

Differences between groups: The skills of cognition

Parameter		COGSJ1	COGSJ2	COGSJ3	COGSJ4	COGSJ5	COGSJ6	COGDM1	COGDM2	COGDM3	COGDM4
Non-dancers	Mean	2,67	4,47	2,72	3,9	3,07	3,4	3,6	2,72	4,22	2,93
Dancers	Mean	3,12	4,6	3,17	4,14	3,5	3,71	3,72	2,97	4,34	3,12
Total	Mean	2,9	4,53	2,95	4,02	3,28	3,55	3,66	2,84	4,28	3,03
Mann-Whitney U		5118	6633	5230	6312	5490	5972	6616	6000	6616	6266
Wilcoxon W		11904	13419	12016	13098	12276	12758	13402	12786	13402	13052
Z		-3,298*	-0,242	-3,098*	-0,865	-2,503*	-1,533	-0,228	-1,474	-0,268	-0,932
Asymp. Sig. (2-tailed)		0,001	0,809	0,002	0,387	0,012	0,125	0,82	0,14	0,789	0,352

*p < 0,05

The research result revealed the existence of statistically significant differences in social skills specific to dancesport dancers in comparison to non-dancing people. The differences were observed in four categories and nine sub-groups (Interacion; Communication: verbal communication, non-verbal communication, flexibility; Emotional: self-awareness, self-evaluation, and emotional expressiveness, self-control; and Cognition: social sensitivity) out of five and fifteen respectively. No differences were observed in the category of skills' of Participation and in the subgroups of interrelation, social expressiveness, and conflict-resolution (Communication); emotional sensitivity (Emotional); and decision-making (Cognition).

Discussion

The obtained results approved the finding of Long et al. (2006) that sports enable not only the improvement of physical skills, but also encourages mental development, integrate socially, educate to obey the rules. Sport is a part of human social life. It can be considered as a social phenomenon; inseparable part of a spiritual and physical culture. Sport makes an impact on the process of positive socialization, which could be interpreted as an interaction between the individual and the society; moreover, it helps the individual to obtain behavioural norms and spiritual values, forming the cultural heritage for the society (Vilkas, 2006).

Dancesport is a special part of body culture encompassing characteristics of both: sports and art (Uzunovic et. al., 2005). The performance of the dancesport is regulated, and the moves and figures are canonized. During the dancesport, two kinds of dances are performed: European Classic (also called Standard or ST): Waltz, Tango, Viennese Waltz, Slow Foxtrot, Quickstep; and Latin American (LA) dances: Samba, Cha Cha, Rumba, Paso Doble, Jive.

By body moves and expression, dancers demonstrate intrinsic feelings and emotions – they create art. Performance emerges as a game in which the amateur challenges the socially constructed norms of legitimacy in art culture (Lawson, 2009). Moreover, as a fundamental human body activity, the dance obtains the power of communication and reflectiveness through its meaning. The moves of the dance can convey happiness, sorrow, pain, aggression, etc. For those having communication problems, dance can help in bearing the social segregation. Achieving to resolve the problems of social adaptation and integration, dancesport or ballroom dances (waltz, tango, foxtrot, etc.) are recommended. Moreover, such problems as loneliness are better dealt in the dance-floor by finding a contact with other people. The results of the research presented in this paper substantiate latter insights. During the dance, between partners manifests common spiritual growth, from their actions spreads natural spiritual power, forms the interactive culture, develops esthetical and social communication with other people.

Dance and move exercises enable the development of one's basic skills (personal, social, etc.) by fostering person's spiritual world based on humanistic values. Moreover, the exercises of dance and move append basic artistic and aesthetical competence which is necessary in various areas of life. During the dance performance the dancer expresses his- / herself through the artistic and aesthetic moves which encompass creation, communication, give sense to one's life through the input to community's, country's, and world's artistic culture (Soraka et al., 2006). Torbert (1990) determined that motion applying any forms of moves, dances, exercises or plays is the methodological background for cognition of one-self and the environment; moreover, it enhances the socialization. The research results demonstrate that dancesport dancers can be characterized by specific social skills determined by the engagement in the dancesport.

The positive impact of dance is known from the ancient times; dancing was taught purposefully (Hazel, 2006). The historical analysis of the dancesport education demonstrates that dance and move were considered as a form of communication (Soraka, Sepažinskienė, 2009). Considering the dance-related interaction, it is note-worthy to mention that this process is reflective, connecting the partners in a couple, with their coaches, and the surrounding environment. The results of current research substantiate the idea that skills of communication are more evident in the behavior of dancesport dancers than of non-dancing people; especially the skills of verbal and non-verbal contact, flexibility and adaptability are more expressed.

According to Hazel (2006), the dance can be considered as a factor reducing the detachment from the society. Thus, dancesport is the field of knowledge requiring more deep and thorough social analysis and explanation. This research revealed that social skills specific to dancesport dancers are the skills of interaction, communication, emotional skills (especially self-awareness and self-evaluation; also, emotional expressiveness, self-control) and social cognition (social sensitivity). Knowing the latter differences and social benefits that can be obtained by engaging in dancesport enables the development of more expressed social skills since childhood. The effect of mature people engagement in dancesport on their social skill development requires further studies.

Conclusions

Being a part of human social life, sport is an inseparable part of human spiritual and physical culture. Sport can cause a positive socialization, resulting in interactions between individuals. Dancesport is a kind of sport, engaging at least two individuals in an interaction-based activity, encompassing artistic elements. Dancers communicate their inner-selves through the choreography; moreover, dancesport can be considered as a way for socialization and relationship creating activity.

Based on the artistic and interactive nature of the dancesport, there was hypothesized that dancesport dancers have developed a different set of social skills in comparison to non-dancing people. However, not all the social skills appeared to be different between the two groups. No differences occured in the manifestation of social skills of interrelation and social expressiveness and skills of participation between dancesport dancers and non-dancing people.

Considering the areas where statistically significant differences in manifestation of social skills occurred, the research results showed that the skills of interaction, communication, emotional skills and skills of social cognition were more evident in the behavior of dancesport dancers than of non-dancing people. According to the research results, the dancesport enables positive socialization processes to occur among dancers. Therefore, the engagement in dancesport can be recommended for people feeling socially detached, having communication problems and feeling loneliness, to improve their social life and self-expression through sports.

References

1. Canney, C., & Byrne, A. (2006). Evaluating Circle Time as a Support to Social Skills Development – Reflections on a Journey in School Based Research. *British Journal of Special Education*, *33(1)*, 19–24.

2. Cavell, S. (1990). *Conditions Handsome and Unhandsome: The Constitution of Emersonian Perfectionism*. Chicago: University of Chocago press.
3. Colombero, G. (2004). *Nuo žodžių į dialogą. Psichologiniai asmenų tarpusavio komunikacijos aspektai.* Vilnius: Katalikų pasaulio leidiniai.
4. Cornish, U., & Ross, F. (2004). *Social Skills Training for Adolescents with General Moderate Learning Difficulties*. London: Jessica Kingsley.
5. Goleman, D. (2001). An EI-Based Theory of Performance. In Cherniss, C., Goleman, D. (eds.), *The Emotionally Intelligent Workplace* (pp. 27- 44). Jossey-Bass, San Francisco.
6. Gresham, F. M. (2002). Teaching Social Skills to High-Risk Children and Youth: Preventive and Remedial Strategies. In M. R. Shinn, H. M. Walker, G. Stoner (Eds.). *Interventions for Academic and Behavior Problems. II: Preventive and Remedial Approaches* (pp. 403-432). Bethesda, MD: National Association of School Psychologists.
7. Grigaliūnaitė, V., & Pilelienė, L. (2014) Rural tourist satisfaction index: a case of Lithuania. Research for rural development: annual 20th international scientific conference proceedings, Latvia University of Agriculture, 2, 271-277.
8. Hall, J. A., Coats, E. J., & Smith LeBeau, L. (2005). Nonverbal Behavior and the Vertical Dimension of Social Relations: A Meta-Analysis. *Psychological Bulletin*, *131(6)*, 898-924.
9. Hazel, F. (2006). Dance education: a vehicle for change. World Dance Alliance Global Assembly. Proceedings, the University of the West Indies, 148-154.
10. Jurevičienė, M., Kaffemanienė, I., & Ruškus, J. (2012). Concept and Structural Components of Social Skills. *Ugdymas. Kūno kultūra. Sportas, 3(86),* 42-52.
11. Lawson, H., M. (2009). Why Dance? The Motivations of an Unlikely Group of Dancers. *Music and Arts in Action, 1(2*), 3-15.
12. Long, T., Pantaleon, N., Bruant, G., & d'Arripe-Longueville, F. (2006). A qualitative study of moral reasoning of young elite athletes. *The Sport Psychologist*, *20(3)*, 330-347.
13. Malinauskas, R. (2004). Socialinio rengimo įtaka sporto pedagogų socialiniams įgūdžiams. *Acta paedagogica Vilnensia*, *12*, 1-8.
14. Matson, J. L. (2009). *Practitioner's Guide to Social Behavior and Social Skills in Children.* New. York: Springer.
15. Nunnally, J., (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.
16. Raudeliūnaitė, R. (2007). *Sutrikusio regėjimo paauglių socialiniai įgūdžiai ir jų ugdymo pedagoginės prielaidos*. Monografija. Šiauliai: Šiaulių universiteto leidykla.
17. Raudeliūnaitė, R. (2009). Sutrikusio regėjimo paauglių socialinių įgūdžių tyrimas: interpersonalinis aspektas. *Specialusis ugdymas*, *1(20*), 64-84.

18. Rubin, K. H., & Rose-Krasnor, L. (1992). Interpersonal Problem Solving. In V. B. Van Hassett, M. Hersen (Eds.), *Handbook of Social Development* (pp. 283-323). New York: Plenum Press.
19. Rubin, R. B., & Martin, M. M. (1994). Development of a Measure of Interpersonal Communication Competence. *Communication Research Reports, 11*, 33-44.
20. Soraka, A., Sapežinskienė, L., & Kurlys, D. (2006). Neįgaliųjų šokio ir judesio terapijos pratybų vadovo edukacinė kompetencija. *Kineziterapija, 1(7)*, 23-28.
21. Soraka, A., & Sepažinskienė, L.(2009). Sportinių šokių porų ugdymas tarpdisciplininiu moksliniu požiūriu. Į sveiką gyvenseną ir skaidrią būtį Vydūno keliu: respublikinės mokslinės - praktinės konferencijos programa ir medžiaga. Lietuva: Klaipėda, 54-58.
22. Sukhodolsky, D. G., & Butter, E. (2007). Social Skills Training for Children with Intellectual Disabilities. In J. W. Jacobson, J. A. Mulick (Eds.). *Handbook of Mental Retardation and Developmental Disabilities* (pp. 601-618). New York: Kluwer.
23. Šimkus, A., & Pilelienė, L. (2010). Sporto paslaugų kokybės vertinimas: teorinis aspektas. *Organizacijų vadyba: sisteminiai tyrimai, 53*, 99-110.
24. Torbert, M. (1990). *Follow Me. A Handbook of Movement Activities for Children.* Mexico: Editorial Pax Mexico.
25. Ušpurienė, A. B., & Čepulėnas, A. (2011). D klasės sportinių šokių šokėjų fizinio parengtumo rodikliai ir jų kaita per metinius rengimo ciklus. *Sporto mokslas, 1(63)*, 50-56.
26. Uzunovic, S., Kosti, R., & Slavoljub, R. (2005). A Study of Success in Latin American Sport Dancing. *Physical Education and Sport, 3(1)*, 23-35.
27. Vaughn, S., & Hogan, A. (1990). Social Competence and Learning Disabilities: A Prospective Study. *In*: H. L. Swanson, B. K. Keogh (Eds.). *Learning disabilities: Theoretical and Research Issues* (pp. 175-191). Hillsdale, NJ: Erlbaum.
28. Vilkas, A. (2006). *Kūno kultūros teorijos įvadas*. Vilnius: Vilniaus pedagoginis universitetas.
29. Witt, L. A., & Ferris, G. R. (2003). Social Skill as Moderator of the Conscientiousness – Performance Relationship: Convergent Results Across Four Studies. *Journal of Applied Psychology*, *88*, 809–821.
30. Zins, J., Weissbert, R., Wang, M., & Walberg, H. (2004). *Building Academic Success on Social and Emotional Learning: What does the Research Say?* New York: Teachers College Press.

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ORIGINAL RESEARCH PAPER

HIGH-PERFORMANCE SPORT MANAGEMENT IN LATVIA: A REVIEW OF ATHLETES' VIEW

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Abstract

Countries around the world invest an increasingly larger number of resources into sport, especially in a high-performance sport with an aim to achieve success. High-performance development systems and programs result in international success. A gap may arise between goals and tasks defined in documents and implemented in real-time. Some features can be subjectively assessed by their primary users, in this case – high-performance athletes. The consequence may be dissatisfaction, which can affect athletes' performance. Therefore, this study aims to get a better understanding of the high-performance sport management in Latvia from the high-performance athletes' view. Research methods are as follows: analysis of scientific literature and other studies, questionnaire, and statistical analysis. High-performance athletes were contacted to complete an online survey related to theory and this question. 156 high-performance athletes completed the questionnaire. The ability to properly understand the situation of the sports management in Latvia gives sport directors the opportunity to manage and develop the high-performance sport more effectively by taking into the account athletes' view. The most important finding of this analysis is that there are a lot of issues for potential improvement in the high-performance sport management in Latvia.

Key words: *High-performance sport, high-performance sport management*

Introduction

Sport has a crucial role in the nowadays society. Sport is one of the sectors that are taken into the account during the planning of a country's budget. Respectively, if there is an investment, results are expected. Sustainability and success in sport are influenced by investments and

strategic planning processes of the country (De Bosscher, De Knop, van Bottenburg, Shibli & Bingham, 2009).

Countries around the world invest an increasingly larger number of resources into sport, especially in the high-performance sport with an aim to achieve success. By the growth of an investment levels in one country, indirectly a necessity of investment growth is promoted also in other countries in order to stay in the competition in the sport sector (De Bosscher, Bingham, Shibli, van Bottenburg & De Knop, 2008; Digel, 2005).

Lately, the Latvian government has increased its expectations for the international success also in the high-performance sport. This phenomenon has evolved greatly in the recent years around the world. Various authors have been writing that the high-performance sport and a greater understanding of management are crucial for developing national sport systems leading to success. The main interest of researchers is to identify the factors influencing success. Researchers interested in identifying the factors that lead to the international success have created numerous models to explain the development of the success. A numbers of scientific researches and books dealing with aspects of the high-performance sport management and policies have already their history (Andersen, Houlihan & Ronlang, 2015; Smolianov, Zakus & Gallo, 2015; De Bosscher & Shibli, 2015; De Bosscher, Bingham, Shibli, van Bottenburg & De Knop, 2008; Houlihan & Green, 2008; Bergsgard, Houlihan & Mangset, 2007; Digel, 2005). High-performance sport systems and policies do converge. This convergence in each country differs by national political structures, traditions and values, and different courses of events (Bergsgard, Houlihan & Mangset, 2007).

No significant scientific studies were found relating to the high-performance sport management in Latvia.

The term “sports” in Latvia is understood as all types of individual or organised activities for person's physical and mental health, as well as to achieve success in sports competitions (Saeima, 2002). The goal of the Latvian national sports policy is the formation of healthy, physically and mentally highly developed personalities.

The general legal basis of sports organisation and development in Latvia is determined by the Sports Law which was adopted in 2002. This Law specifies the general and legal basis for sports organisation and development, the general organizational structure of sport nationwide and the mutual relationship of sports organisations, the State and local government institutions and basic tasks in sports development, a well as the basis for the financing of sport (Saeima, 2002).

The medium-term planning document of policies that regulates the sport politics in the State during the closest two Olympic cycles is "Sports Policy Guidelines". The latest "Sports Policy Guidelines" were created by the Ministry of Education and Science in 2013 for the period of 2014–2020. This document addresses the promotion of children and youth sport, and sport for all, including also the high-performance sport. This is the only document in Latvia in which the term "high-performance sport" is defined – *"youth (15 years old, in some sports from the age of 12), junior/cadet and adult/national team candidate, and participant preparation to represent the country and participate in international sports competitions in order to achieve high results and everything related to training – training and work, contest organizational, methodological, financial, scientific, medical, technical, etc. provision accordingly to the criteria* of *outstanding achievements in sports* (Cabinet of Ministers, 2013).

Several definitions of the term "high-performance sport" can be found in the scientific literature. In some resources also the most important international competitions are listed – Olympic Games, World and European championships (Bouchout, 1993; De Bosscher, Bingham, Shibli, van Bottenburg & De Knop, 2008.)

In the document of "Sports Policy Guidelines", several factors of the promotion of the high-performance athletes are mentioned; however, some other factor influence is not mentioned – genetic factors and deliberate practice, environmental factors (for example, family, friends), psychological factors, and also sporting organisations responsible for delivering success (Sherry, 2016; Tucker, 2012; Sotiriadou, 2008; Hanin & Stambulova, 2004.)

In Sports Law, it is stated that The Ministry of Education and Science is the State administration institution responsible for the area of sport. One of the areas of the ministries' actions is the high-performance sport – to support the preparation of talented athletes and national teams (sports games) and their participation at the Olympic Games, as well as world and European championships (finals) (The Ministry of Education and Science, 2016d).

Sporting landscape in Latvia is complex and it includes a wide range of sport organizations. The Ministry of Education and Science created the sport structure, focusing on organisations involved in sport management in Latvia (Figure 1).

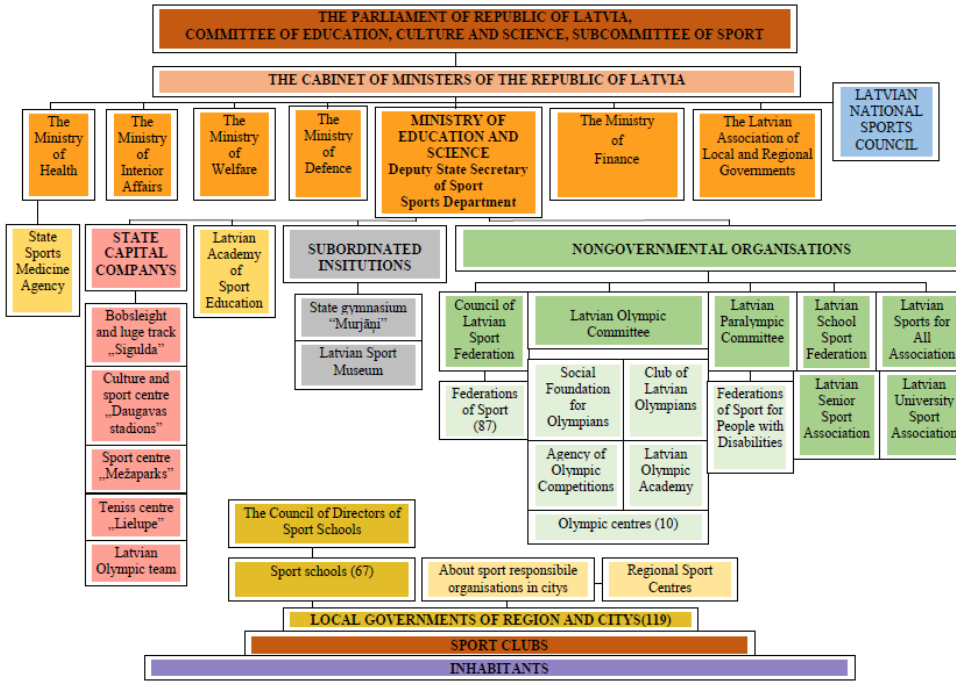


Figure 1. Sport structure of Latvia (The Ministry of Education and Science, 2016c)

In the sport structure is described the responsibility and mutual cooperation of the organizations involved. The structure includes such sub-systems as "Sport Medicine State Agency", the State capital companies, the "Latvian Academy of Sport Education", subordinate institutions, and non-governmental organizations. Every sub-system consists of definite elements, and their work is regulated by a definite ministry.

In relation to structure it is important to mention the main non-governmental organisations which are involved in taking care also about the high-performance sport.

Public consultative institution – the "Latvian National Sport Council" participates in the development of the national sports policy, facilitates sports development and cooperation in the field of sport, as well as makes decisions regarding matters related to sport. This non-governmental organization has an important place in the sport development as one of its tasks is to develop recommendations for the division of national budget funds in the field of sport (Saeima, 2002).

"Latvian Olympic Committee" by the Sport Law is committed to implement the programme for the participation of the State's best athletes in the Olympic Games, youth Olympiads, and other international and regional

complex competitions. However, this is just one out of five programmes the committee has to implement by combining the State's, local governments, and its own financial resources (Saeima, 2002). For the implementation of the Olympic programmes and events, Latvian Olympic Committee receives funding from the general budget of the State, International Olympic Committee budget, donations, and its own generated income. During the period of 2006–2016, the overall budget of Latvian Olympic Committee was 153.16 million EUR (Latvian Olympic Committee, 2016).

The preparation of the country's best athletes for participation in the Olympic Games, youth Olympiads, and other international sports competitions in the individual Olympic sports shall be ensured by the specialised sports organisation – the limited liability company "Latvian Olympic Team" (Saeima, 2002). The main task of the unit is to support the best Latvian athletes organizationally and financially with an aim to improve the quality of trainings as it could lead to high-performance success in official international competitions (Latvian Olympic Team, 2004). This organisation has their criteria, and not every athlete can fulfil the requirements to get the support.

The association "The Council of Sport Federations" coordinates the activities of the sports federations recognised in Latvia represents and implements their shared interests. Up to March of 2016, the Council of Sport Federations had recognized 84 sport federations (The Council of Sport Federations, 2016). Sport federations are responsible for the development of the relevant type or types of sport or the field of activity in the State (Saeima, 2002). The Council of Sport Federations annually summarizes the information regarding the activities of sport federations and distributes the intended federation funding on the basis of the criteria created by the board within the framework of the State budget programme (The Council of Sports Federation, 2016).

According to the Sports Law, the sport sector receives the funding from the State by taking into the account the annual State budget law. The amount of funding to the budget subprogramme "High-performance sport" is defined to be higher every year comperatively to the previous budget year. Unfortunately, during 2009–2011 the amount of funding started to decrease (Table 1) (The Ministry of Education and Science, 2016a). Financial resources for sport shall also contain the resources of local governments, legal entities and individuals, the resources of sports organisations, and allocations of international sports federations (Saeima, 2002).

Table 1

Funding from the State for sport and the high-performance sport
(The Ministry of Education and Science of Latvia, 2016b)

Year	*Funding for Sport (EUR)*	*Funding for High-performance sport (EUR)*
2016	36.893	6.558
2015	31.949	5.980
2014	36.304	5.223
2013	25.244	4.759
2012	23.941	6.188
2011	21.555	5.755
2010	22.202	5.819
2009	26.901	6.057
2008	41.744	1.019
2007	40.656	1.430
2006	33.310	1.477
Total:	*340.699*	*50.265*

Year-over-year the sport sector has to struggle concerning the funding for the provision of the basic needs that does not permit to create new initiatives. Predictable long-term budget is crucial for the stable sport development; however, budget is not the only factor. Researchers seek to find and list these factors. These factors are achieved through multidimensional approach which is adopted for the high-performance sport by a variety of models with a different number of factors.

Houlihan and Green suggest that the main factors of a successful high-performance sport development system could be organised in three various groups: contextual (e.g. the availability of funding/wealth), processual (e.g. talent identification), and specific (e.g. availability to training facilities) (Houlihan & Green, 2008).

Moreover, Singh and Dureja focused on the factors influencing international success. They included identification and selection of talent, quality coaching and competition exposure, standardized infrastructure and supportive aids, scientific back up (exercise physiology and sports medicine, sports biomechanics, sports psychology and sports anthropometry), systematic research programmes, scholarships and financial aid (Singh & Dureja, 2014).

Researcher Digel explained the role of the state and politics in supporting the high-performance sport. He listed other important factors – the economic system (the private sector as a partner of sports), mass media as a promoter of the interests of sport, the role of educational system, the function of science regarding success in sport, and the importance of military force (Digel, 2005).

De Bosscher suggested four from nine policy factors which could be significant and can influence success in the high-performance sport in her study with results from six countries. Financial support improves the environment for athletes to train and achieve success. A support during and after an athletic career is necessary to give the athletes the possibility to concentrate mainly on the sport providing them with other living services; furthermore, ability to train, qualitative and quantitative infrastructure, and highly qualified trainers are also critical (De Bosscher, De Knop, van Bottenburg, Shibli & Bingham, 2009).

Jaspal and Dureja described the inter-relationship of six factors. They published self-explanatory model which shows that inter-relationship exists between six factors (during the talent identification and selection it is prime to select talented athletes in the right age; qualitative coaching and competition exposure plays a vital role for achieving success; standardised infrastructure and supportive aids affect preparation and performance of athletes; sports science holds a vital position in designing all types of sports syllabus and planning for the high performance; the research expertise informs and enhances the performance of athletes, coaches, sports managers; policy makers by providing answers to their performance enhancing queries, scholarships and financial aid help athletes to arrange qualitative coaching and fulfil their needs related to sports performance) (Jaspal & Dureja, 2014).

The factors that describe the high-performance sport included in this research are summarized in Table 2.

Table 2

Studies on high-performance development factors

Studies	Sufficient financial support	Structured work of sporting organizations	Participation in sport	Talent identification & development system	Support for athletes during and after career	Developed sport infrastructure	Provision of coaching and support for coaching career	Structured competition system	Science support for sport
Oakley & Green, 2001	x	x	x	x	x	x	x	x	x
Abbott, 2005				x					
Digel,2005	x	x	x	x	x				x
Green & Houlihan, 2005					x	x	x	x	
Augestad, 2006	x								
De Bosscher, 2008	x	x	x	x	x	x	x	x	x
Vaeyens, 2008				x					
Singh & Dureja, 2014	x			x		x	x		x
Smolianov, 2015	x	x	x	x	x	x	x	x	x
Questions	1, 2	3, 4, 5, 6, 7	8, 9, 10, 11	12, 13, 14, 15, 16	17, 18, 19	20, 21, 22, 23, 24, 25	26, 27, 28, 29, 30	31, 32, 33, 34, 35, 36, 37	38, 39, 40

This study aims to get a better understanding of the high-performance sport management in Latvia. A gap may arise between the expected and delivered service; thus, primary stakeholders should be involved (Chelladurai, 2001) – in this case they were high-performance athletes.

Through extensive literature review, analysis of secondary sources and the view of high-performance sport athletes – the results of this study will be presented and analysed below.

Material and methods

1.Procedure and Participants

In order to find out the athletes' view about the high-performance sports management, a questionnaire based on the literature background (SPLISS model by De Bosscher et al. 2006 as a base model) was created. The questionnaire was pre-tested by the help of Latvian beach volleyball Olympians. After the adjustments, the 40-question questionnaire for athletes evaluating the nine high-performance management factors (Table 2 and Table 3-8) was designed.

Latvian high-performance athletes, who have participated in the Olympic Games, World Championships, and European Championships in various sports in the latest ten years, were surveyed. Those individuals who decided to take part in the study completed the online questionnaire at their leisure time. Respondents were given statements about the high-performance sport management with five multiple choices in Likert scale: strongly agree, agree, neither agree neither disagree, disagree, and strongly disagree. The respondents had to choose one the most appropriate answer in their opinion.

In total, 166 respondents completed the questionnaire; however, ten from the responses did not meet the study criteria for the high-performance sport and were removed from the further examination. Finally were analysed the responses of 156 high-performance athletes. Answers were received from 95 males (average age (SD) 26.8 (±5.7)) and 61 females (average age (SD) 25.0 (±5.1)). Athletes were representing 32 different sports – alpine skiing, arm-wrestling, basketball, beach volleyball, bobsleigh, canoeing, curling, cycling, BMX cycling, road cycling , floorball, freestyle wrestling, ice hockey, karate, lacrosse, luge, modern pentathlon, motocross, orienteering, powerlifting, rallycross, rowing, sailing, sambo, shooting, shorttrack, skeleton, skiing, sport climbing, swimming, table tennis, track and field, and windsurfing. However response rate varied between athletes from different disciplines.

2.Mathematical statistics

Survey responses were regrouped so that analyses were carried out on three categories: "disagree" (strongly disagree with disagree); "neutral" and "agree" (agree with strongly agree).

Descriptive statistics were calculated, and an exploratory factor analysis (FA) was performed. To perform the FA, polychoric correlation matrix was used. Before the FA, the adequacy of data set for FA were confirmed with the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO=0.85) and the Bartlett's test of sphericity (X2=4743.952, p=0.000). Oblique, promax rotation was used as it was expected that there would be dependency among the factors (Tabachnick & Fidell, 2013). The number of factors was selected using parallel analysis. Variables with a loading greater or equal than 0.4 were retained for the factor (Henson & Roberts, 2006). Variables with all loading rates lower than 0.4 were extracted from data set, and the FA was repeated until all variables had loading rate equal or higher than 0.4 associated to at least one factor. All data were processed and calculated using RStudio.

Results

Survey responses were presented as an aggregated percentage. The aggregated percentages of responses allow the appreciation of the distribution of athlete's responses (Table 3 – 8).

With respect to the "Financial support" the following indicators were analysed: the existence of sufficient financial support for sport in general and the financial support for the high-performance sport (Table 3). Following the existing literature it was found that there are several sources of funds; however, more than half of the high-performance sport athletes disagree with the statements about sufficient funding for sport (Q1 and Q2). Athletes who achieved better positions in sport competitions agreed that financial support for high-performance sport was sufficient. This in turn simply proves a logical point – greater satisfaction show athletes who are more successful (also to the following statements).

Table 3

Aggregated percentages of the high-performance athletes' responses on statements

Sufficient financial support	*Strongly disagree & disagree*	*Neutral*	*Agree & Strongly Agree*
Q1. There is a sufficient national-level financial support for sport.	60.9	23.7	15.4
Q2. There is a sufficient national-level financial support for the high-performance sport.	50.6	25.6	23.7

Table 3 countiniu

Structured work of sporting organisations	*Strongly disagree & disagree*	*Neutral*	*Agree & Strongly Agree*
Q3.* There is a coordination of all agencies involved in the high-performance sport with clear task descriptions.	35.9	36.5	27.6
Q4. There is a long-term planning for the high-performance sport in the country.	46.8	32.1	21.1
Q5.* Resources are targeted at relatively few sports through identifying those that have a real chance of success at the world level.	25	19.9	54.5
Q6.* There is a structured communication and cooperation between organisations. commercial partners. and the media.	37.1	41	21.8
Q7.* Athletes are involved in the planning of the high-performance sport policy.	52.6	32.1	15.3

* the removed items from the Factor Analysis as they did not meet 0.4 criteria for the inclusion in the factor.

Of special concern was the statements through which the study gathered opinions as to whether there is "structured work of sporting organisations". The analysis was focused on the existence of coordination. long-term planning, communication, and roles of the all involved organisations in the management of the high-performance sport (Table 3). Views of respondents vary and for several statements almost 1/3 of athletes are neutral, while still in summing up the answers – biggest part of athletes disagree with statements regarding "structured work of sporting organisations". As previously mentioned, the development of the sport sector in Latvia is provided by a large number of a different legal status authorities and organizations. Results from study may suggest that it is necessary to reconsider structure and work of sporting organisations in Latvia.

Table 4

Aggregated percentages of the high-performance athletes' responses on statements (continued)

Participation in sport	*Strongly disagree & disagree*	*Neutral*	*Agree & Strongly Agree*
Q8.* Children have opportunities to participate in sport at school, during physical education or extracurricular activities.	9	6.4	84.6
Q9.* There is a high general sport participation rate.	48.7	25	26.3
Q10. There is a national policy to improve the management of sport clubs/organisations.	50.7	35.9	13.5
Q11. There is a national policy to improve talent development in sport clubs/organisations.	57	30.1	12.8

Regarding „Participation in sport" athletes rated children opportunities to participate in sport extremely well – more than 80% of respondents gave agreement to the statement that children have opportunities to participate in sport at school. during physical education or extracurricular activities, but still in the same time almost half of the athleetes disagreed that there is a high general sport participation rate.

Table 5

Aggregated percentages of the high-performance athletes' responses on statements (continued)

Talent identification and development system	*Strongly disagree & disagree*	*Neutral*	*Agree & Strongly Agree*
Q12. There is an effective system for the identification of young talented athletes, so that the maximum number of potential talents are reached at the right time.	73.1	21.2	5.8
Q13. There is a nationally coordinated planning for sport organisations to develop an effective system for the development of young talented athletes in their sports.	59.6	29.5	10.9
Q14. Young talents receive a multidimensional support to develop them as young athletes at the highest level.	57.7	28.2	13.5
Q15. Young talents receive a nationally coordinated support for the combination of trainings and studies in secondary school (12-16/18) and. where relevant. primary education (for early specialisation sports where such a system is required).	50.7	36.5	12.8
Q16. Young talents receive a nationally coordinated support for the combination of trainings and studies in higher education (university/college level).	42.3	36.5	21.2
Support for athletes during and after career	*Strongly disagree & disagree*	*Neutral*	*Agree & Strongly Agree*
Q17.* High-performance sport is a full-time job. and athletes receive a financial support so that they can fully concentrate on their sport.	42.9	25	32
Q18. There is a coordinated support programme for the high-performance sport athletes.	38.4	25.6	34.6
Q19. Athletes can receive a post-career support from the government. and they are ready for the life after sporting career.	82.7	15.4	1.9

As shown in Table 5, all statements regarding talent received negative feedback from the high-performance athletes. This study prove that there is not an effective system for the identification of young talented

athletes in Latvia, neither is a nationally coordinated planning for sport organisations to develop an effective system for the development of young talented athletes in their sports.

The „support for athletes during and after career" was covered with following statements: athletes receive financial support so that they can fully concentrate on their sport and if there are coordinated support programs for the high-performance sport athletes during and after sporting career. An unequal view between respondents appears to the statement about a support programme for the high-performance sport athletes – in which opinions was indicated by about 25% – 38% of the respondents (Q18). The strongest disagreement (82.7%) is noticable on the statement (Q19) that athletes can receive a support from the government after the sporting career.

The sport sector is inconceivable without sport facilities, and there is a database administrated by the Ministry of Education and Science with information about sport infrastructure in Latvia. The data from the survey shows that almost half of respondents neither agree, neither disagree (49.4%) with the statement that there is a database with information about sport facilities, their availability and quality (Q20). A possible explanation for this would be the awareness of the athletes. Sport facilities should meet size, quality, and sanitary requirements; however, almost half of the respondents are neutral on statements about "developed sport infrastructure" (Table 6).

Table 6

Aggregated percentages of the high-performance athletes' responses on statements (continued)

Developed sport infrastructure	*Strongly disagree & disagree*	*Neutral*	*Agree & Strongly Agree*
Q20.* There is a database with information about sport facilities, their availability, and quality.	24,3	49,4	25,7
Q21. There is a database with information about all high-performance sport facilities, their availability, and quality.	32,7	48,7	18,5
Q22. High-performance athletes have a priority access in to sport centres at any time.	47,5	22,4	30,1
Q23.* There is a special funding for the high-performance sport facilities and their renovation.	38,4	46,2	14,7
Q24.* There are functional sport facilities in the country.	33,4	37,8	28,2
Q25. There are qualitative sport facilities in the country.	39,2	41,7	19,2

k.*the removed items from the Factor Analysis as they did not meet 0.4 criteria for the inclusion in the factor.

A clear view of the high-performance athletes is not visible on the statement for the sufficient number of well-trained and experienced high-performance sport coaches in the country (Q26). But it is clear that the general monthly income of coaches is not sufficient to provide for living: 72.4% of the respondents disagree with Q29. Furthermore, 69.9% of the athletes disagree that high-performance coaches receive a support for life after coaching career (Q31). Table 7 features the results obtained by responses on statements about "provision of coaching and support for coaching career".

Table 7

Aggregated percentages of the high-performance athletes' responses on statements (continued)

Provision of coaching and support for coaching career	*Strongly disagree & disagree*	*Neutral*	*Agree & Strongly Agree*
Q26.* There is a sufficient number of well-trained and experienced high-performance sport coaches in the country.	41	35.3	23.8
Q27. Coaches have sufficient opportunities to develop their coaching career to become a world-class high-performance sport coach.	39.1	31.4	29.5
Q28. There is a well-developed coach education system from the lowest to the highest level.	34	34.6	30.7
Q29. Coaches' general monthly income is sufficient to provide living circumstances.	72.4	20.5	7.1
Q30.* The job of a coach is recognised in the country. and the career prospects are high.	43.6	33.3	23.1
Q31.* High-performance coaches receive a support for life after the coaching career.	69.9	26.9	3.2

*the removed items from the Factor Analysis as they did not meet 0.4 criteria for the inclusion in the factor.

The high-performance athletes agree that young talents (Q34) and high-performance athletes (Q35) can participate sufficiently in international (high-level) competitions while they are neutral on statements about existence of a nationally coordinated long-term planning of event organisation and funding and a reimbursement of athlete and coach costs for participating in international competitions.

Table 8

Aggregated percentages of the high-performance athletes' responses on statements (continued)

Structured competition system	*Strongly disagree & disagree*	*Neutral*	*Agree & Strongly Agree*
Q32. There is a nationally coordinated planning to increase the number of international high-performance sport competitions that are organised in the country in a wide range of sports.	40.4	39.1	19.8
Q33. There is a nationally coordinated long-term planning of event organisation and funding.	34	48.1	17.3
Q34. Young talents can participate sufficiently in international (high-level) competitions at the right age.	29.5	25.6	44.2
Q35. High-performance athletes can participate sufficiently in international (high-level) competitions.	12.8	28.2	59
Q36. Athletes receive a reimbursement of their costs for participating in international competitions.	39.1	32.1	28.9
Q37. Coaches receive a reimbursement of their costs for participating in international competitions.	34	41	25
Science support for sport	*Strongly disagree & disagree*	*Neutral*	*Agree & Strongly Agree*
Q38. Scientific research is collected. coordinated. and disseminated among coaches and sport organisations.	45.5	42.9	11.5
Q39. There is a sufficient financial support for scientific research and innovation.	57.6	40.4	1.9
Q40.* Sport science support is provided at each level of the high-performance sport development.	49.4	41	8.9

*the removed items from the Factor Analysis as they did not meet 0.4 criteria for the inclusion in the factor.

In response to the statements about „science support for sport" this study obtained very low percentage of agreement. This result indicates that probably athletes are not the ones who are informed about sport science, but their knowladge depends on their interest as well. However, more than half of the high-performance athletes disagree with the statement (Q39) that there is a sufficient financial support for scientific research and innovation.

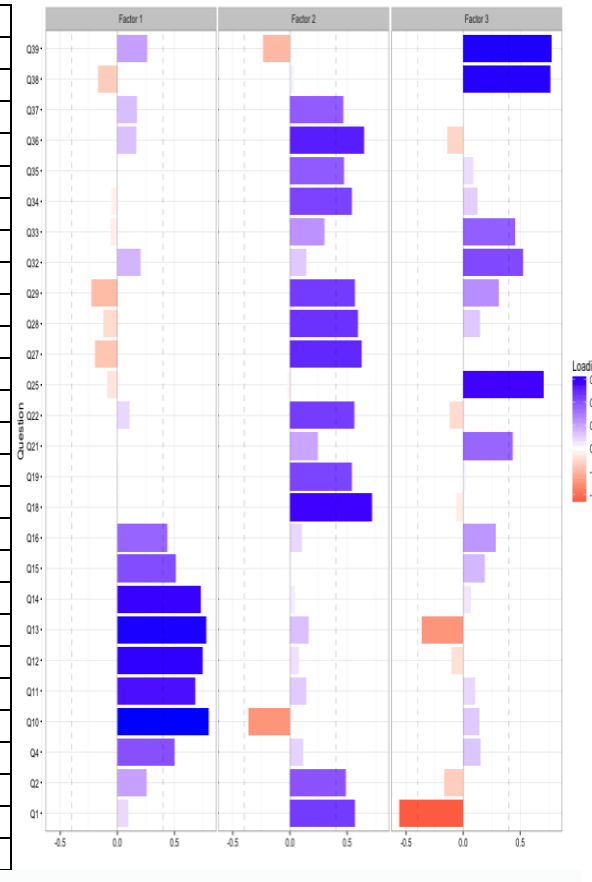
In this study, the FA showed three factors, accounting for 45.1% of the variance. In the three factor solution (Table 8, Figure 2) – *factor 1*: sufficient financial support for sporting career (from talents to high-performance athletes), (Q 1, 2, 18, 19, 22, 27, 28, 29, 34, 35, 36, 37); *factor*

2: talent policy (development, identification, coordination, and support programmes), (Q 4, 10, 11, 12, 13, 14, 15, 16); and *factor 3:* coordination of scientific information and other resources (sport infrastructure, sport events) (Q 21, 25, 32, 33, 38, 39).

Table 9

Factor loading rates

	Factor 1	*Factor 2*	*Factor 3*
Q39			0.77
Q38			0.76
Q37	0.46		
Q36	0.65		
Q35	0.47		
Q34	0.54		
Q33			0.46
Q32			0.52
Q29	0.57		
Q28	0.59		
Q27	0.62		
Q25			0.71
Q22	0.56		
Q21			0.44
Q19	0.54		
Q18	0.72		
Q16		0.44	
Q15		0.51	
Q14		0.73	
Q13		0.78	
Q12		0.75	
Q11		0.68	
Q10		0.80	
Q4		0.50	
Q2	0.49		
Q1	0.57		-0.56



14 statements (Q 3, 5, 6, 7, 8, 9, 17, 20, 23, 24, 26, 30, 31, 40) were removed as they did not meet the 0.4 criteria for the inclusion in the factor. One item was loaded on two factors – sufficient national-level financial support for sport. It is a logical conclusion as the factor 3 could not function without the financial support (Table 9).

Discussion

The aim of the research was to find out the view of athletes regarding the high-performance sport management in Latvia. After the analysis of the available and corresponding literature, were found several

factors, which were approved by different authors as significant in reaching success in high-performance sport.

Countries which priority in sport politics is a high-performance sport reach higher results in international competitions (De Bosshe & Shibli, 2015); however, the priority of sport politics in Latvia defined in the policy planning documents is children and youth sport and sport for all (Cabinet of Ministers, 2013).

The view of athletes regarding the high-performance sport management in Latvia was displayed in negative percentage results. Improvements are necessary in every factor included in this research.

De Bosscher distinguishes four of nine factors as more crucial and influential in success of high-performance sport; they are financial support, support for athletes during and after career, sport facilities and further education of coaches. These factors were highlighted as the most important in the research carried out in six countries (De Bossher, De Knop, van Bottenburg, Shibli & Bingham, 2009). After the analysis of the research conducted in Latvia, all the four above mentioned factors reached low percentage results.

After the FA analysis, three the most crucial factors in Latvia were identified: sufficient financial support for sport, talent identification and development coordination, and a coordinated use of scientific information and other resources. In order to improve the possibility of international success, improvements have to be made, and higher attention has to be given to these factors throughout the process of high-performance sport management in Latvia.

Despite the significant and important factors of the high-performance sport management that have to be improved in order to ensure the possibility of reaching international success, there are many factors which cannot be changed by the government; for example, cultural and historical heritage, climate in the country, natural resources and the environment in which the athlete is located (Taro & Hanni, 2015).

Conclusions

The development of the sport sector in Latvia is provided by a large number of a different legal status authorities and organisations. The administration of the sport sector is organized in a united organisational system developed by the Ministry of Science and Education. Several organizations considering their responsibilites defined in the Sports Law significantly influence the development of high-performance sport in Latvia – Latvian National Sport Council, Latvian Olympic Committee, Latvian Olympic union, and Latvian Sports federation council.

During the period of 2006 – 2016, 50.265 million EUR were invested in the high-performance sport of Latvia.

After the data cleaning and omitting the respondents that did not fulfil the criteria, 156 athletes were included in the final analysis.

After the analysis of the respondents' views, it can be concluded that athletes have identified several areas that require improvements: the overall financial support for sport and the high-performance sport is not sufficient; the development of high-performance sport has to be planned in the long-term; coordinated talent identification, support programme and coordinated support programe for athletes and coaches during and after career is necessary and has to be created; and sport science has to be included in the development of the high-performance sport.

All the above described factors of the high-performance sport management and development are tightly connected and interdependent; however, it is important to understand the correlation between needs and available resources.

The conducted FA analysis presented three the most import factors in the context of Latvia: sufficient financial support for sport; talent identification and development coordination; coordinated use of scientific information and other resources.

All in all, this type of research that examines the high-performance sport management in Latvia is still in its infancy stage.

References

1. Abbott, A., & Button, C. (2005). Unnatural Selection: Talent Identification and Development in Sport. Nonlinear Dynamics, *Psychology and Life Sciences, 9* (1), 61-88.
2. Andersen, S., Houlihan, B., & Ronglan, L. (2015). *Managing Elite Sport Systems: Research and Practice.* NewYork, Routledge.
3. Bergsgard, N.A., Houlihan, B., & Mangset, P. (2007). *Sport policy. A comparative Analysis of Stability and Change.* London, Elsevier.
4. Bouchout J. P. (1993). Political and Social Conditions of Elite Sport in Europe: 2nd European Forum "Sport Sciences in Europe 1993" - Current and Future Perspectives: Cologne, Meyer&Meyer Verlag.
5. Cabinet of Ministers. (2013). *Sporta politikas pamatnostādnes 2014. – 2020.gadam* (Guidlines of Sport Politcs Year 2014-2020). Retrieved October 1, 2016 from http://polsis.mk.gov.lv/documents/4599
6. Chelladurai, P. (2001). *Managing organizations. For sport & physical activity. A system perspective.* Scotsdale, Holcomb Hathaway publishers.
7. De Bosscher, V., De Knop, P., van Bottenburg, M., Shibli, S., & Bingham, J. (2009). Explaining international sporting success: An international comparison of elite sport systems and policies in six countries. *Sport management Review, 12* (3), 113-136.

8. De Bosscher, V., & Shibli, S. (2015). *Successful elite sport policies. An international comparison of the Sport Policy factors Leading to International Sporting success (SPLISS 2.0) in 15 nations.* Maidenhead: Meyer & Meyer.
9. De Bosscher, V., Bingham, J., Shibli, S., van Bottenburg, M., & De Knop, P. (2008). *The global sporting arms race. An international comparative study on sport policy factors leading to international sporting success.* Oxford: Meyer & Meyer.
10. Digel, H. (2005). Comparison of successful sport system. *New Studies in Athletics, 20* (2), 7-18.
11. European Commission. (2014). *Special Eurobarometer 412. Sport and Physical Activity.* Retrieved December 8, 2016 from http://ec.europa.eu/health//sites/health/files/nutrition_physical_activity/docs/ebs_412_en.pdf
12. Green, M., & Oakley, B. (2001). Elite sport development systems and playing to win: Uniformity and diversity in international approaches. *Leisure studies*, 20, 247-267.
13. Hanin, Y., & Stambulova, N. (2004). Sport Psychology: The Psychology of Athletic Excellence. *Encyclopaedia of Applied Psychology* (Vol.3, pp.463-477). Oxford, Elsevier Academic Press.
14. Henson, R. K., & Roberts, J. K. (2006). Use of exploratory factor analysis in published research: Common errors and some comments on improved practice. *Educational and Psychological Measurement*, *66*, 393–416.
15. Houlihan, B., & Green, M. (2008). *Comparative Elite Sport development: systems, structures and public policy.* London, Elsevier.
16. Latvian Olympic Committee. (2016). Latvijas Olimpiskās komitejas 2016.gada budžets The Budget of Latvian Olympic Committee for year 2016. Retrieved September 21, 2016 from http://olimpiade.lv/lv/lok/finanses/budzets
17. Latvian Olympic Team. (2004). Sabiedrības ar ierobežotu atbildību "Latvijas Olimpiskā vienība" statūti. The Statutes of Limited Liability company "Latvijas Olimpiskā vienība". Retrieved September 21, 2016 from http://www.lov.lv/statuti/
18. Saeima. (2002). Sporta likums.Law of Sport. Retrieved September 12, 2016 from http://likumi.lv/doc.php?id=68294
19. Smolianov, P., Zakus, D., & Gallo, J. (2015). *Sport Development in the United States: High Performance and Mass Participation.* New York, Routledge.
20. Sherry, E., Schulenkorf, N., & Phillips, P. (2016). *Managing sport development: An international approach.* New York, Routledge.
21. Sotiriadou, K., Shilbury, D., & Quick, S. (2008). The attraction, retention/transition, and nurturing process of sport development: Some Australian evidence. *Journal of sport management*, *22*, 247-272.

22. Singh, J., & Dureja, G. (2014). Sports Excellence: A pathway from grass roots to elite performance Level. *Education practice and innovation, 1,* 51-60.
23. Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics (5th ed.).* Boston, Pearson.
24. Taro, K., & Hanni, E. (2015). Using a Comparative Method in Performance Audit for Evaluating Effectiveness of the Elite-Sports Policy: The Case of Estonia. *Administrative Culture 16*, 24-46.
25. The Council of Latvian Sport Federation. (2016). *Atzīto sporta federāciju reģistrs* The register of approved federation. Retrieved September 20, 2016 from http://www.lsfp.lv/sporta_registrs/atzitas_federacijas
26. The Ministry of Education and Science of Latvia. (2016a). *Par valsts budžeta programmas 09.00.00 "Sports" sadalījumu 2015.gadā* About dividing of governmental budget programm 09.00.00 "Sports" in year 2015. Retrieved September 12, 2016 from: http://www.izm.gov.lv/images/jaunumi/budzets_2015_LNSP_140115.pdf
27. The Ministry of Education and Science of Latvia. (2016b). *Publiskie gada pārskati* [Public reports. Retrieved September 21, 2016 from http://www.izm.gov.lv/lv/publikacijas-un-statistika/publiskie-gada-parskati
28. The Ministry of Education and Science of Latvia. (2016c). *Sporta nozares struktūra* [The structure of Sport]. Retrieved August 12, 2016 from http://www.izm.gov.lv/lv/sports/sporta- nozares-struktura
29. The Ministry of Education and Science of Latvia. (2016d). *Sports.* Retrieved October 16, 2016 from: http://www.izm.gov.lv/en/sports-en
30. Tucker, R., & Collins, M. (2012). What makes champions? A review of the relative contribution of genes and training to sporting success. *British Journal of Sports Medicine*, *46*, 555-561.1.15.
31. Vaeyens, R., Lenoir, M. Williams, M.A., & Philippaerts, M.R. (2008). Talent Identification and Development Programmes in Sport Current Models and Future Directions. *Sports Med, 38* (9), 703-714.

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ORIGINAL RESEARCH PAPER

TECHNOLOGY TRAINING: ATHLETES USING VIBRATION METHOD AND TECHNICAL MEANS

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Abstract

The core idea behind the article is to work out a set of exercises that will use vibrostimulation combined with traditional power training, and the application of these methods in leisure activities provided to people at various ages. Study aim: 1. determination of frequency parameters under the influence of vibro-mechanical stimulation of human muscles, 2. the combination of vibrostimulation and other coaching methods and trainer's aims to increase power, speed and suppleness of athlete joints. The test results and new technologies worked out will have an opportunity to be used in such scientific and teaching areas as: theory and methodology of sport and physical education, anthropomotorics, kinesiology, biomechanics, but first of all they will provide coaches of various sports disciplines with the sets of ready-made exercises, significantly improving innovative element in athlete coaching.

Key words: *technology, training, vibrostimulation, technical means*

Introduction

Nowadays new social, economic, political and environmental (both ecological and technical) implications require a whole new approach in the field. One of the directions to take on while improving the framework of students' physical education is to implement cutting-edge technologies: technical means, computer systems assisting training and monitoring its performance.

On the basis of firsthand experience, as well as the review of relevant academic resources available, one may indicate the possibility to apply the so-called human engineering in sport as a means of preparing athletes in physical terms.

Drawing up a system of new means and methods does not result in total rejection of the currently applied ones; it should, however, lead to their consistent and rational enhancement, as well as adding variety in the long-term process of training.

The article provides examples of training simulators and other devices which play a part in the development of motor fitness and coordination skills and gives an overview of the methods and technologies implemented, with a view to raising the level of motor skills and sport achievement. Practical guidelines have been indicated on how to put to practical use the vibromechanical stimulation method and also its influence on the body has been examined.

As it is known, long exposure to vibration is unfavorable for a human body and may lead to vibropathology. In the training process of sportsmen vibrostimulation is applied during relatively short periods of time and is not harmful to health (Назаров, 1986; Weber, 1997; Ратов, et al., 2007; Романов, 1983). At work they try to minimize synchronization and resonance of vibration (Скрипко, 2003). During the training process of sportsmen this phenomenon is used for the development of strength, flexibility, and joint mobility (Попов, 2014). But it is necessary to take prophylactic measures during the training process in order to limit the levels of vibration. We have researched and determined the levels of vibration at a stationary vibro training machine of "VMS" for the stimulation of leg muscles and joints (Назаров, 1986) and with a portable vibrostimulator "Junost" for the stimulation of face and head muscles.

High-level of physical education and sport instruction fundamentally calls for the implementation of the more effective activities, means and methods (Starkers, et al., 1995; Trzaskoma 1998; Treadwill, 1988; Wank, et al., 1998), as well as for new technology and the introduction of modern training devices (Frohner, 1995; Horn, Willams & Scott, 2002; Kosmol & Kosmol 1995; Назаров, 1986; Rybakow, 1996; Скрипко, 2003, 2004; Skrypko & Żurek 2010; Wit, 1988). Such devices may be used at every stage of sport instruction, may be useful in teaching movement techniques and developing motor skills regardless of fitness. As well as raising the level of motor skills and sport achievement, the effectiveness of the same means and methods may have an impact on their stability rather than enhancement. Therefore, it is imperative that new means and methods are implemented, or the formerly introduced and applied refined. Sport simulators and other technical devices make it possible for the body to be subject to various intensity loads and demonstrate its reserves.

Professor W. Kuzniecow (1979) analysed maximum psychophysical aptitudes of a man. He went on to describe this direction as the so-called

antrophomaximology, which, apart from maximum aptitude, deals with exactness, accuracy and precision of motions as well as their economy. The implementation of technical means enables us to develop all motor skills, raise the individual level of conditioning and ensures harmonious physical growth. It also influences the formulation of motor skills which are instrumental in professional terms (for instance, in defense), health aspects, and allows the functional reserve of the body to be released. The implementation of various technical devices accelerates the acquisition of movement technique (due to the effective realization of the reference principle) and coordination of motions, enables personalization of an individual's training and the selection of exercises. Moreover, it makes it possible to differentiate loads, dynamics and kinematics of particular exercises as well as performing joint movements (Skrypko, 1990 – 2015).

Very important in sports training and the equipment development is volleyball training machine, constructed by professor Ермаков (С.С. Ермаков, 1997). There are different kinds of suspended balls, balls with changed center of gravity, ball passing machines.

Technologies in physical culture and sport are interrelated processes of optimal and effective methods, means and exercises aimed at creating the conditions for achieving the planned sports result in metrology and pedagogical control (Скрипко, 2003).

Technical devices – these are various kinds of accessories, equipment, vehicles and utensils, produced in their vast majority on the basis of an engineering processes, that are used by athletes and their coaches for the purpose of conditioning, diagnostics, competitions of all kinds, for work, by medical staff and by others. Training simulator – it is a technical device which enables one to master, in contrived conditions, movements that recur in a chosen sport (Скрипко, 2003; Skrypko & Żurek 2010). Practically applied training simulators may be divided into: a) Assistant devices such as catapults for firing tennis balls or volleyballs, various kinds of punchballs; b) simple simulators, e.g., bicycle ergometers, kayak ergometers, tracks; c) feedback-oriented simulators, which account for training and research stations, and are equipped in devices transmitting information about the value of forces developed in certain stages of the movement, about the speed of a particular fragment of the motion or the athlete's body reaction to loads (e.g. cardioleader). The former two kinds of training simulators allow multifold repetition of an exercise in standard conditions, facilitating or perhaps enforcing specific movements; the latter makes it possible to adjust the quality and intensity of exercises performed in an ongoing way".

Study aim:

1. Determination of frequency parameters under the influence of vibromechanical stimulation of human muscles.
2. The combination of vibrostimulation and other coaching methods and trainers' aims at increasing power, speed and suppleness of athlete joints.

Methods and material

The basis of the research technique stands on research methods and available apparatus.

Accelometric movement *analysis* system – measurement of acceleration of human biomechanical chains, running track to analyse foot pressure, push off and fly time in the run, polydynamometry – measurement of muscle group power; a device that combines a precision dynamometer allowing to take measurements of singular muscle power, pulsometry. The results will be calculated mathematically and statistically by means of the software such as Statistica 10, vibrometry ("Briul and Kier"), motor tests, and literature analyses.

Twenty highly qualified athletes aged 18 – 25 years were tested. The means given in Table 1 contain a variance coefficient of<10%, $p<0.05$. Table 1 shows acceleration, below the value is converted in decibels (dB).
Organization of research.

We have researched spreading of vibrations along the body on the "leg" training machine from the heel bone in the standing position on the supporting leg: 1. on a shin of a shin-bone; 2. on muscles of the front surface of a hip; 2. on the head and on hip muscles from vibrostimulator "Junost" attached to the hip.

At the zone of application with the vibrating surface in the mentioned above points we determined the vibrovelocity (m/s^2) and recalculated this parameter in dB in the spectrum of frequencies, measured by the vibrometer – 8, 16, 32, 63, 125, 250, 500 and 1000 Hz. The basic frequency of the vibrostimulator was within 20 – 40 Hz.

Detailed objectives: *1.* to find out the character of vibration spreading of different frequencies along the human body at different application points; *2.* to compare the results with the critical permissible levels of vibration in the spectrum of 8 – 1000 Hz.

Results

The human body can be presented in the form of mechanical vibrating model. Frequency of internal vibration of a human body does not depend on a human being himself. It is predetermined by his or her ontogenesis and is within 30 – 35 Hz range. The peculiarity of vibro-mechanical stimulation (VMS) is that vibration spreads mainly along the

muscle fibers, what is natural for muscle contractions and not perpendicular as it occurs under massage influence (Назаров, 1986). We researched the vibrations of the body on "leg" training apparatus from the heel bone in the standing position on the supporting leg. The vibrations were registered by a vibrometer 2511 of "Briul and Kier". We researched the effect of vibration on a sportsman depending on the point of application (Скрипко, 2003).

We measured the level of vibro-acceleration at the point of application of vibratod (at the heel bone). At this point vibro-acceleration was 100 decibels with frequency of 25Hz at the average. Reduction of vibration on the frequencies shown by the vibrometer took place from 2 to 5 times on the shin and hip and up to 10 times on the head. In the researched spectrum of frequencies we discovered that the excess of admissible values took place on the shin in the horizontal and vertical plane on the frequencies 16, 31, 63 Hz. On the hip muscles we discovered the reduction of vibration and the admissible values were not exceeded. We observed only a little increase in 16 Hz range along the direction of vibration. We have received the following data (tab. 1).

Table 1

Vibroacceleration at the parts of the body under VMS at the "leg" stimulator with frequency of 25 Hz (medium values; m/s^2, dB)

Parts of body	Ordinates	Frequency, Hz							
		8	16	31	63	125	250	500	1000
Shin	X	$14\cdot10^{-2}$ 53	$5\cdot10^{\circ}$ 84	$4\cdot10^{\circ}$ 83	$2\cdot10^{\circ}$ 77	$18\cdot10^{-1}$ 78	$12\cdot10^{-1}$ 72	$20\cdot10^{-2}$ 57	$8\cdot10^{-2}$ 48
	Y	$16\cdot10^{-2}$ 54	$1\cdot10^{\circ}$ 91	$7\cdot10^{\circ}$ 87	$4\cdot10^{\circ}$ 83	$2.5\cdot10^{\circ}$ 78	$3\cdot10^{\circ}$ 80	$5\cdot10^{\circ}$ 84	$3\cdot10^{\circ}$ 80
	Z	$16\cdot10^{-2}$ 54	$8\cdot10^{\circ}$ 88	$5\cdot10^{\circ}$ 84	$11\cdot10^{-1}$ 71	$4\cdot10^{-1}$ 63	$12\cdot10^{-2}$ 52	$4\cdot10^{-2}$ 43	$30\cdot10^{-3}$ 40
Hip	X	$7\cdot10^{-2}$ 47	$6\cdot10^{-1}$ 66	$5\cdot10^{-1}$ 64	$14\cdot10^{-2}$ 54	$30\cdot10^{-3}$ 40	$15\cdot10^{-3}$ 34	$5\cdot10^{-3}$ 25	$30\cdot10^{-4}$ 20
	Y	$5\cdot10^{-2}$ 44	$3\cdot10^{-1}$ 61	$2\cdot10^{-1}$ 58	$7\cdot10^{-2}$ 47	$12\cdot10^{-3}$ 32	$4\cdot10^{-3}$ 23	$2\cdot10^{-3}$ 16	$8\cdot10^{-4}$ 8
	Z	$5\cdot10^{-2}$ 44	$3\cdot10^{-1}$ 60	$15\cdot10^{-2}$ 54	$9\cdot10^{-2}$ 50	$14\cdot10^{-3}$ 33	$12\cdot10^{-3}$ 32	$3\cdot10^{-3}$ 20	$14\cdot10^{-4}$ 14
Head	X	$6\cdot10^{-2}$ 46	$4\cdot10^{-1}$ 63	1·10-2 51	$6\cdot10^{-3}$ 26	$12\cdot10^{-4}$ 12	$6\cdot10^{-3}$ 26	$18\cdot10^{-4}$ 16	$9\cdot10^{-4}$ 10
	Y	$1\cdot10^{-3}$ 31	$8\cdot10^{-1}$ 69	$3\cdot10^{-1}$ 60	$2\cdot10^{-2}$ 37	$2.5\cdot10^{-2}$ 38	$12\cdot10^{-3}$ 32	$6\cdot10^{-3}$ 26	$2\cdot10^{-3}$ 17
	Z	$7\cdot10^{-2}$ 47	$6\cdot10^{-1}$ 66	$2\cdot10^{-1}$ 57	$5\cdot10^{-2}$ 45	$4\cdot10^{-3}$ 23	$7\cdot10^{-3}$ 27	$2.5\cdot10^{-3}$ 18	$1\cdot10^{-4}$ 11
Critical permissible values		63	63	69	75	81	87	93	93

We have measured the vibroacceleration in the zone of contact with vibroplatform (on the heel bone). At this part of the leg the level of vibroacceleration was at the average 100 dB under frequency of 25 Hz.

The determined drop of vibration was 2 – 5 times on the shin and hip and 10 times on the head. At the same time within the researched spectrum of frequencies we determined that the excess of permissible values (shown in the table) was on the shin in the horizontal plane on X and Y axis at frequencies of 16.31, 63 Hz and on vertical component on Z axis. There was a drop of vibration on hip muscles and there was practically no excess of permissible values, but just a little excess within the range of 16 Hz on the X axis that is along the direction of vibration. More radical drop of vibration was determined on the head but vibration was close to permissible in the spectrum of 16 – 31 Hz. It may be explained that the basic frequency of vibrostimulation was close to these values – 25 Hz. There were no vibroacceleration values exceeding permissible under vibrostimulation with frequency of 35 Hz .That means that when we increase the frequency of vibration the vibro effect localizes and drops on the far parts of the body.

It is proved by the following fact. The level of vibration on the head when the hands were stimulated was rather high under stimulation with the frequency of 25 Hz. We registered the excess of permissible doze in the spectrum of 16 – 31 Hz. When we increased the frequency of vibrostimulation up to 35 Hz, there was a drop of vibration 1.5 – 2 times.

When we applied a portable vibrostimulator ‘Junost” to the muscles of the hip, in spite of the lower power of vibration generating, the level of vibration at the vibrodot application point was 16 – 31 Hz within 80 dB. To compare - under vibrostimulation by “leg” vibrator at the application point the level of local vibration was 100 dB.

With the most used frequency of 25 – 30 Hz there is an excess of admissible values in the range close to the basic frequency on the parts of the body within the application points and a considerable reduction while spreading along the body.

VMS of muscles in the lengthwise spreading of vibration is predetermined by both frequency of vibration and the point of application. Under vibrostimulation by typical frequency of 25 Hz in the spectrum of affecting frequencies we noticed an excess of permissible values in the range close to the basic vibration frequency on the parts of the body which are close to the application point and considerably reduce while spreading along the body. The results may be used when it is necessary to find out the modes of vibrostimulation (frequencies, amplitudes, and time) under different postures of the body and application points.

Research has been undertaken to examine the level of vibrations while performing exercises on vibrating training simulator – a stimulus for muscles and joints of lower limbs (Назаров, 1986; Skrypko, 1990 – 2015).

It examined the dispersion of vibrating waves across the body starting from tuber calcanei on the lower limb placed on the vibrating device in an erect position on the other lower limb. The following were subject to research: biceps thigh muscle and quadriceps thigh muscle. On the basis of experiments conducted by independent authors a positive impact was observed regarding dosed vibromechanical stimulation with a specified value of amplitude and activation time of vital body functions. The processes which take place in biological systems as a result of vibrations are characterized by a specific optimal structure. Vibromechanical stimulation influences acceleration of recovery processes to a bigger extent than it is the case during passive rest. It also increases energetic efficiency of muscles, impacts muscle receptors, flexibility and plasticity of joint apparatus and blood vessels. The application of VMS during the training process is instrumental in improving blood circulation in muscle tissues. Therefore, training loads are more bearable if the pulse is stable. Devices facilitating the development of motor skills are called vibrating devices (tab.2).

Table 2

Exercises with the use of vibrating devices
(Скрипко, 2003; Skrypko, Żurek & Łojewski, 2011)

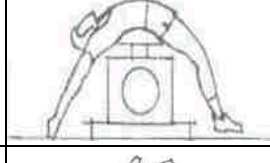
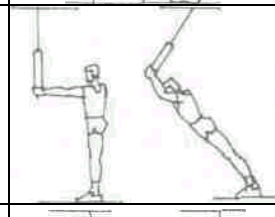
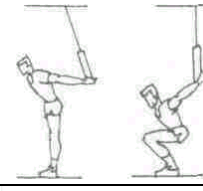
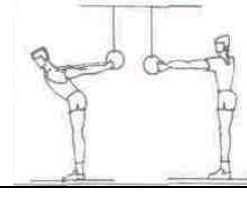
	Exercise	Description	Effect of exercise
1		Erect position on the supporting leg, next to the training simulator, the other leg straightened in the knee-joint, with the foot on the simulator. The athlete executes rhythmical trunk bends sideward.	Quadriceps muscle of thigh stretch. Agility of trunk muscles improves.
2		In a horizontal position, with the back to the floor at the level of lumbosacral joint, hands and legs hang downward loosely.	Mobility of the spine is improved, trunk MM and the frontal plane of thigh MM stretch.
3		Standing on one leg, the other is straightened in the knee and raised, the heel leans against the vibrating part, and one hand holds the belt to keep a balance.	It influences stretching and agility of MM adductor muscles of thigh and mobility in the hip joint.

Table 2 countinion

4		Erect position on the supporting leg facing the simulator, the other leg bent in the knee joint, the foot leans against the simulator. The athlete executes rhythmical deep bends forward.	It develops agility and flexibility in hip and knee joints. It influences the development of mm NN strength.
5		Standing on the supporting leg with the back to the simulator, the other leg bent in the knee joint, against the simulator.	The exercise stretches and stimulates the frontal plane of mm of hip joint.
6		Standing on both legs, RR hold a special belt (or gymnastic wheels) overhead, The athlete aims to maintain the body in the position enforced (hang)	While performing exercise 6, 7 and 8 trunk muscles are stimulated. Agility and joint mobility is developed as well.
7		Standing on both legs, RR hold a special belt (or gymnastic wheels) behind the back. The athlete executes rhythmical sit-ups.	While performing exercise 6, 7 and 8 trunk muscles are stimulated. Agility and joint mobility is developed as well.
8		Standing on both legs, RR hold a special belt (or gymnastic wheels) while they are straightened. The athlete aims to maintain the body in a given position.	While performing exercise 6, 7 and 8 trunk muscles are stimulated. Agility and joint mobility is developed as well.

Sample exercises and results

Force loading and vibromechanical stimulation (VMS) were performed simultaneously. Six leg VMS sessions were carried on in a day over a two-week microcycle. Stimulation session included two exercises.

Exercise 1. From basic (starting) position standing on the front part of the foot of one of the legs on vibrating surface of the stimulator with additional hand support do bending and unbending of an ankle joint. The exercise is done with the resistance that is 70 – 80% of the maximum, the body being inclined as for sprint. Perform 10 ups and downs on the foot. The rate of doing the exercise was one movement in 2s.

Exercise 2. From basic (starting) position with the support of one of the legs on the vibrator surface perform 5 – 6 second effort, the emphasis

being put on the possibly rapid intensification. The total duration of exercises in 20 mm (two runs). In the beginning Ex. 1 is done with one approach on each leg in 40s. rest. After one minute recovering Ex. 2 is done with two approaches on each leg, the interval between them being 1 mm. In 5 min the exercise runs are repeated. Vibration frequency of vibrating surface of the vibrator ranges between 16 – 30 Hz depending on the feeling of the highest comfort and the amplitude of vibrations is 4 mm.

The experiment results have shown that after two stimulation sessions maximum strength indicators decreased by 3.4% on average. However already after the third session the cumulative effect of their real increase ($p<0.05$) was observed. Maximum increase became apparent only in a week after VMS course (on average 7.8%). After four months of training the strength indicators exceeded the initial level by 10%, the joint mobility becoming better as well.

The research was done to examine VMS application for developing strength abilities of muscles participating in foot bending as well as VMS influence on the attendant development of flexibility and speed-and-strength abilities of track and field athletes. The sportsmen were trained by using generally accepted (conventional) methods as well as with additional application of specific loads that were done for six sessions during two week microcycles.

The research done has shown the high effectiveness of additional exercises based on the methods proposed by us to develop strength abilities of sportsmen specializing in kinds of sports with speed and strength abilities needed. Speed and strength abilities (up to 7%) are developed along with the development of muscle strength of legs (up to 11%), which led to better results in sprint in combination with special training. These methods are recommended to apply not later than 30 days before the beginning of contest season.

Basing on the scientific facts of evolutional biomechanics - the presence of the periods of accelerated and slowed development of activity systems of a man, personal evolution, the principles of adequate training effects (age and condition aspects) and the determination of morphofunctional system components of a man (conservative and changeable), it can be noted that it is up-to-date technologies that help to detail training programmes and to effectively use them for physical training of a man.

Conditioning programs on an electromechanical track

Detailed conditioning programs have been designed on the basis of the research (Скрипко, 2003) concerning time measurements and the

frequency of particular stages of running step and the cardio-vascular system's reaction in runners:

Program 1: initial instruction of running and walking- exercises on the track in a slow, steady pace, with and without the so-called bar. The speed of track's shift is no more than 4 m/s. Practical guidelines: a) walk in a slow pace, the walker holds on to the grips, duration – 30 s, interval – 2 mm, 6 repetitions; b) walk in a faster pace, the walker holds on to grips, then releases the grip, duration – 20 s, interval – 2-3 mm, 4 repetitions; c) run in a steady pace with the bar – 30 s, interval – 2-3 mm, 5 – 6 repetitions; d) run in a steady pace without the bar – 15 s, 3min interval, 4 – 5 repetitions.

Program 2: steady run on a track with and without a bar in three speed zones. Guidelines and practical tips:

exercise 1:

speed, m/s	2	3	4
duration, s	80	60	30

Interval – 3-4 mm, 2 – 3 repetitions;

exercise 2:

speed, m/s	3	4	5
duration, s	60	30	15

Interval – 3-4 mm, 2 – 3 repetitions.

Program 3: near maximum speed training with and without a bar.

exercise 1:

speed, m/s	3	5	7
duration, s	60	20	10

Interval – 3 mm, 2 repetitions;

exercise 2:

speed, m/s	5	7	8
duration, s	25	15	7

Interval- 5 mm, 2-3 repetitions.

Program 4: maximum speed training with a bar.

exercise 1:

speed, m/s	4	6	8
duration, s	60	30	10

Interval – 6 mm, 2 repetitions.

On the basis of the above-mentioned programs one may conclude that the instruction of running technique on a mechanical track may comprise 1 – 2 trainings. Programs 2 and 3 were recommended on a twice weekly basis, program 4 – once weekly. Track training results in increased frequency of steps whilst running, enhanced level of speed-force aptitudes and, consequently, an improvement of time results in short distances. During electromechanical track training the loads which the body is subject to are lesser in comparison to analogous speed results on a field track, whilst

the restitution of the frequency of heart contractions retains its level from before the training only about 4 – 5 minutes later.

The proposed article is of a research nature and implementation destined, with its objectives clearly outlined and forecast results provided to assist improvements towards sports mastery. The methods envisaged by the project can be used along with other coaching means and trainers to provide coordinative and fitness readiness, e.g. on various electromechanical run tracks, power trainers frequent in fitness rooms. Testing different muscle groups based on polydynamometry will yield a topographic image of the power of individual muscle groups. On the grounds of the obtained image, it will be possible to find out which muscles are weaker, and subject them to proper coaching so that their physical potential could be increased. With tests being carried out, the application of vibromechanical stimulators might find a wider field of use while their construction can be improved, which will, eventually, give rise to an opportunity to file for a patent right of new devices, coaching technologies and diagnostic methods. On the basis of the conducted research health promoting methods will be offered to increase fitness levels of people of various ages.

The research itself and the implementation of the proposed technologies will open up paths leading up to research and engineering centres, industrial centres in Poland with a view to producing vibrostimulatings devices on a larger scale, which will lead to their being used universally for coaching sports people at various ages.

The core idea behind the article is to work out a set of exercises that will use vibrostimulation combined with traditional power trainers, and the application of these methods in leisure activities provided to people at various ages.

Conclusions

Modern technologies in athletic training make it possible to apply effective methods and programs in the instruction of movement techniques as well as developing motor skills. It presents opportunities for controlled synergy in artificially contrived conditions while executing physical exercises within the entire framework of movements, which are linked to the specificity of a given sport. Application of human engineering in sport in vocational training of athletes reflects interdisciplinary aspects of sport sciences. The arrival of new devices as well as sport specializations justifies the need for more effective means and methods in physical conditioning. Therefore, one may infer that it is advisable to implement training simulators and other technical devices in athletes training. One may also conclude that it is legitimate to continue research in order to design new

devices and methods which take into account the specificity of particular sport specializations and monitoring training performance.

With the most used frequency of 25 – 30 Hz there is an excess of admissible values in the range close to the basic frequency on the parts of the body within the application points and a considerable reduction while spreading along the body. VMS of muscles in the lengthwise spreading of vibration is pre-determined by both frequency of vibration and the point of application. Under vibrostimulation by typical frequency of 25 Hz in the spectrum of affecting frequencies we noticed an excess of permissible values in the range close to the basic vibration frequency on the parts of the body which are close to the application point and considerably reduce while spreading along the body. The results may be used when it is necessary to find out the modes of vibrostimulation (frequencies, amplitudes, and time) under different postures of the body and application points.

Vibromechanical stimulation (VMS) is another method which influences acceleration of training and recovery processes. It also increases energetic efficiency of muscles, has a positive impact on muscle receptors, flexibility and plasticity of joint apparatus and blood vessels. The application of VMS in the training process is instrumental in enhancing blood microcirculation in muscle tissues. Therefore, training loads are more bearable if pulse is stable. Its application also improves the level of agility and nimbleness in athletes of various sports (Назаров, 1986; Skrypko & Żurek 2010; Weber, 1997).

References

1. Fröhner, B. (1995). Für praktischen Arbeitsweise mit Computer und Videotechnologien in der wissenschaftlichen ProzeBbegleitung im Volleyball. *Leistungssport*, nr 5, s. 19-26.
2. Horn, R., Willams, A., & Scott, M. (2002). Hearning from demonstrations: the role of visual search during observational learning from video and point-light models. *Journal of Sports Sciences*, nr 3, 9 p. 253-269.
3. Kosmol, A., & Kosmol, J. (1995). Komputery nowoczesne technologie w sporcie, Warszawa, *COS Resortowe Centrum MSZ KFIS*, 180 s.
4. Rybakov, D.P. (2005). Modem Football training, Turku: *Becda Ltd*, 300 s.
5. Skrypko, A. (2007). Influance of vibrostimulation on muscule activity, 9 International Scientific Conference, Bologna, Italy.
6. Skrypko, A., & Żurek, P. (2010). Trenażery w grach sportowych. Poznań: *Akademia Wychowania Fizycznego im. Eugeniusza Piaseckiego w Poznaniu*. 2010, 90 s.
7. Skrypko, A., Żurek, P., & Łojewski, J. (2011). A diagnosis of physical fitness in the contemporary army (red.) M. Sokołowski. *Polish scientific physical education association section of physical education in the army*.

8. Starkes, J. L., Eduards, P., Dissanayce, P., & Dunn, T. (1995). A new technology and field test of advance cue usage in volleyball, *Research Quartely for Exercise and Sport*, Vol. 66, nr 2, 162-167.
9. Treadwell, P. J. (1988). Computeraited Match Analysis of Selected Ball Games, *Science and Football*, Ed. T.Reilly, London, p. 282-287.
10. Trzaskoma, Z. (1998). Zastosowomie specjalistycznych urzdzeń treningowych w procesie zwiçkszania sprawnoci fizycznej czlowieka, *Wychowanie Fizyczne i Sport*, tom XLII, nr 2, Warszawa, Wydawnictwo Naukowe PWN, 1998, s. 39-51.
11. Wank, V., Frick, U., & Schmidtbleicher, D. (1998). Vergleichende Betrachtung der Bewegungsmuster beim Laufen auf dem Laufband und auf der Bahn. *Leistungssport*, № 1, s. 48-53.
12. Weber, R. (1997). Muskulstimulation durch Vibration. *Leistungssport*, № 1, s. 53-56.
13. Wit, A. (red.), Urządzenia techniczne w doskonaleniu metod treningowych, Instytut Sportu, XIX, Warszawa, *Instytut Sportu*, 1988.
14. Ермаков, С.С. (1997). Обучение технике ударных движений в спортивных играх на основе их компьютерных моделей и новых тренажерных устройств. Автореф. дисертации докт. пед. наук. Киев.
15. Назаров, В. Т. (1986). Биомеханическая стимуляция: Явь и надежды. Мн.: Полымя. 95 с.
16. Попов, Г.И. (2014). Биомеханика. *Академия*. Москва.
17. Ратов, И.П., Попов, Г.И., Логинов, А.А, Шмонин, Б.В. (2007). Биомеханические технологии подготовки спортсменов. *ФиС*. Москва.
18. Романов, С.Н. (1983). Биологическое действие механических колебаний. Л.: Наука.
19. Скрипко, А.Д. (2003). Технологии физического воспитания. Мн.: *ИСЗ* – 284 с.
20. Скрипко, А.Д., Попов, Г.И. (2004). Технология подготовки бегунов. *Теория и практика физической культуры*, № 3.

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ORIGINAL RESEARCH PAPER

POSTURE ASSESSMENT IN CHILDREN WITH AND WITHOUT DISABILITIES

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Abstract

Postural problems in children may lead to greater health problems in the musculoskeletal system as children grow. However, little is known about the variability of upright standing posture in children with various disabilities. This study aimed assessing the postural alignment of children (age 7 – 11 years) with intellectual, hearing, and visual disabilities. Postural alignment in standing was measured by using photogrammetry. The software ArchiCAD program was used to analyse data. Participants were 37 children (age 7 – 12 years) including 28 children with disability and 9 typically developed children. In the frontal plane, the asymmetry of posture and deviation of reference points was found in children with disabilities and also their peers without disability. Deviation of the posture from vertical axis was not found only in children with hearing disabilities. The most common deviation outcomes were lateroflexion of the head, asymmetry of shoulders, and scapulae, asymmetry of the pelvis, and asymmetry between ASIS and PSIS. In the sagittal plane the most common deviations were forward posture deviation, deviation of the head in relation to vertical and horizontal axis, the placement of the first vertebra and the manubrium against the horizontal axis, and pelvic inclination. The obtained results from this study revealed that postural deviations in children with mild and moderate disability are similar to those in typically developing children.

Key words: *postural alignment, children with and without disability*

Introduction

The most common health problems determined in preschool and elementary school age children in Latvia are related to posture, speech and

language, and vision. According data of the Centre of Disease Prevention and Control of Latvia (2016) about 15% of children age between 15 – 17 years have posture problems. It can be explained by growth spurts occurring during elementary school age (7–11 years) that cause widespread alterations in body shape and dimensions, and affecting muscle tightness and flexibility (Bloomfield, Ackland, & Elliot, 1994).

Posture indicates relation between the spinal segments and environmental factors. Vertical posture is considered to be an important indicator of the musculoskeletal health. The ideal alignment in the vertical posture is related to the gravity line, which is an imagined vertical line passing through the center of gravity of the body. Previous research findings indicated that disability increases the risk of acquiring postural disorders in children with visual and hearing disabilities (Zwierzchowska, & Gawlik, 2007; Ray, Horvat, Croce, Mason, & Wolf, 2008) and intellectual disorders (Hill & Goldsmith, 2010). The Posture Committee of the American Academy of Orthopaedic Surgeons (1947) defined correct posture as "the state of muscular and skeletal balance which protects the supporting structures of the body against injury or progressive deformity, irrespective of the position (erect, lying, squatting, or stooping) in which these structures are working or resting". While there is not standard approach to measure posture, the photogrammetry has been found to be reliable and cost-effective approach used in many studies (Claeys, Brumagne, Deklerck, Vanderhaeghen, & Dankaerts, 2016; McEvoy & Grimmer, 2005; Watson, & Mac Donncha, 2000). The progressive trend of postural deviations in children, including those with disability, followed by costly rehabilitation requires more evidence based research on posture variables in elementary school age children with disabilities. Therefore, this research aimed to assess posture in children with visual, hearing and intellectual impairments and their typically developed peers.

Materials and Methods

Participants in this study were 28 children with mild to moderate disability age from 7 – 12 years (8 with hearing, 8 with visual and 12 children with intellectual impairment) and 9 healthy children. Children with disability were recruited from special education programmes according to the Regulations of the Cabinet of Ministers No. 990 "Regulations on the Classification of the Latvian Education" (2008). The nine typically developed children were randomly selected from the general education program. The study received the Ethics Committee approval of the affiliated institution of the authors of this study. All participants and/or their parents/guardians provided written consent priori to the study. The

photogrammetry method applied to obtain postural assessment data of all participants in the orthostatic position from the sagittal and frontal views.

The reference points cited by Kendall et al (1994) were used. Researchers used coloured circular stickers (diameter of 0.5 cm) to mark these points on each participant. The Ideal Postural Alignment (Normal posture) defined by Kendall et al (2005) was used to analyse obtained (Kendall, McCreary, Provance, Rodgers, & Romani, 1994; Васильева, 1996). The following reference points were marked in frontal plane: *mastoideus process, acromia and scapula, upper medial corners and shoulder blade (scapula) lower corners, iliac crest and posterior superior iliac spine (PSIS)*. Furthermore, in posterior plane following reference points were marked: *eye cavity outer canthi, iliac crest and anterior superior iliac spine (ASIS).* To assess posture deviation in the frontal plane, the following reference points were marked: *chin, manubrium and symphysis*.

In the sagittal plane, the following reference points were marked: *external auditory canal, the eye cavity outer canthus, manubrium, acromion process and axillary line, ASIS and PSIS.* To assess posture deviation in the sagittal plane, the following reference points were marked: *ear external opening, acromion, trochanter, lateral condyle, and lateral malleolus*.

A digital camera (Canon D5000) was positioned at a standard distance of 5.00m from the platform at a height of 1.20m. The camera's height was adjusted individually so that the imaginary lens axis would go through the centre of gravity of the participant (Galeja, 2015). The subjects wore bathing clothes and/or shorts and top. The pictures were taken from the anterior, and posterior directions (frontal plane) as well as from both sides (sagittal plane).

The obtained pictures were processed using computer programme ArchiCAD, analogous to computer programme MathCAD 14 (PTC, Needham, MA, USA) (Claeys, Brumagne, Deklerck, Vanderhaeghen, & Dankaerts, 2016). The posture characteristics in the frontal and sagittal planes were analysed by using angle measures between the reference points and its deviation from the horizontal and vertical axis. These angular measures have been previously used in studies investigating posture (Smith, O'Sullivan, & Straker, 2008).

Statistical calculations were performed by SPSS 19 and Microsoft Office Excel add-on programme Statistics 3.1. Descriptive statistics were used to check for normal distribution. Furthermore, nonparametric data analyses were used for further processing of quantitative study outcomes.

Results

In total seven reference points were assessed to analyse the body alignment of all participants in the frontal plane (Figure 1). For example, for the first reference point indicating the average deviation angle of the body from vertical was $1.04\pm .35^0$ in children with visual impairment, $.74\pm .17^0$ in children with intellectual impairment, and $2.03\pm .42^0$ in children without disability. However, none of children with hearing impairment did not present posture deviation from the vertical axis.

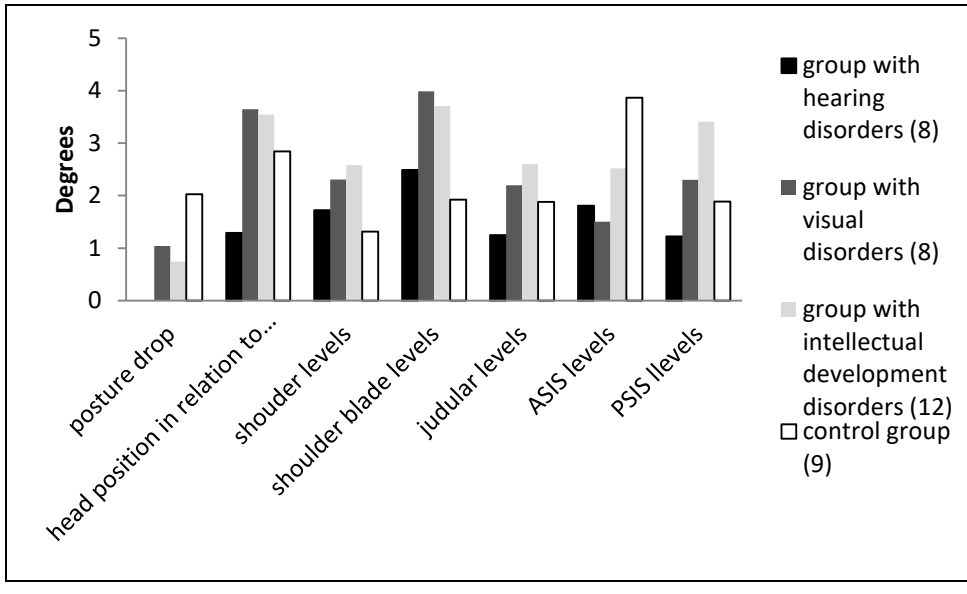

Figure 1. Mean results of the posture reference points in frontal plane

The average outcome results of the second reference point indicating the head position in relation to the vertical for children with hearing impairment was $1.29\pm .30^0$, for children with visual impairment it was $3.65\pm .79^0$, for children with intellectual impairment it was $3.55\pm .74^0$, and for children without disability it was $2.84\pm .48^0$.

The average outcome of the shoulder asymmetry measures in children with hearing impairment was $1.72\pm .59^0$, in children with visual impairment it was 2.31 ± 0.41^0, in children with intellectual impairment it was $2.58\pm .42^{0,}$ while for children without disability it was $1.32\pm .31^0$.

Analysing the measurement results of the reference points in shoulders (*scapula*) in relation to the Ideal Postural Alignment (Normal posture) defined by Kendall et al (2005), asymmetry in the right and left lower corner of the scapula was found in all participants. As illustrated in Figure 1 for children with hearing impairment the average deviation from Normal posture was $2.49\pm .50^0$, for children with visual impairment it was

3.99±1.08^0, in children with intellectual impairment it was 3.71± .67^0, and in children without disabilities it was 1.93± .22^0.

Furthermore, analysing the measurement results of the reference points in pelvis the asymmetry of the the iliac crest in relation to the horizontal plane was found in all participants indicating deviation from the Ideal Postural Alignment (Normal posture) defined by Kendall et al (2005). The Figure 1 illustrates that the average asymmetry of iliac crest reference points in children with hearing impairment was 1.25± .41^0, in children with visual impairment it was 2.20± .62^0, in children with intellectual impairment it was 2.60± .54^0, and in typically developed children it was 1.88± .29^0. Also, measures of the placement of ASIS reference points revealed asymmetry between the right and left side in all participants. In children with hearing impairment the average asymmetry angle was 1.81± .54^0, in children with visual impairment it was 1.50± .25^0, in children with intellectual disability it was 2.52± .39^0, and in typically developed children it was 3.87± .91^0. Analyses of the PSIS reference points in relation to the Ideal Postural Alignment (Normal posture), the asymmetry was found in all participants. The average asymmetry angle in children with hearing impairment was 1.22 ± .35^0, in a group with visual impairment it was 2.30± .54^0, and in a group with intellectual disability it was 3.41± .68^0, and in typically developed children it was 1.89± .22^0.

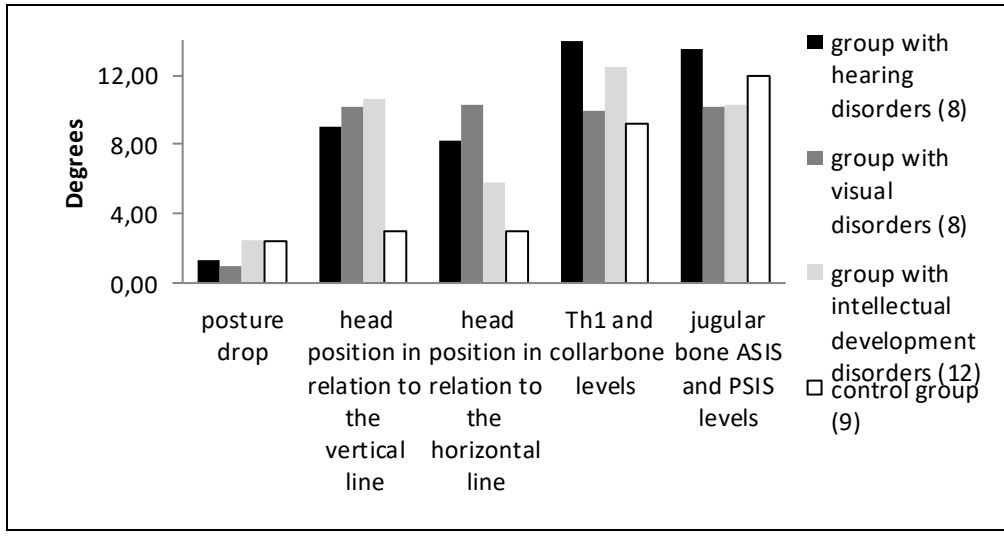

Figure 2. Mean results of the posture reference points in the sagittal plane

Analyses of obtained results for posture reference points in the sagittal plane, deviation from the Ideal Postural Alignment (Normal posture) was found in all selected parameters (Figure 2). For example, the mean

results of the reference point indicating the angle of the body deviation from vertical indicated that all participants displayed forward posture deviation. In children with hearing impairment the average angle of forward deviation of the posture was $1.27\pm .28^0$, in children with visual impairment it was $.93\pm .36^0$, in children with intellectual impairment it was $2.46\pm .43^0$, and in children without disability it was 2.40 ± 0.43^0.

Furthermore, for all participants the measurement outcomes of the head in relation to the vertical indicated deviation from the Ideal Postural Alignment (Normal posture). In the children with hearing impairment the mean deviation angle was 9.01 ± 2.02^0, in children with visual impairment it was 10.18 ± 2.20^0 on the average, in children with intellectual impairment it was 10.67 ± 2.31^0, and in children without disability it was $3.00\pm .58^0$.

Also, the assessment outcomes for the head position in relation to the horizontal axis indicated deviation from the Ideal Postural Alignment (Normal posture). The mean deviation angle in children with hearing impairment was 8.2 ± 2.2^0, in children with visual impairment it was 10.28 ± 2.90^0 on the average, in children with intellectual impairment it was $5.79\pm .94^0$ on the average, and in typically developing children it was $2.99\pm .65^0$.

As in results described above, the study outcomes for the placement of the first vertebra and the manubrium against the horizontal axis indicated deviation from the Ideal Postural Alignment (Normal posture). The mean deviation angle in children with hearing impairment it was 13.97 ± 2.11^0, in children with visual impairment it was 9.95 ± 2.54^0, in children with intellectual impairment it was 12.46 ± 1.38^0, and in typically developing children it was 9.23 ± 1.77^0.

Analysing average study outcomes of the pelvis position in the sagittal plane described as reference points of ASIS and PSIS in relation to the horizontal axis had deviation angle over 5^0 indicating difference from the Ideal Postural Alignment (Normal posture). In children with hearing impairment it was 13.54 ± 2.06^0, in children with visual impairment it was 10.20 ± 1.97^0, in children with intellectual impairment it was 10.26 ± 1.14^0, and in children without disability it was $11.92\pm .89^0$.

Discussion

This study presented measures of posture reference points indicating that children with visual, hearing and intellectual impairments and their typically developing peers had deviations from the Ideal Postural Alignment (Normal posture). Also, other authors have presented similar results when assessing posture in children without health disorders (e.g., Claeys, Brumagne, Deklerck, Vanderhaeghen, & Dankaerts, 2016; Penha, Casarotto, Sacco, Marques, & João, 2008; Paušic, Pedišic, & Dizdar, 2010).

For example, Paušic et al (2010) found deviation of the head, shoulder and pelvis placement in boys (n=273) from 10 to 13 years of age. Furthermore, authors of previous studies have listed many factors causing the development of postural disorders where the most common factor is muscle imbalance (Kendall et al., 1994; Васильева, 1996).

Assessing the reference points in neck and shoulder in relation to the Ideal Postural Alignment (Normal posture) in the frontal plane, we found lateral flexion of the head and asymmetry in the shoulders in all participants. This outcome might be explained by the relationship between the curve of the head and neck in the frontal plane, which in turn, can be resulted from unbalanced tightening muscles on the right and left side of the neck (Almeida, Guimarães, Moc, Menezes, Mafort, & Lopes, 2013).

Also, out study revealed asymmetry in the lower corner of *scapula*. According literature this asymmetry in children can develop if the *scapula* is rotated medially which in turn can influence the muscle tone of the upper part of *m. trapezius* (Kendall et al., 1994; Васильева, 1996).

In the sagittal plane the obtained results of reference points revealed that all participants had retroflexion of the head. Also, deviation from the Ideal Postural Alignment (Normal posture) was found in reference points of first vertebra and the manubrium. The reason for deviations in the head, neck and the shoulder segments might be related to a weakness of deep neck flexor muscles and posterior shoulder muscles (Watson, & Trott, 1993; Jull, Barrett, Magee, & Ho, 1999; Placzek, Pagett, Roubal, Jones, McMichael, Rozanski, & Gianotto, 1999; Almeida et al., 2013; Galeja, 2015).

This study found that for all participants' measures of reference points in pelvis were deviating from the Ideal Postural Alignment (Normal posture). The pelvis placement in frontal and sagittal plane can be affected by imbalance between the lateral and frontal abdominal muscles, and pelvis muscles (Левит, Захсе, & Янда, 1993; Васильева, 1996). Also, authors have indicated that the abdominal front and lateral muscles form the abdominal wall protecting respiratory organs and making the intra-abdominal pressure, which in turn, provides stability in lumbar segments of the spine. These muscles also prevent pelvic inclination. People with decreased strength in abdominal muscles have increased lumbar lordosis (Васильева, 1996).

Moreover, authors have reported that *m. quadratus lumborum* affects lateral traction strength on vertebras of the lumbar part of the spine and provides intra-abdominal pressure. All together with deep core muscles it ensures the lumbar and pelvic stability. In case of the imbalance between the muscle strength and length, the pelvic position changes, for example,

forming hip asymmetry, or iliac deviation (Oatis, 2009). Our study was in line with outcomes of other authors presenting hip asymmetry in all participants.

Overall, outcomes of the posture assessment in this study was in line with the literature reporting that there are reflector relations between the vertebrae of the spine segment, muscles that stabilizes the head, and the pelvic functional position. Any functional impairment, for example, movement restrictions, functional blocks, heightened muscle tone, in these body parts, will cause changes in the pelvic functional position (Левит et al., 1993).

Conclusions

The obtained results from this study revealed that postural deviations in children with mild and moderate disability are similar to those in typically developing children.

Acknowledgments

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References

1. Almeida, V. P., Guimarães, F. S., Moc, V. J. R., Menezes, S. L. S., Mafort, T.T.,& Lopes, A. J. (2013). Correlation between pulmonary function, posture, and body composition in patients with asthma. *Rev Port Pneumol*, 19 (5), 204-210.
2. Bloomfield, J., Ackland, T. R., & Elliot, B. C. (1994). Applied Biomechanics and Anatomy in Sport Melbourne: *Blackwell Scientific Publications*.
3. Centre of Disease Prevention and Control (2016). *The overview on children health in Latvia.* Retrieved on March 11, 2017 from http://www.lm.gov.lv/upload/petijumi/lmzino_211216_bernu_parskats_2015.pdf
4. Claeys, K., Brumagne, S., Deklerck, J. , Vanderhaeghen, J., & Dankaerts, W. (2016). Sagittal evaluation of usual standing and sitting spinal posture. *Journal of Bodywork and Movement Therapies,* 20 (2), 326-333.
5. Galeja, Z. (2015). Sportistu kakla un krūšu daļas segmentu funkcionālā stāvokļa izmaiņas reflektora kairinājuma ietekmē. Rīga, LSPA.

6. Hill, C. S., & Goldsmith J. (2010). Biomechanics and Prevention of Body Shape Distortion. *Tizard Learning Disability Review*, 15 (2), 15-29.
7. Jull, G., Barrett, C., Magee, R., & Ho, P. (1999). Further clinical clarification of the muscle dysfunction in cervical headache. *Cephalalgia*, 19, 179-185.
8. Kendall, F. P., McCreary, E. K., Provance, P. G., Rodgers, M. M., & Romani, W. A. (1994). *Muscles: testing and function with posture and pain*. Baltimore: Lippincott Williams & Wilkins; 451p.
9. Karlin, L. I. (1986). *Injury to the hip and pelvis in the skeletally immature athlete.* In The Lower Extremity and Spine in Sports Medicine Edited by: Nicholas JA, Hershman EB. St Louis: Mosby, 1292-1332.
10. McEvoy, M. P., & Grimmer, K. (2005). Reliability of upright posture measurements in primary school children. *BMC Musculoskeletal Disorders, 6,* 35-44.
11. Oatis, C. A. (2009). *Kinesiology: the mechanics and pathomechanics of human movement.* 2 st. ed., Philadelphia, Lippincott Wiliams & Wilkins.
12. Paušic, J., Pedišic, Ž., & Dizdar, D. (2010). Reliability of a photographic method for assessing standing posture of elementary school students. *In: Manipulative and Physiological Therapeutics*, P. 371-380.
13. Penha, P. J., Casarotto, R. A., Sacco, I. C. N., Marques, A. P., & João, S. M. A. (2008). Qualitative postural analysis among boys and girls of seven to ten years of age. *Rev Bras Fisioter, 12,* 386-391.
14. Placzek, J., Pagett, B., Roubal, P. Jones, B., McMichael, H., Rozanski, E., & Gianotto, K. (1999). The influence of the cervical spine on chronic headache in women: a pilot study. *Journal of Manual & Manipulative Therapy*, 7, 33-39.
15. Ray, C. T., Horvat, M. B., Croce, R. C., Mason, C. B., & Wolf, S. L. (2008). The impact of vision loss on postural stability and balance strategies in individuals with profound vision loss. *Gait & Posture. 28*, 58-61.
16. Smith, A., O'Sullivan, P., & Straker, L. (2008). Classification of Sagittal Thoraco-Lumbo-Pelvic Alignment of the Adolescent Spine in Standing and Its Relationship to Low Back Pain. *In: Spine, 33*(19), 2101-2107.
17. Watson, D., & Trott, P. (1993). Cervical headache: an investigation of natural head posture and upper cervical flexor muscle performance. *Cephalalgia*, 13, 272-284.

18. Watson, A. W. S., & MacDonncha, C. (2000). A reliable technique for the assessment of posture: assessment criteria for aspects of posture. *Journal of Sports Medicine and Physical Fitness, 40,* 260-70.
19. Zwierzchowska, A., & Gawlik, K. (2007). Deaf children and adolescents and defective posture. *New Medicine*, *2* (37-9).
20. Левит, К., Захсе, И., & Яндла, В. (1993). *Мануальная медицина*. Москва: Медицина. 512 с.
21. Васильева, Л.Ф. (1996). *Визуальная диагностика нарушений статики и динамикиопорно-двигательного аппарата человека.* Иваново, 109 с.

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ORIGINAL RESEARCH PAPER

LOWER EXTREMITY MUSCLE CO-CONTRACTION AT STANCE PHASE DURING GAIT IN CHILDREN WITH AND WITHOUT DISABILITIES

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Abstract

The purpose of this study was to determine the differences of muscle co-contraction in the leading leg in 45 children (20 girls and 25 boys) with disabilities (intellectual, visual, hearing and functional) (n = 31, mean age 8.6±1.2 years) and without disabilities (n = 14, mean age 9.3 ±1.3 years). This study analysed co-contraction in knee and ankle joints during stance phase of the gait circle. BTS FREEEMG 1000 (BTS, Garbagnate Milanese MI, Italy) was used to collect EMG signals from the four muscles (m.biceps femoris, m.rectus femoris and m.tibialis anterior, medial head of m.gastrocnemius). The percentage of co-contraction (% COCON) was calculated and compared between children with and without disabilities. Pearson`s correlation did not reveal significant association between stance phase duration and agonist/antagonist co-contraction of m.gastrocnemius and m.tibialis, and m. biceps femoris and m.rectus femoris muscles in children with and without disabilities. Conclusions: This study provides evidence that lower extremity stance phase duration have no impact to muscle co-contraction during the normal walking. While this might be explained by movement restrictions associated with various disabilities, it cannot be explained by association between muscle co-contraction and stance phase duration.

Key words: *stance phase, gait, co-contraction*

Introdaction

Increased physical fitness (both cardiorespiratory fitness and muscular strength), reduced body fatness, favourable cardiovascular and metabolic disease risk profiles, enhanced bone health and reduced

symptoms of depression (WHO, 2010). Previous studies of children with physical disabilities (Bloemen et al., 2015; Jaarsma 2014), intellectual disabilities (Arim et al., 2012), visual and hearing impairment (Majlesi et al., 2014; Dursuns et al., 2015) have indicated that they face multitude barriers of participation in daily social and physical activities. Bloemen et al. (2015) and Malina (2014) has explained participation in physical activity as any movements produced by skeletal muscles which results energy expenditure. Energy expenditure is main indicator of physical activities level. The World Health Organization (WHO) recommends children and youth aged 5 – 17 to accumulate at least 60min of moderate – to vigorous intensity physical activity every day.

While walking activities are recommended to increase the level of daily physical activity (WHO, 2010), walking ability depends on locomotor or gait quality. If the child's walking ability is affected by disability then he/or she might not be able to reach the recommended level of physical activity. Furthermore, it create barriers for participation in social events and decreases social engagement, for example, enjoying being with friends or playing soccer (Ross et al., 2016a; Ross et al. 2016b, Must et al., 2015; Shields et al., 2016). Many authors have studied relationship between gait related factors and subject's health aspects and its impact on gait pattern in children with cerebral palsy (Bojanic et al., 2011; Desloovere et all., 2006) and children with intellectual disabilities (Mohd-Nor et al., 2016). However, only few studies have explored this relationship in heterogeneous group of children with and without disability. For example, Majlesi et al. (2014) and Rine et al. (2004) found relevance between the quality of gait and statistic balance. Also, fall risk prediction has showed positive association with gait pattern in children with hearing impairments. Importance of balance during a gait and association with muscle co-contraction has been showed in previous studies (Rosa et al., 2014).

According Perry (1992) each gait cycle is divided into two periods, (1) stance and (2) swing phase. Stance is the term used to describe the entire period during which the foot is on the ground. Stance begins with initial contact and ends when the foot is lifted from the floor (toe-off). At 60% of gait cycle are consist of stance phase, while swing phase is 40% (Mohd-Nor et al., 2016). Increased duration of muscle co-contraction has been recognised as strategy to improve walking stability. Hallal et al. (2013) reported that excessive levels of co-contraction in older adults might lead to higher energy expenditure during ambulation, especially for persons with cognitive impairments. Also, co-contraction in the stance phase had significant associations with physical measures and co-contraction in the

swing phase had significant associations with cognitive measures (Benedetti et al., 2010; Detrembleur et al., 1997). Also, Hallal et al. (2013) and Lo et al (2017) proposed to consider co-contraction in separate gait phases.

The purpose of this study is to determine the differences of muscle co-contraction of the leading leg in children with and without disabilities during a stance phase.

Materials and Methods

Subjects

Participants were 45 children (20 girls and 25 boys) with and without various disabilities recruited from special and general education programs. They were divided in two subgroups, (1) children without disability, and (2) children with disability. The first group included 14 children without disability (6 girls and 8 boys). The mean age was 8.6 ±1.2 years, the mean height was 139.10 ± 12.6 cm, the mean weight was 30.2 ± 78.3kg. Second group included 31 children with mild to moderate intellectual, visual, hearing and functional (14 girls and 17 boys) with mean age of 9.3±1.3 years; mean height 138.00±10.2; mean weight 30.4±7.2. Inclusion criteria were following, (1) 7 to 12 years old; (2) ability to perform 10 m walk without walking devices; and (3) ability to understand instructions and to follow the test procedure. Exclusion criteria were severing musculoskeletal disorders, neurological pathology and orthopaedic surgery during last three month.

Data were recorded in the Kinesiology Laboratory at the Latvian Academy of Sports Education after approval was obtained from the Research Ethics Committee. Participant's parents signed informed consent forms. The research was undertaken in compliance with ethical principles oh Helsinki Declaration.

Procedure of Data Collection

Data were obtained from EMG signal analysis of the four muscles in the dominant leg muscles (m.biceps femoris (BF), m.rectus femoris (RF) and m.tibialis anterior (TA), medial head of m.gastrocnemius (MG)) during stance phase. BTS FREEEMG 1000 (BTS, Garbagnate Milanese MI, Italy) was used to collect data. To define the dominant/ leading leg each participant was asked to answer following question: "Which leg you would use to kick a ball?". Surface EMG probes were attached to m.tibialis anterior, medial head of m.gastrocnemius, m.rectus femoris, and lateral hamstring m.biceps femoris as it was reported in previous studies (Hallal et al., 2013; Lo et al., 2017; Bojanic et al., 2011). To detect signals, adhesive Ag/AgCl electrodes (Covidien, UK) with an effective diameter of 10mm and an inter-electrode distance of 20mm (center to center) were used.

According standards for surface electromyography called "Surface EMG for non-invasive assessment of muscles (SENIAM)" recommendations, before electrode placement, the skin was cleaned with alcohol and shaved (if needed), electrodes were placed to the belly of selected muscles (Bojanic et al., 2011; Rainoldi et al., 2004). After positioning of electrodes, children were instructed to walk barefoot at their natural pace over the straight track with force plates, which were synchronized with EMG and used to identify phases of gait. Before the beginning of the gait trials, all participants were familiarized with test procedure and practiced walking for 3 min at their preferred gait speed (Dingwell & Marin, 2006). After the familiarization, five different trials were recorded. Trials were not retained when the participant made excessive movements of the head, arms or trunk unrelated to walking. Despite careful measurement, some trials had to be omitted due to irregularities in the kinematics of heal strike (Mahdi et al., 2014). Gait stance phase was identified based on data from the force plate (BTS P-6000, 60 x 40cm, BTS, Garbagnate Milanese MI, and Italy). These data were collected unilaterally as subjects walked over the two force plates at regular walking speed, from heel strike to toe-off. Trial was considered valid when a full heel strike pattern was captured by the pressure plate per walk (Agostini et al., 2014; Shanthikumar et al., 2009).

Signal processing

Signal from the force plate was used to extract the individual stance phases of the gait cycle; data were sampled at 1.080Hz and filtered with a 2^{nd} order bidirectional. Butterworth filter using a low-pass frequency of 50Hz was used to corrected phase. Data were collected unilaterally as each participant walked over the force plate at his/her self-selected walking speed, from heel strike to toe-off. To overcome artifact-connected problems EMG signals were processed with BTS SMART – Analyzer (BTS Bioengineering, Padua) using a Butterworth bandpass fourth order filter of 20–400Hz, full-wave rectification, and then a Butterworth low pass, fourth order filter with a cut-off frequency of 6 Hz to calculate linear envelopes. A similar method was reported in previous studies (Hallal et al., 2006; Hermens et al., 2000).

Gait Analysis

First, the stance phase duration was measured. The length of stance was defined as the time during the gait cycle when the foot is in contact with the ground (Lo et al., 2017). The mean stance phase duration of the leading leg was calculated from all five recorded trials for each participant.

According to SENIAM (1997) and Standards for reporting EMG data (ISEK) (Merletti, & Torino,1999) and recommendations of Konrad (2005) and Perry (1992), EMG data normalization was applied. The linear EMG envelopes of each muscle were time normalized to the mean duration of that particular stance phase obtained in all five strides. The whole stance phase was represented in percentages from 0 to 100%. The next step was to normalize the EMG amplitude, which is crucial for comparisons between muscles, subjects and groups. The amplitudes of the linear envelopes from all five strides of each muscle were averaged, and the peak value of the mean pattern was normalized to the same procedure was perform to create mean pattern for each group.

The percent co-contraction between the agonist/antagonist muscles RF/BF and TA/GM were calculated using the following equation:

$$\%COCON = 2 * \frac{common\ area\ A\ \&\ B}{area\ A + erea\ B} * 100$$

Where % COCON is the percentage of co-contraction between the agonist/antagonist muscles; area A is the area below the processed EMG curve of muscle A; area B is the area below the processed EMG curve of muscle B, common area A & B is the area under the curves shared by both muscle A and muscle B during an average stance phase (Fig. 1) (Candotti et al., 2009; Hallal et al., 2013; Lo et al., 2017).

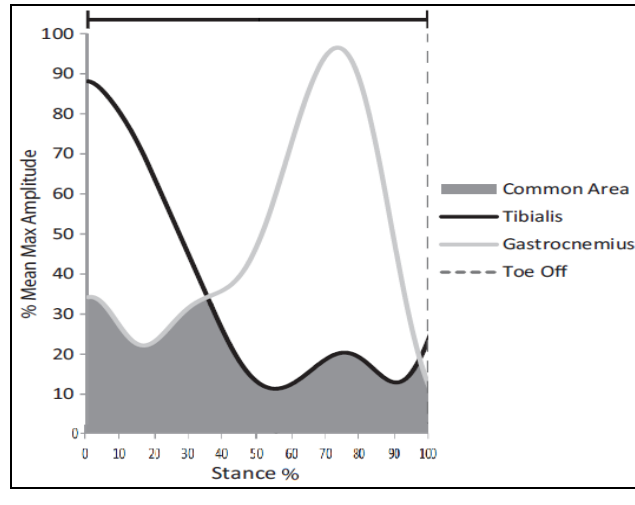

Figure 1. Percentage of co-contraction between TA/GM (Lo et al. 2017)

Statistical Analysis

SPSS 22.0 was used for statistical analyses of obtained data. Descriptive statistics were used to analyse the group mean data of

characteristics. The Shapiro–Wilcoxon test was used to determine if the data were normally distributed. Then, a Student t-Test was performed in order to evaluate differences in co-contraction indices and stance phase duration values between both groups. Significance was set at p= .05. Pearson correlation was performed in order to determine the relationship between stance phase duration and co-contraction values in both groups.

Results

The percentage of co-contraction and stance phase duration data were analysed across 42 out of the 45 recruited participants. Missing co-contraction and stance phase duration data was due to missing or corrupted EMG files and/or missing footswitch data (n =3).

Student t-Tests revealed no significant differences in co-contraction indices for stance phase duration tested (Table 1). Mean values for m. gastrocnemius and m. tibialis anterior (TA/GM) co-contraction indices were for 4.2% COCON higher in children without disabilities than children with disabilities (p> .05). But mean m. biceps femoris and m.rectus femoris (BF/RF) co-contraction indices were for 6.6 %COCON higher in children with disability (p> .05). Stance duration for children without disabilities was for .05s shorter than in children with disabilities (p> .05).

Table 1

Mean data of muscle co-contraction and stance duration. Values are meaning (standard deviation)

Variable	*Children without disabilities (n=12)*	*Children with disabilities (n=30)*	*Significance*
TA/GM (% COCON)	52.3± 14.3	48.1± 18.7	p> .05
BF/RF (% COCON)	42.6± 7.1	49.2± 15.6	p> .05
Stance duration(s)	.65± .1	.7± .1	p> .05

Pearson`s correlation did not reveal any significant associations between stance phase duration and agonist/antagonist co-contraction of m.gastrocnemius and m.tibialis, and m. biceps femoris and m.rectus femoris muscles (Table 3)

Table 2

Pearson`s correlation coefficients (r) for muscle pairs and stance phase duration

Children without disabilities (n=12)			*Children with disabilities (n=30)*		
Pair (%COCON : seconds)	*r*	*p*	*Pair (%COCON : seconds)*	*r*	*p*
TA/GM : stance duration	.05	p> .05	*TA/GM : stance duration*	.08	p > .05
BF/RF : stance duration	.27	p > .05	*BF/RF : stance duration*	.004	p > .05

Discussion

Stance phase duration and percent of muscle co-contraction for both groups was in line with findings of other authors Hallal et al., (2010) and Lo et al., (2017). Previous studies by Benedetti et al., (2010) and Detrembleur et al., (1997) have showed association between gait speed and behaviour of ankle joint agonist/ antagonist muscles. Increased gait speed leads to stance phase duration decrease which might affect muscle co-contraction as result of ground reaction force becoming greater. This study found that stance phase duration was longer among children with disabilities .7± .1 than in children without disabilities .65± .1, and co-contraction of m.gastrocnemius and m.tibialis anterior (TA/GM) was lower in children with disabilities (48.1± 8.7). On the contrary, mean m. biceps femoris and m.rectus femoris (BF/RF) co-contraction index during the stance phase in children with disabilities was higher than in children without disabilities, however the duration of stance phase was longer. Furthermore, Hallal et al., (2010), and Lo et al., (2017) has confirmed, that disturbed balance conditions have impact to co-contraction levels, respectively co-contraction level is higher, they also found that persons with low balance confidence had higher lower limb co-contraction compared to others. These findings coincide with Abbud et al., (2009) who concluded balance confidence association with lower limb co-contraction level directly at stance phase. It may explain one of barriers why children with disabilities face the difficulties to reach a recommended physical activities level, but there is still need for more specific studies aimed to verify association between stance phase duration and muscle co-contraction. No one of the mentioned studies does not provide data of positive association between stance duration and muscle co-contraction in children with or without disabilities during a normal walking. However, Lo et al (2017) found positive association between co-contraction level and phase duration during the stride phase in dual task walking exercise ($R2=0.157$, $p=0.034$), also Detrembleur et al (1997) found that changes in phase duration affects muscle involvement level in movement stabilization during the treadmill walking. Children with disabilities groups result might be impacted by variability between different disabilities. Especially functional disabilities subgroup had high variability in co-contraction value, they could only be analysed separately if amount of participants would be increased. Current study purpose was not to show differences between specific disabilities, but to compare variables between children with and without disabilities.

Study limitations include measuring only relative muscle activity and testing association with stance phase duration of children with and

without disabilities, in future studies other variables, like gait speed and dynamic balance measurements, should be take into account. For more informative comparison of specific age or disabilities group co-contraction level, future studies should develop normative co-contraction levels for children, similar, as it has been done for normative EMG activation patterns by Agostini et al., 2009.

Conclusion

This study provides evidence that lower extremity stance phase duration have no impact to muscle co-contraction during the normal walking. Evidence provide information that muscle co-contraction may have important functional role, which may explain some of the mobility impairment associated various disabilities but it cannot be explained by muscle co-contraction and stance phase duration association as it is explained at Results and Discussion chapters.

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Declaration of Interest

The authors report no conflict of interest. The authors alone are responsible for the content and writing of this article.

References

1. Abbud, G. A., Li K. Z., &. DeMont, R. G., (2009). Attentional requirements of walking according to the gait phase and onset of auditory stimuli, *Gait Posture 30*, 227-232.
2. Agostini, V., Balestra, G., & Knaflitz, M. (2014). Segmentation and classification of gait cycles, *IEEE Trans. Neural Syst. Rehabil. 22*(5) 946-952.
3. Arim, R. G., Findlay, L. C., & Kohen, D. E. (2012). Participation in physical activity for children with neurodevelopmental disorders. *Int J Pediatr*, 9-14, Doi:10.1155/2012/460384
4. Benedetti, G. M., D'Apote1, G., Agostini, V., & Knaflitz, M. (2010). Physiological Electromyographic Activations Patterns of Lower Limb Muscle in Children, *The Open Rehabilitation Journal*, 3, 132-135.
5. Bloemen, M., Verschuren, O., van Mechelen, C., Borst, H. E., de Leeuw, A. J., van der Hoef ,M., & de Groot, J. F. (2015). Personal and environmental factors to consider when aiming improving

participation in physical activity in children with Spina Bifida: a qualitative study. *BMC Neurol*, 15(11), 2-11, DOI 10.1186/s12883-015-0265-9

6. Bojanica, D. M., Petrovacki-Baljb, B. D., Jorgovanovica, N. D., & Ilic, V. R. (2011). Quantification of dynamic EMG patterns during gait in children with cerebral palsy. *Journal of Neuroscience Methods,* 198(2), 325-331.
7. Desloovere, K., Molenaers, G., Feys,, H., Huenaerts, C., Callewaert, B., & Van de Walle, P. (2006). Do dynamic and static clinical measurements correlate with gait analysis parameters in children with cerebral palsy? *Gait & Posture*, 24(3), 302-313.
8. Detrembleur, C., Willems, P., & Plaghki, L., (1997). Does walking speed influence the time pattern of muscle activation in normal children? *Dev Med Child Neurol* 39(12): 803-7.
9. Dingwell, J. B., & Marin, L. C. (2006). Kinematic variability and local dynamic stability of upper body motions when walking at different speeds. *J Biomech*, 39(3), 444-52.
10. Dursun, O. B., Erhan, S. E., Ibis, E. O., Esin, I. S., Keles, S., & Sirinkan, A., et al. (2015). The effect of ice skating on phychological well-beinh and sleep quality of children with visual or hearing impairments, *Disable rehabil,* 37(9), 783-9, Doi:10.310 9/09638288.2014.942002
11. Gardinier. E. S. (2009). The relationship between muscular co-contraction and dynamic knee stiffness in ACL-deficient non-copers (Bachelor thesis, University of Delaware, Newark, USA). Retrieved from: http://udspace.udel.edu/handle/19716/4251
12. Global Recommendations on Physical Activity for Health [Brochure]. (2010). World Health Organization.
13. Gunter, K. B., De Costa, J., White, K. N., Hooker, K. A, Hayes, W. C., & Snow, C. M. (2003). Balance self-efficacy predicts risk factors for side falls and frequent falls in community-dwelling elderly, *J. Aging Phys. Act*. 11 28-39.
14. Hallal, C. Z., Marques, N. R., Spinoso, D. H., Vieira, E. R., & Goncalves, M. (2013). Electromyographic patterns of lower limb muscles during apprehensive gait in younger and older female adults. *Journal of Electromyography and Kinesiology* 23, 1145-1149.
15. Hermens, H. J., Freriks, B., Disselhorst-Klug, C., & Rau, G. (2000). Development of recommendations for SEMG sensors and sensor placement procedures. *Journal of Electromyography and Kinesiology*, 10(5), 361-374

16. Jaarsma, E. A., (2014). Sports participation and physical disabilities: Taking the hurdle?! ISBN: 978-90-367-7297-6 (electronic version), Retrieved 2/18, 2017, from https://www.kennisbanksportenbewegen.nl/?file=3688&m=1422883372&action=file.download
17. Konrad, P. (2006). The ABC of EMG: a practical introduction to kinesiological electromyography. Noraxon US.
18. Lo, J., Lo, O., Olson, E. A., Habtemariam, D., Iloputaife, I., Gagnon, M. M., & Lipsitz, L. A. (2017). Functional implications of muscle co-contraction during gait in advanced age. *Gait & Posture,* 53(2017), 110-114.
19. Majlesi, M., Farahpour, N., Azadian, E., & Amini, M., (2014). The effect of interventional proprioceptive training on static balance and gait in deaf children, *Research in Developmental Disabilities,* 35(2014) 3562-3567.
20. Malina, R., Bouchard, C., & Bar-Or, O. (2004). Growth, maturation, and physical activity. 2nd edition. Illinois, USA: Human Kinetics.
21. Merletti, R., & Torino, P. (1999). Standards for reporting EMG data. International society of electrophysiology and kinesiology, 9 (1), III - IV.
22. Must, A., Phillips, S., Curtin, C., & Bandini, L., (2015). Barriers to Physical Activity in Children with Autism Spectrum Disorders: Relationship to Physical Activity and Screen Time. *J Phys Act Health* 12(4), 529-34, doi:10.1123/jpah.2013-0271
23. Perry, J. (1992). Gait analysis: normal and pathological function. Thorofare, New Jersey*:* SLACK.
24. Rine, R. M., Cornwall, G., Can, K., Locascio, C., O'hare, T., Robinson, E., et al. (2000). Evidence of progressive delay of motor development in children with sensorineural hearing loss and concurrent vestibular dysfunction. *Perceptual and Motor Skills*, 90(3), 1101-1112. http://dx.doi.org/10.2466/ pms.2000.90.3c.1101
25. Ross, S. M., Bogart, K. R., Logan, S. W., Case, L., Fine, J., & Thompson, H. (2016). Physical activity participation of disabled children: A systematic review of conceptual and methodological approaches in health research, *Public Health,* 187(4), Doi:10.3389/fpubh.2016.00187
26. Ross, S. M., Case, L., & Leung, W. (2016). Aligning physical activity measures with the International Classification of Functioning, *Disability and Health framework for children disability*. *Quest, 68(4),* 521-535, DOI: 10.1080/00336297.2016.1145128

27. Shanthikumar, S., Low, Z., Falvey, E., McCrory, P. & Franklyn-Miller, A. (2009). The effect of gait velocity on calcaneal balance at heel strike; Implications for orthotic prescription in injury revention. *Gait & Posture,* 31(2010), 9-12.
28. Shields, N., & Synnot, A. (2016). Perceived barriers and facilitators to participation in physical activity for children with disability: a qualitative study. *BMC Pediatr* 16(9), doi:10.1186/s12887-016-0544-7
29. Stegeman, D., & Hermens, H. (1999). Standards for surface electromyography: The European project "surface EMG for non-invasive assessment of muscles (SENIAM)". Retrieved 2/18, 2017, from http://www.med.uni-jena.de/motorik/pdf/stegeman.pdf Google Scholar

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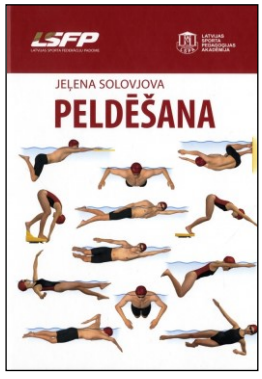
SHORT COMMUNICATION

Review of Jeļena Solovjova book „Swimming”



30 years ago was published the book “Swimming” by Arvils Lielvārds, since then it has been on the list of compulsory literature for the upcoming swimming coaches, it is a teaching and learning tool, that for three decades has been one of the most important sources of knowledge and inspiration for almost all swimming coaches in Latvia. I am really pleased that exactly in this anniversary year teachers, trainers and everyone keen on swimming can obtain a printed work resuming the mission to a new quality. This book gives an opportunity to improve and fulfill the lives of hundreds, even thousands of people, by helping them to learn this supposedly simple thing – swimming skills.

Aivars Platonovs
President of Latvian Swimming Federation

Swimming has also practical application, because the ability to swim allows feeling safe when getting in water. People of all ages can go swimming. Consequently, swimming is a physical activity that helps to develop a rapidly growing body, improve athlete physical characteristics and maintain different generation people health throughout their lives. The book examines and analyzes the techniques of various swimming styles, as well as summarizes the exercises for their acquisition. The book is intended for sports teachers, sports coaches and sports instructors in comprehensive schools, professional orientation sports schools and sports clubs, as well as future sports specialists and everyone interested in the acquisition of swimming skills and various swimming styles.
Solovjova

Jeļena Solovjova, Dr.paed., Professor,
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